96th Congress
1st Session

JOINT COMMITTEE PRINT

SOVIET ECONOMY IN A TIME OF CHANGE

A COMPENDIUM OF PAPERS

SUBMITTED TO THE

JOINT ECONOMIC COMMITTEE
CONGRESS OF THE UNITED STATES

Volume 1

OCTOBER 10, 1979

Printed for the use of the Joint Economic Committee

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LETTERS OF TRANSMITTAL

OCTOBER 5, 1979.

To the Members of the Joint Economic Committee:

Transmitted herewith for the use of the members of the Joint Economic Committee and other Members of Congress and the interested public, is a two-volume compendium on the economy of the Soviet Union entitled "Soviet Economy in a Time of Change." This is a compilation of research papers, prepared at our request by scholars and experts dealing with the recent performance of the Soviet economy. It is the latest in a series of Soviet compendiums which the Joint Economic Committee has published, beginning in 1959. There is understandably a great deal of interest in the Soviet economy, its prospects and problems, and their implications for the United States and Western industrial countries. The submission of the SALT II Treaty to the Senate and the renewed discussion of a trade agreement with the Soviet Union further enhances likely interest in these volumes. The first two volumes, released together, are on Policy Perspectives, Plan and Performance, Soviet Agriculture and the Grain Trade, and Foreign Economic Activities. The third volume, to be released later, is a reconstruction and recomputation of various statistical material by analysts at the Central Intelligence Agency. We believe that these volumes will prove helpful to the Members of Congress in their policy deliberations related to United States-Soviet relations, as well as to scholars and interested members of the public. We are indebted to the scholars who have given so generously of their time and their knowledge. They are listed in the Executive Director's letter to me and I would like to express the committee's gratitude for their valued efforts.

Also I wish to express my appreciation to the Congressional Research Service for making available the services of Dr. John P. Hardt, Associate Director for Senior Specialists, who helped to plan the scope of the research, coordinated and edited the contributions, and wrote a summary for the present compendium. Dr. Hardt was assisted by Ronda Bresnick, also of the Library staff.

It should be clearly understood that the views expressed in these papers are those of the individual contributors and do not necessarily represent the position of their respective government, or nongovernment institutions, the Joint Economic Committee, or individual members thereof.

LLOYD BENTSEN,
Chairman, Joint Economic Committee.

OCTOBER 1, 1979.

HON. LLOYD BENTSEN,
Chairman, Joint Economic Committee, Congress of the United States, Washington, D.C.

DEAR MR. CHAIRMAN: Transmitted herewith is a volume of materials on the economy of the Soviet Union entitled "Soviet Economy in a Time of Change." The compendium contains papers written by scholars and specialists who, as recognized authorities on the Soviet Union, were invited to contribute. The specialists have been drawn from the ranks of various universities here and abroad, private research institutes, several departments of the Federal Government and the Library of Congress. The papers they have submitted, in response to our request, cover the broad range of topics dealing with the recent performance of the Soviet economy. Included among these topics are economic policy, the defense burden, agriculture, politics, computer technology, energy, industry, population, research, science, international trade, and foreign aid.

The Joint Economic Committee has undertaken a number of compendiums on the Soviet economy. Among the earlier compendiums were "Comparisons of the United States and Soviet Economies" (1959); "Dimensions of Soviet Economic Power" (1962); "New Directions in the Soviet Economy" (1966); "Economic Performance and the Military Burden in the Soviet Union" (1969); "Soviet Economic Prospects for the Seventies" (1973); and "Soviet Economy in a New Perspective" (1976). The latest of the committee releases in the triannual series on the Soviet Union, East Europe and the People's Republic of China was "Chinese Economy Post-Mao" (1978).

At a time when the relationships between the United States and the Soviet Union on arms control, commercial, scientific, and technological affairs all are entering a new stage, an assessment of Soviet economic policy appears especially timely.

The contributors to the compendium have been most considerate of our needs and generous in giving of their time and expertise to provide not only basic information, but also an essential analytical perspective. The individual scholars who have participated in the preparation of the present study are:

Catherine P. Ailes
Dennis J. Barclay
Abraham Becker
Herbert Block
Daniel L. Bond
Morris Bornstein
Scott Bozek
Lawrence T. Brainard
Jack Brougher
David W. Carey
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Marshall I. Goldman
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Economics Department, Tufts University.
Institute for Comparative Economic Studies, Vienna, Austria.
Department of Economics, University of Virginia.

It should be clearly understood that the views expressed in these papers are those of the individual contributors and do not necessarily represent the position of their respective government, or nongovernment institutions, the Joint Economic Committee, or individual members thereof.

The Library of Congress made available the services of John P. Hardt, senior specialist in the Congressional Research Service, who helped to plan the scope of the research, coordinated and edited the contributions, and wrote a summary for the present study. Dr. Hardt was assisted by Ronda Bresnick, also of the Library staff. Prof. Holland Hunter of Haverford College assisted in the organization of the volume and wrote an initial overview chapter.

JOHN M. ALBERTINE,
Executive Director, Joint Economic Committee.

CONTENTS

SUMMARY

(By John P. Hardt)

Economic performance, long a central problem for Soviet leadership, may in the 1980's become economic and political crises. Shortfalls in economic plans and prospects to meet felt needs may pose policy problems for those aspirants for power rising to the fore with the inevitable end of the Brezhnev era.

The Eleventh Five-Year Plan for 1981–85, likely to be a centerpiece of the agenda for the Twenty-Sixth Congress of the Party of the Soviet Union, may reflect some policy changes designed to improve performance. Significant improvement in the quality and quantity of performance may await basic changes in resource allocation policy, the traditional system of planning and management, the interrelations of the domestic to the foreign economy. Most of the changes represent clear costs or losses to important leadership constituencies, e.g., more modernization investment, less military outlays; more professional planning and management, less Party intervention in the economy; more reliance on foreign technology and systems, less control over key aspects of the economy. These painful changes in the traditional Stalinist principles and institutions may not, however, provide essential improvements in the economy. So the risk of crisis from fully performing within the status quo policy must be weighed against changes that have no guarantee of success.

In the 58 chapters of this two-volume compendium some 79 specialists from government, private professional research and academic institutions in the United States, Canada, Austria, the United Kingdom, and Israel have assessed recent Soviet policy, performance, and prospects with their implications for the future. Volume 1 deals with Policy Perspectives and Plan and Performance. Volume 2 includes chapters on Soviet Agriculture and the Grain Trade and Foreign Economic Activities. A third volume, on a separate time schedule, will contain statistical analysis by the Central Intelligence Agency related to their quantitative economic estimates.

Each of the authors provide analyses based on their own professional views. Many have provided their own summaries. The reader should reference the summaries and the full analyses before making judgments on the professional differences of views, or the validity of the conclusions. The following are some of the major questions raised by the papers with an indication of their responses and where in the compendium the appropriate analyses may be found.

1. *What central economic problems do Soviet leaders face? What are the likely policy responses?*

In a nutshell, this analysis suggests that the USSR must change in order to deal adequately with its economic problems. The problems stressed here are declining output growth, serious inflationary pressure, slow technological progress,

and accumulated deficiencies in housing and other public needs. Responses to these problems are blocked, however, by institutional resistances that reflect the very nature of the present Soviet system. The methods used to create massive heavy industrial and military power worked well for a generation, but they have been the cause of the accumulated deficiencies, the slow technological progress, and the inflationary pressure. Now, under new conditions, Soviet authorities face a choice between frustration of their growth objectives and reform of their methods.

We examine three alternative Soviet policy approaches: a "muddling through" scenario in which existing policies continue, a "liberal" scenario involving relaxation and decentralization of controls, and a "conservative" scenario embodying reversion to even more centralized and stern procedures. We also sketch the foreign economic relations likely to accompany each scenario, noting some of their implications for the outside world. Not unexpectedly, the gains in productivity and efficiency obtained under the "liberal" scenario make it far more effective in meeting Soviet problems than the "muddling through" or "conservative" scenarios. The "liberal" scenario is also the one most conducive to peaceful and healthy international economic relations. The "muddling through" scenario, though perhaps the most likely to occur, involves continuation of economic policies and procedures that have already shown their inability to meet the economy's current problems. Continued "muddling through" will also limit the USSR's ability to be a productive participant in the world under later 20th century conditions. (Hunter, pp. 23–24.)

2. *How does the Brezhnev regime view economic policy? What is the likelihood of change in the post Brezhnev period?*

Guns, butter, and growth are the official policy goals in the economic sphere as the Brezhnev era winds down. In one form or another these goals have been pursued since the advent of the command economy under Stalin 50 years ago. But at various times, one or the other has predominated, usually defense, followed by growth, and only then butter. Pursuit of all these goals simultaneously in the present political environment has exacerbated the problem of resource allocation, which together with planning for transfer of power when Brezhnev leaves the scene, is perhaps the most crucial problem facing the Kremlin leadership other than war or peace itself.

Decisions on economic priorities are taken by a handful of men in the Kremlin who are responsible for such varied tasks as—

The preservation of the Party's supremacy in the Soviet system rule;

National security abroad and internal order at home; and

The development of what has at times been called "the new Soviet man," i.e., the educational attainment and cultural outlook of the entire citizenry.

As a result, economic decisionmaking is inextricably intermixed with all other aspects of the Soviet political process at the macro and often at the micro level. . . .

The foregoing leads to the conclusion that barring national catastrophe, continuity, not change, is likely to predominate in Kremlin policy over the near term.

Soviet foreign policy, whether it is primarily reactive, opportunistic, or expansionist, is likely to remain cautious. Deliberate provocation to either the East or the West will be few because of the new relationships between them. Miscalculations, however, can and perhaps will produce confrontations of sorts. But the Soviet leaders are not likely to be adventuristic. Once having committed themselves, however, they will be most reluctant to back off.

At home, movement toward some form of market socialism or genuine reform to revitalize economic growth appears unlikely. Calls for extensive improvement of planning and management are likely to generate only additional bureaucratic restructurings. . . .

One can never exclude from consideration, however, the possibility that whoever succeeds might turn out to be far more dynamic once he has the gavel in his hand. Certainly Khrushchev was not a Stalin, nor Brezhnev a Khrushchev. But 15 years have passed since Brezhnev took over and perhaps as a result of his penchant for consensus-style decisionmaking, there does seem in general to be a basic agreement on systemic questions among the elite. Actuarial realities also suggest that the tenure of the successors will be short and that another succession will take place by the mid-eighties.

In the meantime, guns, butter, and growth will remain the declared policy. The practical impossibility of attaining all these simultaneously will continue

to make economic decisionmaking, especially the allocation of resources, among the most important—and contentious—features of Soviet politics. (Cook, pp. 38, 49–50.)

Other Western views do not see likelihood of major changes in the Soviet political economic system, even with a change of the top leadership.

Soviet modernization to date is a prime example of unbalanced national development. Instead of rounded economic, political and general societal development, it has become increasingly oriented toward the military. The resulting imbalance is attributable to overriding foreign policy and strategic considerations. In Lenin's and Stalin's days economic and military modernization was driven by the needs of sheer survival. Their post-WWII successors, however, have added global Great Power dimensions to Soviet foreign policy. The new expansive policy is reflected most prominently in the USSR's growing activities on the world's oceans.

However, the new global Soviet policy is evoking a negative reaction of other major, non-communist nations and could lead to a new anti-Soviet alignment. This could serve to "self-fulfill" the traditional Soviet prophecy of a hostile capitalistic world bent on the USSR's destruction. Ironically, the hostility of fellow socialist states, e.g. China, has also been aroused, currently exceeding that of "the capitalist camp." In Soviet eyes, an even worse situation is in the making—collusion of both groupings against the USSR—which requires even greater military modernization. But given the increasingly poor performance of the Soviet economy, the USSR is faced with the need for drastic reform to improve efficiency. The Party's pervasive rule is greatly responsible for that inefficiency; this is raising the question of political reform from the Soviet elite groups outside the Party apparatus and focused on allowing professional competence to prevail.

However, their views are unlikely to effect any significant change in the near future: in over 60 years of control, the Party has created sufficient momentum in the system, reinforced by the world's most elaborate political control structure, to continue its sway. The more distant future of Party rule as it is now practiced is, however, open to question. The outcome will depend on whether the Party has enough organizational flexibility and intellectual creativity to transform itself in order to carry out systemic reforms needed to correct today's imbalance, or face the possibility of being overwhelmed by the many problems of the Soviet economy and policy and the external dilemmas created by the expansive foreign policy. (Thomas, pp. 71–72.)

3. *Will the Soviet Union play a more active role in international economic relations as a result of the recent major changes in the world economy?*

If one thing is clear from reflections on different aspects of the subject set out above, it is that no single line of development of future Soviet involvement in the world economy is inevitable. One major conditioning factor will be the state of the world economy. Another, closely linked, will be what other countries do to reshape the processes of international economic cooperation. This will be primarily in response to things other than East-West issues. The gamut of possibilities is great but it may be enough to think about four major variants: (1) an improved and extended version of the Breton Woods system; (2) the creation of major new arrangements, often global in extent; (3) selective innovation, often involving different countries for different purposes; (4) the further erosion and eventual breakdown of multinational cooperation. (Diebold, p. 66.)

4. *Can or should Western policymakers influence those foreign options open to Soviet planners?*

Among the foreign options available to Soviet policymakers in the coming decade, those in the trade area pose the greatest problems and challenges. The constraints of market demand and location present significant limitations to future Soviet export expansion, given the current commodity composition of trade. Soviet planners possess little scope for a flexible adaptation to these constraints, unless ways can be found to deal with the complex set of domestic factors that hinder the expansion of manufactured exports. These domestic constraints have proven to be very resistant to change in the past. Until a new

generation of Soviet leaders emerges they will continue to resist change in the future. By contrast, constraints on long-term economic strategy due to credit appear much less important and more amenable to modifications in Soviet policy. The major problems relate to the very large size of some of the projects.

In terms of relative importance as a constraint on Soviet decisionmaking, the following ranking is suggested:

(1) Domestic factors limiting the effectiveness of technology trade;

(2) Foreign market demand and location factors limiting the access of Soviet goods; and

(3) Factors relating to credit availability.

The ranking points to several conclusions for Western policy. The most important restraint on the use of foreign economic options by Soviet policymakers is a domestic one and is not, therefore, under the influence of Western policy. Secondly, the importance of credit availability as a constraining factor on Soviet policy is probably overestimated. Soviet credit policy appears cautious and conservative. For this reason, restrictions by Western governments on lending to the Soviet Union promise little in the way of political leverage. The most important issues for Western policy lie in the trade area, particularly in relation to market access and fair trade practices.

U.S. policy toward the Soviet Union since 1975 has focused on the denial of MFN, of Eximbank credits, and selected Soviet technology purchases. The Soviet Union has been able without much difficulty to deny us any political benefit from the policy and lost sales by U.S. businesses have imposed economic costs. In turn, we have been unable to deny their access to credit and technology in other countries.

In the wake of the 1974–75 recession and the opening up of China, market access for export is now a very important constraint facing the Soviet policymakers; it is also directly controlled by U.S. policy. We both stand to gain economically from normalized trade relations and there should also be political gains for the United States. In offering MFN and normalized trade and credit relations, however, we must be careful to keep the potential benefits to the Soviet side in proper perspective and bargain accordingly. (Brainard, p. 109.)

5. *How does Soviet economic performance, as measured by comparative national product assessments, compare on a global scale? What are the future prospects?*

. . . The growth experience of the USSR and the advanced West on the whole has been quite similar over the decades with GNP progress of around 5 percent on average in the 1950s and 1960s and a noticeable slowdown to less than 4 percent in the 1970s. Does this slowdown in East and West suggest that there are forces at work that depress growth in industrial societies, whatever their mode of operation? Or is the deacceleration a shortlived happening either in the USSR or in the advanced West, while hard times will continue on the other side?

There are some developments that reduce productivity growth in all modern nations, namely adverse changes in the physical and social environment in the widest sense of the word; awareness of these problems is greater or, at least, more vociferous in the West than in the USSR and so is the outlay in the fight against deterioration. The public service sectors with their seemingly lower productivity—largely a statistical illusion—expand every where, though more in the advanced West than in the USSR. There is no evidence of a growth-depressing slowdown in technological progress on either side, a Soviet lag vis-a-vis the West notwithstanding. The law of diminishing returns is in operation throughout the world and technology can be relied upon to offset its impact, although it may temporarily fall behind (energy output is such a field, with the OPEC monopoly—which benefits the USSR—complicating conditions).

Specific reasons for a slowdown on the Soviet side are a heavy and rising military burden, which absorbs more resources otherwise available for growth-promoting capital formation than in the West, and an economic system which has become increasingly cumbersome in running a by now vast and sophisticated economy. These peculiar institutions and policies appear unchangeable at the present time; as a result, the Soviet Union will have difficulties coping with resource constraints both human and material in the foreseeable future. The more flexible and innovative market economies have a better chance to overcome the current dislocations and the accompanying malaise, but this is where eco-

nomics converges with unfathomable social and political elements and where analysis ends in a matter of hunch and an article of faith. (Block pp. 111–112.)

6. *Equal distribution of productive resources has been an official Soviet policy since Lenin's time. How successful has this policy for regional egalitarianism been? What are the possible future implications?*

Soviet Union republics are the core of the economic and cultural life of the constituent Soviet nationalities. There has been a long-term commitment to leveling their economic development.

To appraise inequalities in productive activity and in material welfare among these republics for 1958–78, we measure the weighted coefficients of variation among them and the ratio between the average non-Russian republic and the RSFSR for net material product and total incomes. It appears that NMP per worker in the "productive" sphere, which has always been higher in the northern republics, became more so during the two decades under review, although even the poorest Central Asian republic continued to progress slowly. . . .

Total nominal income per capita is distributed more equally than is NMP or GDP, suggesting an open or implied subsidy to some of the poorer republics. These transfers have been growing rather rapidly. The Soviet republics have not become more unequal in their material well-being. . . .

Since those early years when the Bolshevik leadership reunited nearly all the former vassals of the Russian Empire under the battle standard of proletarian internationalism, Soviet national divisions have attracted continual attention, not least in Moscow. Now, too, with a transition of leadership and possibly a prolonged succession crisis at hand, an outside analyst does well to probe the deep fault-lines of this multinational state. Such probing can help us determine whether and where the smooth surface might crack, or even split, in the event of severe disunity or other signs of weakness at the top. (Spechler, pp. 141–142.)

7. *The Baikal-Amur Railroad (BAM), the "project of the century," is a showcase of Siberian development. Why has it been given priority? What is the progress to date? What are the prospective impacts of a complete BAM?*

Since the announcement of its resumption in 1974, the 2,000 Baikal-Amur Mainline has become one of the highest-priority construction projects in the Soviet economy. Unlike many similar undertakings, especially of such magnitude, work on the BAM appears to be reasonably close to schedule despite the harsh, uninhabited northern environment, engineering problems, and the usual problems of coordination and supply inherent in Soviet projects. By the end of 1978, about 900 miles of track, or close to one-half of the proposed system, had been laid. Completion of the project on time, by 1983, will depend mainly on the construction of the two major tunnels at the western end of the line (nine and four miles long).

Although the decision to proceed with construction of the BAM undoubtedly has some strategic implications (the line is 110 miles farther north from the Amur River border with China than the Trans-Siberian), there are clearly strong economic motivations behind the project. Aside from providing an additional east-west route through eastern Siberia, thus relieving the traffic load on the Trans-Siberian, the BAM will provide access to an entirely new northern tier of resource sites that were previously devoid of transport outlets. These resources are expected to be used both to build up the economy of the eastern half of Siberia and to generate a new export potential through Soviet Pacific ports, especially the new and expanding harbor at Nakhodka-Vostochnyy. . . .

The payoff of the multibillion-dollar BAM project will depend on the Soviet Union's ability to identify and develop potential export-oriented resources along the way. Because of the huge overland distance separating the BAM zone from the economic heartland in the western USSR, the rail project is not expected to have more than a marginal impact on the domestic economy. Although geological prospecting and exploration parties are out in the field to survey the riches of the BAM zone, the only certain resource project thus far is the development of South Yakutian coking coal, mainly for export to Japan. It remains to be seen whether

additional projects will be included in the 1981–85 five-year plan. (Shabad, pp. 175–176.)

8. *The Soviet industrial economy has not yet been able to generate a volume of industrial exports comparable to that of other developed economies. What are the prospects for raw materials and industrial exports in future Soviet trade with the West?*

Although the Soviet Union has long been regarded as the world's second largest industrial power, in fact, from the perspective of foreign trade, the Soviet Union is more of a raw material than an industrial power. In 1977, 83 percent of all the Soviet Union's hard currency earnings were derived from the export of raw materials. It is true that the Soviet Union is the world's largest exporter of various types of machinery and machine tools, but these go predominately to either the other members of CMEA (Council of Mutual Economic Assistance) or to the LDCs. Soviet machinery has almost no market in the OECD countries. Whereas the Soviet Union sells a country like West Germany $40 million worth of machinery a year, it buys in return $1,449 million, over 30 times more. The same vast disparities exist in Soviet trade with Japan and the United States. The situation is slightly better in Italy and France and England, but the machinery trade deficit even there is enormous.

In contrast, the Soviet role as a raw material producer and exporter in both soft and hard currency countries is an important one. After Saudi Arabia, the Soviet Union is the world's second largest exporter of petroleum. The Soviet Union is the world's second largest exporter of natural gas. It is also a major factor in the timber, iron ore, manganese, coal, asbestos, apatite, chromium, and precious metals markets as well. . . . While its reserves of petroleum are a state secret and therefore much disputed, it is readily agreed that the Soviet Union has enormous deposits of a variety of other resources and in several cases leads the world. For example, according to one Soviet geographer, it has 59 percent of the world's coal reserves, 41 percent of its iron ore, 37 percent of its natural gas, 80 percent of its manganese, and 54 percent of its potassium. It also has substantial deposits of apatite and asbestos. It is true that a large percentage of these reserves are in remote and climatically hostile areas. But it is also true that the Soviets are used to working under such adverse conditions.

Given such resources, it is clear that Soviet interests are very much linked to those of the raw material exporting countries. Indeed, the Soviet interest in high energy prices is probably greater than those of most of the members of OPEC. It is not just that the Soviets increase their prices (now even to Eastern Europe) along with anyone else when OPEC does, but that the Soviet Union is not constrained to withhold production and exports, as Iran and especially Saudi Arabia have been, in order to assure the continued effectiveness of OPEC. It is not surprising, therefore, that when raw material prices soared in 1973 and 1974, the Soviet Union benefited enormously. The Soviets recorded one of their best trade balances in years. (Goldman, pp. 177, 180.)

9. *What is the nature of the Soviet "energy problem"? Are they more likely to move toward more interdependence with the West or return to economic isolation, or is a third scenario of "muddling through" more likely?*

Having stressed that general development in the Soviet energy economy have conformed to world trends, that the system shares certain universal problems, that the perceptions of Moscow planners concerning the role of different fuels are roughly congruent with global views, one must also emphasize that the "energy problem" for Moscow assumes substantially different contours.

Where does this leave us? Predictions are hazardous but should not be entirely shirked. The future cannot, like Proteus, assume any wild and zany shape, for the past does constrain. The physical environment, the state of technology, its embodied infrastructure, long-established institutions—none of these are liable to sudden and bizarre changes save in very exceptional circumstances. The field of energy certainly cannot boast about notable structural and technological flexibility in the short and even medium term. Soviet institutions and administrative arrangements are quite rigid, slow to respond and prone to screen out the risky and the new. And since the fall of Khrushchev, the Kremlin leadership has

been one of the most conservative, cautious and least innovative anywhere in the world. This analyst, therefore, feels justified in emphasizing the constraints and difficulties (geographical, technological, political, and institutional) which obstruct, delay, and in some cases downright confound the adjustments called for by economic forces in the Soviet energy system. He claims no access to any crystal ball. If he feels that a gradual, unplanned retrenchment is more probable than the other two scenarios, he may be expressing his own belief in the strength of institutional and technological inertia against the hubris of formal economic rationality. (Dienes, pp. 223, 228.)

10. *Is falling economic growth likely to call for a new or revised investment strategy?*

Rising resources constraints compel a switch of the Soviet economy to a growth strategy which emphasized productivity of productive inputs. In this vein constraints on rates of increase in investment require higher rates of return on capital. This goals calls for greater emphasis on investment which replaces obsolescent assets with new equivalents incorporating later technology, rather than investments in new plan and equipment. This course is the main channel for furthering the infusion of new technology into the system.

Replacement investment has been less than half the share of total investment compared with the economy of the United States. Furthermore, its share has been rising very gradually over the past decade. The official estimates of replacement investment are somewhat inflated in terms of technological impact since they include a considerable ingredient of retired, obsolescent assets which have been transferred to lower priority claimants. The most promising type of replacement investment lies in the mechanization of largely manual auxiliary industrial operations, particularly materials handling. This emphasis is particularly advisable as labor stringencies loom even larger.

Official policies have hitherto mitigated against this investment strategy. Although official asset lives have been reduced twice since 1963, they are still longer than those specified in U.S. and Western European business tax codes. In other words, Soviet planners still understate asset obsolescence. In addition, actual service lives tend to be even longer than those set by official standards. If service lives are too lengthy, the official amortization allowances designated for financing asset replacement are insufficient. Productive assets can be retained for long periods only if heavy maintenance expenditures occur. Essentially the investment tradeoff is between replacement and prolonged maintenance. Such maintenance outlays termed capital repairs in Soviet parlance, are pervasive throughout the system. Since it is a labor-intensive, non-specialized activity within the Soviet institutional context, capital repairs tend to be highly wasteful in the use of manpower and equipment. The deficiency of spare parts production by machinery sectors forces enterprises to manually fabricate replacement parts in their own small repair shops. Financial incentives are biased in favor of repairs and against replacement in the earmarking of amortization allowances for the two activities.

The institutional environment also mitigates against the adoption of a concerted replacement strategy. The planning process does not explicitly provide for replacement investment, meaning that there is no assurance that machinery production plans are keyed to replacement requirements. The pattern of managerial incentives is skewed toward current performance, not toward innovation. Essentially a replacement decision is an innovation decision, the culmination of the research and developmental process. To the extent that prices of new machinery products tend to be inflated, a further barrier is erected to discourage a manager from selecting the replacement option. The most serious constraint to encouragement of the desired investment strategy at the grassroots level is the absence of any risk-bearing propensity by Soviet managers. Since successes are only partially rewarded and failures are fully penalized, Soviet managers prefer to be risk averters. For investment policy such behavior leads to a preference to make do with the old technology, to choose continued maintenance of old assets rather than their replacement with technologically advanced assets.

Some of the official constraints may be overcome with comparatively minor policy changes. However, until the system of managerial incentives is completely revamped full implementation of the new investment policy is not likely. (Cohn, pp. 230–231.)

11. *How have Soviet economic relations with the smaller East European nations of CMEA changed since 1975 when substantial price changes were introduced in inter CMEA trade?*

My chief conclusions are (1) the USSR has extended substantial amounts of aid to Eastern Europe in the form of trade surpluses; but (2) there is no one-to-one correlation between such aid and the terms of trade effects of the 1975 price changes; (3) furthermore, how much net aid the USSR has extended is uncertain, in view of an apparently considerable flow of Eastern European credits to the USSR in recent years; and (4) the last four years do not appear to have been marked by any dramatic turn toward closer Soviet-Eastern European economic ties, beyond that was already in the works before 1975. (Kohn, p. 247.)

Placing CMEA price changes in a broader geographic and time context provides additional insights.

Since 1975, foreign trade prices have changed within the CMEA to an extent unknown before in that organization's history. These price changes were caused by the extreme increase in world market raw materials prices—especially in the rise of crude oil price imposed by the OPEC cartel in the fall of 1973, and the modification of the Bucharest price formula, which led to a speedier adjustment of intra CMEA prices to world market prices.

Since there is a preponderance of raw materials exports to East European countries over imports of manufactures from these in Soviet trade, the Soviet terms of trade vis-a-vis their East European partners have improved considerably since 1975—by over 10 percent in 1975 alone. By 1980 they will have improved by an estimated 30 to 40 percent, bringing in their wake a tightening of Eastern Europe's economic link with the USSR. The extent of price changes is remarkable. Soviet export prices increased by approximately 39 percent in 1975 and by approximately 9 percent in 1976, while import prices rose by 26 percent and 6 percent respectively. The price increases vary considerably in trade with the various countries, and consequently so do the terms of trade. This is mainly due to the differences in the countries' commodity structures. The highest terms-of-trade gains accrued in theh USSR's bilateral relations with the GDR and Czechoslovakia—being trade of the highest degree of complementarity (raw materials against finished products) in Eastern Europe.

In trade with the rest of the world Soviet terms of trade apparently react with great sensitivity to economic fluctuations. In 1975, when the inflationary tendencies in the raw materials sector abated and the recession set in the West, Soviet terms of trade declined by more than 10 percent, thus more than compensating the improvement achieved against the CMEA countries.

The new sliding price formula constitutes a compromise in respect of the welfare effects, in that the USSR participates in the general raw materials price increases without suddenly overburdening the other CMEA countries. In terms of systemic theory, the new price formula attempts to create a path between two snags. On the one hand, this formula with its annually changing prices is a disturbing element in intra CMEA trade whose proper functioning would be better served by a fixing of intra CMEA prices coincidental with the five-year plan periods. On the other hand, the sliding price formula helps avoid major frictions in intra CMEA trade by speeding up the adjustment of intra CMEA prices to world market prices; for an excessive price gap would lead to supply problems, despite medium-term supply contracts frequently including fixed quantity provisions. (Dietz, pp. 263–264.)

12. *How do inter bloc—East-West—and intra bloc economic trends complement and conflict with each other? What are the implications?*

The USSR and Eastern Europe face serious problems in the 1980s, when domestic economic growth will be retarded by inadequate supplies of labor, capital, fuels, and raw materials. These countries can expect only limited help in overcoming their problems, either from the expansion of East-West economic relations or from successful regional integration in CMEA.

However, insofar as the development of East-West economic relations and CMEA regional integration are complementary in some ways, progress on one front will also benefit the other.

1. Some large-scale CMEA joint investment projects—for example, the Kursk metallurgical complex, the Ust-Ilim pulp and paper complex, and the Orenburg gas fields and pipeline project—involve both East European and Western participation in Soviet natural resources development. Without Western equipment, licensing of technology, technical assistance, and financing, these "CMEA joint investments" would be impossible. Thus, Western participation has contributed decisively to one of the most prominently cited examples of CMEA "integration."

2. Western capital and technology can also promote product specialization in manufacturing in CMEA. CMEA countries are more willing to buy a product from a CMEA source if it is produced with Western technology, Western components, and the assistance of Western partners.

> There have in fact been not infrequent instances of East European countries' vying to acquire, and to prove their ability to apply, Western technology in order to obtain official designation as the regional source of a product (i.e., to "capture" the regional "market").

At the same time, industrial cooperation is more attractive to a Western partner if it brings access to the CMEA market as a whole because the Eastern partner obtains a regional specialization assignment.

3. The greater the opportunities for trade with the West, the stronger will be the pressures in CMEA to adjust the level and structure of CMEA contract prices closer to world market prices, to increase convertiblity and multilateralism, and to rationalize other CMEA practices—thereby providing a sounder economic basis for intra CMEA trade, production, and investment.

4. Despite differences in national interests, the East European countries and the USSR are negotiating jointly through CMEA for reductions in the EEC's restrictions on imports from the East.

On the other hand, East-West economic relations and Soviet-East European economic relations continue to compete in important respects.

1. CMEA countries generally prefer Western machinery and equipment and technology—both "embodied" and licensed separately—over what is available from CMEA sources.

2. However, insofar as Western markets appear difficult to penetrate because of recessions or slow growth, and increasing protectionism, East European interest in the stabler and more accessible Soviet market is strengthened.

3. But as world oil prices climb, while the growth of Soviet oil production tapers off, the USSR experiences a rising opportunity cost in supplying oil to Eastern Europe on a barter basis at below-world-market prices, instead of exporting it to the West for convertible currencies.

Thus, success in expanding East-West economic relations weakens interest in CMEA integration by providing an economically—and, for Eastern Europe at least, also politically—more appealing alternative. (Bornstein, pp. 308–309.)

13. *Changes or reform in Soviet institutions of planning and management have often been touted as effective means for improving economic performance. How significant have official reform programs been to date? What are the prospects for reform contributing to economic performance?*

Over the past dozen years, the Soviet government has undertaken a series of measures unprecedented in scope and intensity, in an effort to improve efficiency in the economy's use of resources and the quality of its products. These measures have entailed: restoration of the ministerial system of managing industry; establishment of new agencies to administer prices and centralized rationing of producer goods and to oversee the mammoth research and development effort; the merger of enterprises into large associations; revisions of prices; increased use of financial variables; alterations in planning techniques; contracts and pecuniary sanctions; and numerous revisions in incentive arrangements, emphasizing profits, sales and other indicators of efficiency. This plan of attack on the USSR's perennial problems was outlined in 1965 by Premier Kosygin in his much-touted program of economic reform. Since the problems stubbornly refused to go away, the period since 1970 has witnessed a continuous process of reforming these initial reforms. The reformed "reforms" and the "improved" plans also have not made matters much better. Throughout the decade, the

growth of productivity has been declining, and Soviet products continue to meet sales resistance both at home and abroad. Yet another round of reforming the reforms is now on the drawing board. It seems to involve more administrative centralization and coordination, perhaps with new intermediate organs of some kind, and still another revision in plan indicators and incentive arrangements. If, as in the past, these new reforms leave the essentials of the system unaltered, they, too, will not alleviate the system-based malaise. A severe economic crisis—administrative paralysis, declining production or popular uprising—might persuade the political leadership to embark on a system-shattering reform, as did Lenin in a period of crisis nearly six decades ago. If the economy continues to inch forward, the decade of the 1980's will probably witness still more "reforms" of planning procedures, organizational arrangements and incentive schemes, along with persistence of the familiar problems. After 60 years of experience with a socialist economy run by government agencies, however, nearly everyone seems to have found ways to turn its shortcomings to individual advantage. (Schroeder, pp. 312–313.)

14. *What have been the trends in Soviet defense spending? How does it compare with other nations including the United States? How may we assess their approach to the "defense burden" and to military and economic resource allocation choices?*

Contrary to the newspaper headlines, the U.S. Government estimates do not show that the Soviets "outspend" the United States, because Soviet military spending does not take place in dollars, nor do Soviet military planners respond to U.S. relative costs and prices. The same conclusion would hold in a ruble comparison with the actors' roles reversed. However, there is little question that the aggregate of Soviet military programs as well as most of the major components are larger in size than those of the United States, and have been so for most of this decade. The Kremlin has maintained a fairly steady pace of increase in Soviet military outlays for 10–15 years, and U.S. ME declined during the first part of the 1970's. But, so what? Does it matter?... Two conclusions from the available estimates must temper the observer's agnosticism:

(*1*) Given the duration of the Soviet ME buildup and the only somewhat shorter period of decline in American ME, a change must have taken place in comparative capability relative to the situation of the early 1960's. Only two factors could negate that result—substantial diversion of Soviet energies in directions that do not bear on the U.S.-USSR military balance or increasing inefficiency of Soviet relative to U.S. ME.

Critics of the allegedly "alarmist" view of the Soviet buildup have pointed to the massing of Soviet forces along the Sino-Soviet frontier as evidence of the operation of the first factor. However, apart from the fact that Soviet Asian forces can be used in a variety of other contingencies that do affect the central superpower balance, it appears that deduction of the estimated cost of Soviet programs with a primary mission against China would lower the dollar value of total Soviet activities in 1978 by only 15 percent. Moreover, a significant portion of U.S. outlays may also be deemed peripheral in this sense.

As for the second factor, the possibility of increasing gaps between resource costs and military capability, this may be understood in two senses. The first is the ordinary idea of productivity, relating input to output, and on this no hard evidence is yet available. True, the corollary of the CIA's 1976 change in ruble estimates was a downward revision of the implicit estimate of Soviet military productivity, but this was a one-time change with no implications for the trend—that is, it represented a parallel shift downward of the trend line, not a change in its inclination. It seems likely that Soviet military production costs have been rising (based on a variety of evidence, including the increased complexity of certain categories of Soviet hardware). So have the costs of U.S. weapons procurement. The *comparative* rates of change in cost appreciation are unclear. This is certainly true of the change in comparative military efficiency.

A second sense of the cost-capability gap raises the familiar question, How much is enough? As William Hoehn notes, the United States and the Soviet Union have had sharply different strategic perspectives. The Soviet commitment to "war-fighting" is expectedly costly, but perhaps the Kremlin is misguided and is simply wasting resources. This is not the place to enter into that question, but it must be noted that U.S. Government views are apparently changing and draw-

ing closer to the Soviet perspective, as signalled in Defense Secretary Harold Brown's recent "posture statement," which in turn may be connected with the change in Congressional and public attitude.

(2) Continuation of the outlay trends of the early and mid-1970's into the 1980's is likely to result in additional capability changes in the same direction. As noted, there are no signs of a halt to the Soviet buildup; CIA forecasts "business a usual" for the next few years. SALT II, if it comes into operation, will probably have only a marginal effect on either side's military effort. Much has been made of the recent turnaround in U.S. outlays and the 3 percent annual increase promised our NATO allies. However, many observers doubt that U.S. ME in aggregate will achieve a sustained real rate of increase of as much as 3 percent annually, because of the pressures of competing domestic U.S. efforts.

How long the USSR will be able to maintain the steady pace of enlargement of its military might cannot, of course, be predicted. The Western perspective has been substantially altered by the sharp revision in 1976 of CIA's estimates of Soviet ruble ME, which resulted in raising the estimated ME share of Soviet GNP from 6–10 to 11–13 percent. Also, major economic problems—related to energy, demography, and productivity—are on the Soviet horizon, the first symptoms of which are already being experienced. However, a judgment on how heavy a "burden" the current defense/GNP ratio constitutes must take into account Soviet historical experience, not just the contemporary record of other nations. Above all else, the judgment depends on appreciation of the perceptions of various Soviet leadership groups. This is a very large subject and cannot be attempted here.

Unless internal economic and political pressures act to slow down the Soviet military buildup, the United States must expect that stabilization of American ME will mean a continued lag in improvement of military capability relative to that of the USSR. (Becker, pp. 365–366.)

Likewise the assessment of the likelihood of shift in resource allocation from military to civilian purposes is complex and subject to varying views.

With mounting economic problems Soviet intentions in the military sphere have become an increasingly controversial question. Some observers have argued that Soviet institutions and ideology, in conjunction with Russian history, virtually dictate a continued rapid military buildup and its aggressive use for political—and perhaps economic—purposes. Others have maintained, generally with less fervor, that technological and economic necessity may lead the USSR to slow the pace of its military expansion. Neither side has been able to develop a persuasive case on the basis of recent evidence, for Soviet actions and doctrines have often appeared contradictory. The result has been highly unsatisfactory, both in terms of clarifying expectations about future Soviet policies and in terms of developing approaches for countering or influencing these policies . . . .

There appear to be two basic ways in which observers tend to think about the relationship between the economic and military sectors when considering the impact of the Soviet economic slowdown. One is to view military production as a "burden" and to ask how the Soviets can afford to devote such a large share of GNP to the military sector and to continue to maintain a high rate of military growth as the economy slows. Behind this way of thinking appears to lie the assumption that logic or rational policy ought to dictate a parallel reduction in the military growth rate as economic growth declines; i.e., it posits a positive correlation between changes in military and economic growth rates.

The second approach tends to view military production as the top priority, indeed, as the ultimate "final product" of the Soviet economic system, rather than as a burden on that system. The expectation is that military production will be maintained at past growth levels despite the increasing costs this imposes on economic growth and consumption. Those who take this approach in effect argue that even though productive capacity is growing at a progressively slower rate, the Soviets can afford and will choose to allocate an increasing share of GNP to the military, i.e., they posit essentially no correlation between change in military and economic growth rates. . . .

For many years the Soviets have devoted considerably more of their resources to military production than most countries. This has been reflected in the structure of the economy, particularly the lack of consumer goods and housing. An

a priori case can be made that a command economy will in the short run be best prepared to produce more of what it has accorded top priority.

If the Soviets appear to face better military returns in the near term but potentially better economic returns over time, the question of technology transfer becomes more complex. On the one hand, technology which has a relatively rapid impact on production would appear to have the greatest prospects of ending up supporting military production. On the other hand, technology which takes a considerable time to affect production would appear less likely to be used in support of military production. While obviously many factors need to be considered in any particular case (especially the transferability of the technology itself), the desire to transfer civilian—but not military—technology to the Soviet Union may in general be better served by encouraging Western involvement with long-range projects which promise to increase the returns in the economic sphere for long-run Soviet Power Production Possibilities Frontiers (PPPF's). Encouragement of such involvement, if taken by the Soviets as a sign of an improved and more stable political climate, might also have some impact on Soviet preferences, the other basic determinant of elusive Soviet "intentions." (Schaefer, pp. 341–342, 345.)

15. *How does overall economic performance of the United States and the Soviet Union compare in recent years?*

Since 1955 the Soviet economy has gained substantially on the American economy in relative terms although the absolute gap separating them is still increasing. In 1955, with postwar recovery completed, the USSR's gross national product (GNP) was 40 percent of U.S. GNP. Ten years later, the ratio had climbed to 50 percent. After 1965, the USSR continued to close the gap, although at a slower rate. By 1977, Soviet GNP had reached 60 percent of the U.S. level. Over the whole period 1956–75, the absolute difference between U.S. and Soviet GNP increased slightly. . . .

Soviet progress vis-a-vis the U.S. has been markedly uneven, with the most rapid gains occurring in defense and new fixed investment. Progress in consumption has been less remarkable. . . .

Most of the Soviet gains in relative U.S.-U.S.S.R consumption levels occurred in the food and soft goods categories. The effects of the Khrushchev-Brezhnev grain and livestock program can be seen in the rise of per capita consumption of meat and dairy products from 27 percent of the U.S. consumption in 1955 to 48 percent in 1977. Even larger relative gains were made in the provision of consumer durables and household services. The consumer fell further behind in housing, and health, and lost his lead in education.

Meanwhile, Soviet outlays for investment and defense and space caught up with and surpassed those of the U.S. Investment in the USSR was 46 percent of the U.S. level in 1955 and 116 percent in 1977. Trends in defense spending are equally striking. Between 1965 and 1977, Soviet defense outlays increased as a share of U.S. spending from 72 percent to 137 percent. Perhaps the most noteworthy aspect of Soviet economic history over the past 25 years has been the USSR's success in supporting both civilian and military investment so lavishly. As returns on fixed investment continue to decline and the costs of providing the economy with energy and raw materials rise, however, the Soviet leadership has concluded that investment cannot continue to climb at past rates. . . .

With economic growth slowing down, the tradeoffs between new fixed investment and defense spending and between new fixed investment and consumption seem to become more apparent to Soviet policymakers. (Edwards, Hughes and Noren, pp. 370–371.)

16. *Industrialization has been the centerpiece of Soviet economic development. How does current compare to past industrial growth?*

After some 25 years of sustained high rates of growth, fueled by even larger increases in new capacity, Soviet industry is entering a period of increasing strain. Rising costs of raw materials, impending energy shortages, slowing growth in labor and capital resources, and sluggish productivity—all point to a major slowdown in industrial growth from now through much of the 1980s. Indeed the lackluster performance of this sector during the past three years, whether gauged by Western measures or Soviet official statistics, suggests that some of these problems already are beginning to take their toll.

Since 1975, heavy industry has slowed sharply and, with it, the wherewithal to maintain rapid rates of growth simultaneously in investment goods, defense hardware, and consumer durables. Shortfalls in the production of key industrial commodities—especially steel, construction materials, and machinery have been a major factor in this slowdown. In the energy sector, growth in oil output and coal production also is slowing. Growth in these products since 1975 has been the lowest in the post-World War II period, reflecting an approach to resource management that has emphasized short-term exploitation at the expense of maximum lifetime recovery. Moreover, the Soviet record in bringing new capacity on stream during the last three years has been dismal. And this has delayed the introduction of labor-and-materials-saving technology which, in turn, is hampering current efforts to conserve resources.

To some extent, the recent decline in industrial growth reflects increasing tension between demand for and supply of labor, capital, and natural resources. But more important, it reflects the Soviet failure to use resources more efficiently. While productivity has never been the primary engine of industrial growth, in recent years declining productivity has constrained growth. Thus, Soviet leaders are under increasing pressure to reconcile industrial capabilities with resource constraints. As yet, however, no clear strategy has emerged. Instead, the leadership seems to have adopted a crisis management approach: throwing a larger share of investment resources into the hard-pressed energy and ferrous metals sectors to maintain the flow of raw materials to the rest of the industry and to other sectors of the economy. With ever rising capital costs in extractive industries and smaller increments to total investment, however, a continuation of this approach could squeeze the investment resources of other claimants. This may increase tension within the leadership over civilian vs. military resource allocations decisions, the more so as marginal changes in resource allocations take on increasing importance in the 1980s.

Even without this complication, resource allocation decisions are not likely to get any easier for industrial planners in the years ahead. The greater role of Siberia as the source of future increases in raw materials means that investment projects will be more costly and their payoff further away. Thus, Soviet planners will have to make judgments about the cost-benefit ratios of alternative projects whose major benefits may lie chiefly externalities that are as yet dimly perceived. To the extent that planners continue to apply short-run criteria to long-run investment decisions, industrial and economic growth is likely to fall still further in the 1980s and beyond. (Whitehouse and Converse, pp. 402–403.)

17. *How has labor productivity increased in recent years of restricted labor supply?*

. . . Unlike the requirements for intermediate product inputs, total labor requirements changed drastically, declining throughout the period and especially in 1966–1972. Nearly twice as much labor would have been required to produce 1972 final demand with 1959 technology as was in fact required in 1972. In absolute terms more than half the decrease was attributable to agriculture and another 25 percent to the construction and transportation and distribution sectors. In relative terms, the most striking changes are the increase in Machine Building and Metal Working (MBMW) requirements and the decrease in agriculture. The electric power, chemicals, light and food, and transportation and distribution groups also increased relatively, while fuels and wood, paper, and construction materials declined.

This analysis provides statistical confirmation of the general rise in labor productivity in the Soviet economy. Not surprisingly, the agricultural sector contributed heavily to this rise. Nearly 40 million more agricultural workers would have been required to produce the 1972 bill of final goods with 1959 technology than were required in 1972—130 percent more, and even with 1966 technology over 20 million (67 percent) more would have been needed. The changes in the wood and paper industries and in transportation were nearly the same in proportion (though far less in numbers). Other sectors that exhibited large decreases in labor requirements were construction, construction materials, textiles and apparel, and food processing.

A surprising conclusion from this analysis is that the MBMW and chemicals group apparently contributed little or nothing to the overall rise in labor productivity, especially in the period 1959–1966. In MBMW, the use of 1966 technology to produce 1972 final demand would have required about 40 percent more labor than with 1959 technology. . . . (Gallik, Guill, Kostinsky, and Treml, p. 433.)

18. *How do the introduction and implementation of inventions contribute to technological progress and sectoral performance?*

To the best of our knowledge, we have provided the first comprehensive measure of Soviet lead time and measure of certain technical, organizational, and administrative factors affecting Soviet lead time....

The results of this paper bear out most of the hypotheses developed earlier by Western scholars on the basis of case studies, Soviet policy pronouncements and anecdotal material.... "In-house" implementation drastically reduces lead time, and Soviet lead time is considerably slower than Western lead times. . . . However, our finding of similar lead times in the defense, industrial, and civilian machine building sectors—after accounting for technology—questions the generally accepted view of markedly superior defense industrial performance.

The findings of differentials in sectoral performance also have important implications for Soviet economic prospects. Our results suggest that lead times in civilian machine building are slightly longer than lead times in other civilian industries.... The civilian machine building sector includes ministries that specialize in computers, instruments, and sophisticated electrical machinery, and it has been a principal recipient of Western tchnology (automobiles and chemical machinery). Generally, machine building has been acknowledged by Soviet specialists to be the principal foundation for technical progress.... (Martens and Young, pp. 507–508.)

19. *What progress has the Soviet domestic computer industry made? To what extent is the USSR dependent on imported equipment?*

The Soviet computer industry lags behind the West in the number, variety, and technology of computers as well as in auxiliary equipment and supporting services. This has led to a substantial level of imports to meet priority needs. Although Western computers comprise only about 4 percent of the total Soviet inventory because of their superior performance and reliability, their relative contribution is much larger.

During 1972–1977, the USSR imported more than $245 million of computer equipment from the West. Nearly 82 percent consisted of computer systems almost equally divided between large and minicomputers. The United States was the largest single supplier accounting for $120 million or nearly half of the exports of total equipment. Including indirect sales, the U.S. share was much larger, since exports of U.S. components in the products of U.S. overseas subsidiaries and other Western firms are not included. The U.S. was also the dominant supplier in numbers of systems exported, accounting for 61 percent of all systems (excluding systems from overseas subsidiaries) : 42 percent of the 45 large computers that were exported, and 62 percent of the 721 minicomputers.

Most of the imported large computers are used for economic data processing. By contrast, nearly half of all minicomputers are used for basic and applied research and development; another 30 percent are employed in industry mainly for process control, and to a lesser extent, for management. Of all the computers in industry, half are in the automotive sector.

The Soviets have imported large Western computer systems because these offer performance they cannot match, include complex software they have not developed, or include training they cannot duplicate. Minicomputers have been imported for similar reasons and also because the great diversity of types of Western systems makes it possible to meet a wide variety of specialized needs. As a result of these attributes, Western computers enable the USSR to accomplish tasks that would be very difficult if not impossible with domestic systems. For example, U.S. computers in use at the KAMA Truck Plant resulted in reducing the time required to achieve a given level of output by at least five years. Finally, the training programs for civil applications provided with imported systems can be reproduced including possible use in military applications.

Over the next few years, the scope and pace of Soviet imports of Western computer equipment is likely to be mainly determined by progress in domestic computer technology. Since the technology gap is not expected to narrow substantially, the Soviets probably will continue to purchase the very large and the very small Western systems. The required outlays of hard currency per computer, however, may gradually decline as advances in Western technology continue the trend toward increased unit capability for less cost.

An unpredictable factor affecting Soviet imports in the 1980s will be the treatment of technology sales. Should controls of sales of technology be relaxed, the Soviets probably would undertake large-scale purchases of computer manufacturing, test, and quality control equipment. The Soviets recognize that purchase of Western manufacturing technology offers the best, and probably the only path for bridging the technology gap quickly. Technology has been sold to the Soviets in the past to a very limited extent. Prospects for a major relaxation of technology controls and hence, of large-scale Soviet purchases, however, seem remote for the next few years at least. (Tasky, pp. 510–511, 523.)

The use of improved domestic and imported computer systems shows promise for facilitating significant improvement in economic performance.

An important point to be made here is that the Soviet vision of using computing as a means of implementing more effective centralized control of a national scale is neither hopelessly ill-conceived nor unattainable (to some extent at least) by the end of the century. Furthermore, this goal could possibly be achieved concurrently with a considerable amount of politically acceptable economic decentralization. This paper has tried to show that, thus far, the gap between Soviet theoretical aspirations and practical implementations has remained large and that progress in closing that gap has had to wait for foreign examples. But the Soviets have yet to take full advantage of opportunities, which exist in theory at least, afforded by national centralized control.

In the meantime, the Soviets have some difficult problems to overcome if they are to continue to progress at their current rate. Two of the most important of these are the prevalent users' attitude toward computer-related vendors and the attitude of Soviet low and middle level management towards the introduction of computers as an important element within their domains. . . .

One particularly Soviet technique for increasing the computer consciousness of management is via the ideology of the "scientific-technological revolution," in which computing is a centerpiece technology. Whatever its philosophical merits, in terms of promoting the practical enterprise-level use of computing, the new ideological framework is useful. . . .

The USSR has lots of talent and lots of need. The two need to be brought together in some effective way. Various forms of technology transfer from the West might serve as catalysts to help bring this about. However, the changes that will come will take time and have to fit in which the way things are done in the Soviet Union. Simple foreign transplants will not work. No reforms in a country that is as self-conscious as the USSR can be successful if they are divorced from Russian and Soviet traditions. This is now the crux of Soviet computing problems, at least as they relate to general purpose use on a national economic scale. (Goodman, pp. 549–551.)

20. *Machine tools may be a central constraint on Soviet industrial technology. How can they cope with this problem?*

Imports of machine tools have made an important contribution to the successful completion of the two largest civilian investment programs of the past decade—the Tol'yatti Passenger Car Plant and the KAMA Truck Plant. These projects, without Western machine tools would have taken longer to bring onstream, and, probably would have imposed severe strain on domestic machinery programs. . . .

Imports, however, are only a short-term solution to an essentially long-term problem. The Soviets need to raise the productivity, precision, and reliability of conventional machine tools across-the-board, and to stay abreast of worldwide developments in advanced machine tool technology. This task will not be easy as the dismal Soviet record of improving the state-of-the-art in gearcutting and grinding machine tools after long effort, amply testifies. At a minimum the Soviets will need to accelerate investments in R&D and in the renovation of machine tool production facilities. . . .

Under existing Soviet priorities and conditions of production, it is unlikely that the Soviets could catch up with the West in machine tool technology by its own efforts. The penchant for copying Western innovations, rather than advancing state-of-the-art through indigenous efforts, tends to condemn the USSR to a permanent "catch-up" role. (Grant, pp. 578–579.)

21. *Will oil production level off and decline, thus becoming a major foreign and domestic economic problem area?*

The Soviet Union, the world's leading oil producer, faces serious problems that are likely to result in a no-growth position by 1980 and a steady production decline beginning in the early 1980s. A major shift in energy policy was initiated at the December 1977 plenum of the Central Committee of the Communist Party. . . . This policy called for a crash program to concentrate oil industry resources in West Siberia, the only region where major output increases have been obtained in recent years or projected by the Soviets in the foreseeable future. In other important regions, such as the Volga-Urals, production is on the decline.

Despite the massive resource shift, Soviet oil prospects are uncertain at best. The failure in recent years to conduct adequate exploratory drilling to locate new oilfields is lowering the reserves-to-production ratio to the point where short-term growth in output is unlikely. No new major oil finds have been made in the last 6 years, despite Soviet admissions that new giant oilfields must be discovered regularly if growth in oil production is to be sustained. . . .

The stepped-up campaign to develop West Siberian oil and gas resources faces two major problems. Given tight constraints on the supply of drilling rigs and skilled crews, more resources for this region will inevitably force older regions to do with less and lead to a more rapid falloff in their output. At the same time, Moscow's failure to create an adequate infrastructure in West Siberia will greatly reduce the effectiveness of new increments of investment. . . . The Soviets have not created the production and support structure required to produce the many smaller and less productive oil fields from which much of West Siberia's oil output must come in future years—now that Samotlor, the USSR's largest oilfield, apparently will peak this year.

Until the 1970's the Soviets relied for the most part on their own equipment and know-how for oil production. In recent years, they have begun to import Western equipment and acquire Western technology to cope with more difficult oilfield problems. But even a much greater effort to buy or acquire Western equipment and technology would avail little in the way of increased production capacity before the mid-1980's.

As the rate of growth of oil production slows further, this year probably will mark the beginning of a trend of declining oil exports to the West. Higher oil prices may still allow the USSR to maintain or increase hard currency earnings from oil sales in 1979 at or above 1977–78 levels. By the mid-1980's, if production declines to a level of 10 million b/d, the USSR may have enough oil for its own needs but would have to procure from the West almost all of the oil it delivers to other Communist countries. At that time the USSR would spend rather than earn hard currency in its oil trade. (Lee and Lecky, pp. 581–582.)

22. *How have central economic plans addressed the widened development gap among the more and less economically developed republics of the USSR?*

. . . An analysis of the interrepublic redistribution of national income accomplished through the state budget shows that since the mid-1960's it has primarily benefited the less developed republics of Central Asia and (to a lesser extent) the Transcaucasus, while the Ukraine has consistently had an excess of produced over utilized national income throughout this period. Calculations based on interregional input-output models constructed for 11 republics reveal a number of relations between the level of development of republics and their dependence on interregional trade. One of the major features of the economic interdependence of republics is the importance of interrepublic ties in the capital formation process. The redistribution of national income has had a greater effect on levels of investment than on levels of consumption in less developed republics, and these republics have been highly dependent on interregional trade in satisfying their needs for capital accumulation. (Gillula, p. 619.)

23. *How does growth of employment and quality of labor force vary by republics in the USSR? Will labor deficits in traditional European Slavic regions be offset by shifts in employment for Central Asia and Kazakhstan?*

Growth of employment varies considerably by republic, but with the exception of Moldavia, the European republics manifest a lower rate of growth than the Asian republics. The R.S.F.S.R. shows the lowest annual rate of increase in employment, 2.0 percent. This low rate shows that campaigns and incentives to retain new workers in Siberia and the Far East have not been successful. It also indicates a considerable outmigration of Russians, particularly to Kazakhstan and the Ukraine. The annual growth rate of 3.7 percent in Kazakhstan was the highest for any republic during this period.... The rate of growth of employment has been declining in recent years. During the 1970–1975 period, for example, the annual rate of growth of employment in the socialized sector declined to 1.9 percent in the USSR as a whole; among the republics, the 1.1 percent rate in Estonia was the lowest. (Rapaway, p. 601.)

This uneven rate of increase in employment by republic might be offset by substantive outmigration from the Central Asian and Kazakhstan republics, but is deemed unlikely.

The overwhelming weight of evidence indicates that migration of labor from Central Asia to the labor-deficit areas of the USSR will not be on the scale required to offset the anticipated multi-millions labor shortage in European Russia during the 1980's. Whether enough machinery can be purchased abroad or manufactured at home to modernize the Soviet industrial plant, enough foreign labor imported, and enough increase in labor productivity attained to make up for the impending shortage of workers are the major imponderables. These seem to be the key elements of current Soviet economic development strategy for the future. It is doubtful, however, whether they will be entirely successful. Rather, it can be expected that there will be further retardation in the rate of economic growth in the Soviet Union during the 1980's. The implications that such a reduction in economic growth would have for the allocation of resources between investment, consumption, and defense are beyond the scope of this paper. (Feshbach, p. 691.)

24. *In view of the constraints on materials and manpower the quantity and quality of scientific and research personnel in the Soviet Union has taken on increased importance. How does employment in scientific, research, and development activities compare in the USSR and the United States?*

. . . during the early 1950's the United States was well ahead of the Soviet Union both in the number of scientists and engineers employed in R&D and in the rate of employment growth. By the end of the decade, however, the Soviet rate of growth rose above the U.S. rate and remained far ahead during the 1960's. The crossover point in number of employees was reached toward the end of the 1960's. From 1969 to 1975 the Soviet total continued to increase more rapidly than the U.S. total, although the rate of growth declined. The U.S. growth rate surpassed the Soviet rate by a slight margin during the period from 1975 to 1978. The number of R&D scientists and engineers in the United States, however, declined during the first half of the 1970's and regained the 1969 level only in 1977. As a result, the Soviet number in 1978 was nearly 60 percent greater than the U.S....

The distribution by scientific field of specialists with advanced degrees (i.e., doctorates in the United States and candidate or doctor of sciences in the USSR) diverges from the distribution of total scientists and engineers in R&D.... The proportion of specialists in the physical and life (i.e., natural) sciences is roughly 45 percent for both countries, whereas approximately 32 percent of the total number of R&D scientists and engineers were in these sciences in 1974. Employment in the individual natural sciences in the two countries has almost the same distribution as employment of total scientists and engineers in R&D. The United States share in biology, however, is much higher than the Soviet share, probably reflecting the years in which biology was a controversial field in the USSR. In engineering, the Soviet percentage of specialists with advanced degrees is more than twice that of the United States. Except in economics, the Soviet proportion in the social sciences and humanities is lower than the U.S. (Nolting and Feshbach, pp. 746–747, 749.)

25. *Rising real income and increased availability of meat, housing, autos, and other prized goods and services are important stimuli for raising labor productivity. How successful has consumption policy been? What are the promises for the future?*

The Soviet consumer entered the 1970's with raised expectations. Consumption goals for the Eighth Five-Year Plan (1966–1970) had been met for the first time in Soviet planning history, boosted by improved performance in agriculture and unprecedented imports of Western soft goods. The average annual rate of growth in per capita consumption during 1966–1970 was above that for either of the previous two five-year periods. Moreover, the Soviet leadership seemed to commit itself more seriously to consumer-oriented programs, symbolized by the pledge to raise the output of quality foods.

In general, the 1970's have been a disappointment. Although substantial resources have been devoted to some consumer programs, a clear-cut boost in priority for the consumer has not been forthcoming. Growth in per capita consumption has been slow and erratic compared with the late 1960's. The main obstacle to steady consumer progress has been the poor performance of the agricultural sector, which seriously disrupted the program to improve the Soviet diet....

The relative mood of the Soviet consumer is not inconsequential to the leadership. If the Soviet worker cannot see a potential for improving his lot, he will not respond with alacrity to increased incentives at the farm or factory. Yet a substantial boost in labor productivity is essential if the economy's sliding growth rates are to be reversed. Leadership decisions in the consumer area also are of increasing significance to the rest of the world. Consumer-related imports excluding machinery and equipment has constituted about a third of total Soviet imports since 1965. The decision to import grain in recent years is a good example of the potential impact on world trade of a change in Soviet consumer policy. (Denton, p. 760.)

Housing like meat has been a key to consumer incentives and satisfaction. In spite of substantial programs, adequate housing continues to be a problem area.

After years of neglect, the Soviet regime in the mid-1950's launched an ambitious residential construction program with the stated purpose of eliminating the severe housing shortage which had forced the majority of urban households to live communally with many families sharing an apartment and averaging 5 sq.m. per person. Now, almost a quarter of a century later, the majority of urban families live in apartments of their own which is a significant improvement.

However, thirty percent or more of urban households (families and singles) still live communally or in dormitories. Therefore, the promise that each family would have an apartment by 1980 will not be kept because the number of dwellings has still not caught up to the number of households. The rate of construction which peaked with 2.7 million units in 1959 has levelled off to 2.1 million units in the latter half of the 1970's and since 1969 has fallen below the yearly number of marriages. This is why most newlyweds are compelled to live with their parents for many years before receiving a place of their own. Housing conditions would seriously worsen if large urban centers were not legally closed to millions of would-be migrants, many of them working in cities but denied permission to reside in them.

The still acute housing shortage is the government's responsibility. It invests heavily in industry, attracting workers and managerial personnel to urban areas yet under-invests in housing construction and other consumer services which are needed to take care of them. It restricts consumer choice to high density apartment-style living in cities thereby discouraging consumer initiative for private home building and for cooperative housing by charging a costly down payment instead of offering more generous credit terms. As long as the state remains the principal financier of urban housing construction without even a partial return on its investment, the housing deficit in relation to households can only be reduced incrementally. However, if rents were raised to pay for a significant portion of the construction cost and for the upkeep of the housing stock then the state would be in a much more favorable position to increase substantially its investment in housing and accelerate the rate of construction without seriously neglecting other sectors of the economy. Since such a change in policy is not

feasible at the present time because of the government's often repeated commitment to distributing housing free of charge, which the Soviet urban consumer finds very attractive (not realizing that he is paying higher prices for food, clothing and durable goods to pay for the state's huge housing subsidy) the shortage in housing will continue for many years to come. (Morton, pp. 808–809.)

Increased availability of passenger cars is both a source of satisfaction and frustration to the productive and rewarded Soviet citizen.

The automobile age has finally arrived in the Soviet Union with the mass production of passenger cars for private use. Production has increased by more than fourfold since 1970 as new automobile production capacity has been expanded, production efficiency improved and existing excess capacity more fully utilized.

Relative to Western countries and even their East European neighbors, however, private car ownership in the USSR is still very low and the average consumer faces frustration and bureaucratic impediments in purchasing a new car. In addition to a carefully orchestrated allocation system whereby "elite" groups are granted special privileges in obtaining cars, retail car prices are relatively high, and consumers face a long waiting period for delivery, a lack of installment credit, and little freedom of choice of model, color and equipment options. Domestic consumption is also stymied by the fact that Moscow exports over one-quarter of the passenger cars produced. . . .

Having successfully purchased a car, a new owner is faced with still further problems. Existing service and maintenance facilities do not meet the public's need—in both quantity and quality. In addition, spare parts and the supply of gasoline are in short supply. As a result, a flourishing black market exists supplying those who can afford the higher prices. Finally, the opportunity to travel by car within the Soviet Union is limited because of both an inadequate and poorly constructed road system and a lack of roadside accommodations.

As private car ownership continues to grow into the 1980's, Soviet authorities will also be faced with a number of formidable problems. Inadequate parking space and traffic safety have already become major problems and will probably get worse. Pollution and traffic congestion in urban areas will also have to be faced as Soviet citizens use automobiles more to commute to work, to shop, and for long excursions. (Welihozkiy, pp. 811–812.)

26. *As an additional source of goods and services and stimulus to the Soviet consumer an illegal, private economy has been permitted to exist and grow. What observations are supportable on this unusual aspect of the Soviet economy at this time?*

The illegal economy probably comprises the larger part of the whole private economy, legal and illegal. To begin with, the range of permitted private economic activity is very limited, and little of that is conducted without some significant admixture of illegality. Thus, though in principle an activity may not be illegal, some of the inputs (materials, supplies, transport, equipment, space, and—not the least—labor) may be systematically obtained in some illicit manner and at unlawful prices or wages, while the products themselves may often (though not always, see below) be sold in black markets at "black" prices. Finally private plot farming aside, all but the most trivial private activity, if permitted, requires a license, but the license inevitably brings the tax inspector and high income taxes in its wake. Hence, taking out a license is often avoided, thereby rendering the undertaking *ipso facto* illegal.

To be sure, there is nothing uniquely Soviet about either illegal production and exchange or bribery, although in both their nature and extent these phenomena are distinctively different in the USSR in some respects. As elsewhere, the scope and variety of illegal economic activity in the USSR are limited only by human daring and ingenuity, as well as by the efficacy of law enforcement.

. . . The total nominal value of personal incomes would almost certainly be significantly augmented by addition of illegal incomes to the total of official (legal) incomes. So would the nominal value of personal consumption and investment expenditures by addition of black market purchases and bribes. This being the case. it is not unreasonable to suspect that there may be perceptible effects also on such break-down measures of personal income as its regional distribution among various functional groups of the population (sectors and branches, occupations, etc.), and, lastly, its size distribution. (Grossman, pp. 835, 851–852.)

I. POLICY PERSPECTIVES

SOVIET ECONOMIC PROBLEMS AND ALTERNATIVE POLICY RESPONSES

(By Holland Hunter*)

CONTENTS

I. Introduction

After a long period of steady progress, the Soviet economy has entered an era of increasing difficulties. Policies and procedures that worked well in the 1950's and 1960's have yielded diminishing returns in the 1970's and now appear to face failure in the 1980's. While the papers in this volume address many detailed aspects of this situation, the present essay offers some overall perspective on the forces at work and the alternatives open to Soviet authorities in responding to major problems.

First, several major features of recent Soviet economic experience are described and compared with recent Western experience. Like other economies, the USSR has been experiencing slower growth rates coupled with inflationary pressures. In addition the USSR has its own unique economic problems. Section III of this essay spells out the resulting many sided dilemma that confronts Soviet authorities. Effective responses to Soviet economic problems may require fundamental changes in the Soviet system. Section IV goes on to sketch three alternative policy directions to illustrate the options that could plausibly be chosen. The three scenarios are not exhaustively analyzed. They are offered, rather, as a conceptual framework within which the detailed papers of this volume can be evaluated. An additional section comments on the implications of these alternatives for Soviet foreign economic relations, and the essay ends with observations on U.S. concerns.

In a nutshell, this analysis suggests that the USSR must change in order to deal adequately with its economic problems. The problems stressed here are declining output growth, serious inflationary pressure, slow technological progress, and accumulated deficiencies in housing and other public needs. Responses to these problems are

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blocked, however, by institutional resistances that reflect the very nature of the present Soviet system. The methods used to create massive heavy industrial and military power worked well for a generation, but they have been the cause of the accumulated deficiencies, the slow technological progress, and the inflationary pressure. Now, under new conditions, Soviet authorities face a choice between frustration of their growth objectives and reform of their methods.

We examine three alternative Soviet policy approaches: a "muddling through" scenario in which existing policies continue, a "liberal" scenario involving relaxation and decentralization of controls, and a "conservative" scenario embodying reversion to even more centralized and stern procedures. We also sketch the foreign economic relations likely to accompany each scenario, noting some of their implications for the outside world. Not unexpectedly, the gains in productivity and efficiency obtained under the "liberal" scenario make it far more effective in meeting Soviet problems than the "muddling through" or "conservative" scenarios. The "liberal" scenario is also the one most conducive to peaceful and healthy international economic relations. The "muddling through" scenario, though perhaps the most likely to occur, involves continuation of economic policies and procedures that have already shown their inability to meet the economy's current problems. Continued "muddling through" will also limit the USSR's ability to be a productive participant in the world economy. Finally, the "conservative" scenario embodies retrogressive policies that seem even less likely to enable the Soviet economy to compete effectively under late 20th century conditions.

II. Four Major Features of Recent Soviet Economic Experience

During the 1970's, output has been growing in the Western industrial world more slowly than during the 1950's and 1960's. Among the forces at work, higher energy costs have been significant. On a smaller scale, efforts to reduce environmental disruption have raised costs and slowed material output growth while raising its overall contribution to welfare. Higher labor costs, higher import costs, and diverse trade restrictions have hampered real gains.

Output has been growing more slowly in the USSR as well, but chiefly for other reasons.[1] The costs of obtaining and using natural resources have been rising in real terms as high grade, well located resources have been depleted and less accessible supplies have been drawn on. Continued massive flows of annual investment in fixed capital formation have encountered diminishing returns, not significantly offset by technological progress. Soviet agricultural output growth has been set back by two very bad crop years (1972 and 1975), with some indication that climatic trends may have changed for the worse.

Though the rate of Soviet output growth has been slowing down, it is still positive. There have been no absolute declines in Soviet

[1] See "Output trends: Prospects and Problems," by F. D. Whitehouse and D. R. Kazmer, and "The Outlook for Soviet Agriculture," by B. S. Severin and D. W. Carey, in Holland Hunter, editor, The Future of the Soviet Economy, 1978–1985 (Boulder: Westview Press, 1978).

GNP since 1946. The recent growth rate, though lower than before, is still respectable. In a world economy where all major economies face growth constraints, recent Soviet overall growth performance appears impressive. It is its internal composition and qualitative characteristics that give concern to Soviet authorities and evoke criticism from outside observers.

The Soviet economy shares with the outside world a second common feature—inflationary pressures. Upward pressure on the price level in the USSR, however, does not reflect the usual wage-price spiral nor is it associated with large government budget deficits. Most wages and prices are controlled by the Soviet state, and official prices are only occasionally revised upward, in substantial general adjustments every eight years or so, with ostensible stability reigning in the intervening periods.

As for budget deficits, a "proposition 13" mentality has long been characteristic of Communist public finance and Soviet authorities have maintained balanced state budgets for several decades. Large hidden sales taxes and taxes on enterprise income siphon off enough current purchasing power to cover state outlays for national defense, education and public health, social security, and most fixed capital formation. The state budget does not, therefore, inject purchasing power into current income flows.

Chronic concealed inflation is nevertheless a serious problem in the Soviet economy. The pressures reveal themselves, not in sharply rising wages and prices, but in chronic shortages, long consumer queues, pervasive economic inefficiency, and widespread corruption. Soviet authorities accept these malignancies as being less undesirable than market-clearing prices. For two decades the performance of the economy in delivering increasing output appeared to outweigh these operational defects, but in recent years reduced output growth has intensified inflationary pressures and focused more attention on these painful byproducts of the Soviet allocational mechanism.

The aggregate purchasing power of Soviet wages and salaries exceeds the ruble value of available consumer goods, priced at current official prices, so a growing mass of ruble savings in state savings banks and in currency outside banks hangs over the market. Soviet money wages are meant to provide material incentives for sustained effort and are further differentiated to attract labor, e.g., to jobs in the East and North. Thus Soviet authorities are both unwilling to curtail the public's purchasing power and unwilling to expand and reprice the flow of consumer goods; the resulting savings are thus not voluntary in the usual sense.

A major source of inflationary pressure is the regime's policy of providing job security to all Soviet men and women employed in state enterprises.[2] Since unemployment is officially defined as a capitalist phenomenon, Soviet enterprises seldom fire workers. Padded employment rosters and swollen payrolls are the norm. It is therefore literally true that, apart from seasonal difficulties, unemployment scarcely exists in the Soviet economy. The economy suffers, however, from substantial underemployment of millions of workers in situations where

[2] See Herbert S. Levine's discussion in Seweryn Bialer, editor, Internal Determinants of Soviet Foreign Policy (in press).

layoffs would not reduce output. When Western firms squeeze out excess labor the consequences may be harsh unless alternative job opportunities are available; cost-minimizing efficiency in the firm can impose social costs on the society. Under the prevailing Soviet approach, by contrast, toleration of generous, not to say wasteful, staffing norms in Soviet enterprises facilitaties social peace at the expense of substantial inefficiency. The real output per worker of the Soviet labor force is thus held down, and the potential output increments that might be obtained if the labor force were more efficiently allocated are not available to match the purchasing power embodied in current wages and salaries.

Another major source of inflationary pressure arises from the steadily growing demands of the Soviet public for the goods and services that make up an advanced standard of living. Soviet living standards have improved impressively over the last quarter century, but the regime's priorities have not enabled the system to keep pace with growing consumer demands. In particular, supplies of meat and dairy products have not grown rapidly enough and, instead of raising prices to market clearing levels, authorities have been paying increasingly large subsidies to livestock producers. Occasional incidents in Eastern Europe and the USSR show that market-clearing prices for meat would produce riots and markedly negative reactions from the Soviet public. The gravely inefficient agricultural sector has been unable to reduce costs; in fact procurement prices have been raised repeatedly to provide incentives to livestock producers. The growing state subsidies have therefore seemed a necessary though desperate remedy, in spite of the inflationary pressure they put on the central budget. From time to time and region to region, inadequate meat supplies are accompanied by inadequate supplies of fruit and vegetables, demonstrating a systemic difficulty in raising the quality of the food component of the Soviet standard of living.

In this shortage economy, special supply channels convey higher quality consumer goods to the elite. Moreover many goods and services are exchanged in a "second economy" outside official state channels, under conditions that extend from the officially tolerated to the clearly illegal.[3] These pink, brown, gray, and black markets make life more tolerable for millions of Soviet citizens, but at the expense of economic inefficiency and social inequity. A high price is paid in economic and social terms for an ostensibly stable price level.

While the Soviet economy has recently shared with other economies the problems of slower output growth and rising inflationary pressures, the USSR has also displayed its own unique problems. One that has been of increasing concern to Soviet authorities centers on the system's difficulties with innovation.[4] The classic Soviet formula for output expansion over the last half century has employed an unusual approach to economic innovation. The USSR made a massive effort in the early 1930s to build an industrial capital stock embodying the advanced technology that prevailed in Western Europe and North America at

[3] See Gregory Grossman's paper, below, and, for vivid background, Hedrick Smith. The Russians (New York: Quadrangle, 1976), chap. III. On varicolored markets, see Aron Katsenelinboigen. "Market Colors and the Soviet Economy," pp. 165–201 in his Studies in Soviet Economic Planning (White Plains, N.Y.: M. E. Sharpe, 1978).

[4] See my review essay in Problems of Communism, March–April, 1979, and references cited therein.

the end of the 1920s. The whole decade of the 1930s was required to build this capital stock and train people to employ it. After World War II, defense-related technology incorporated later Western developments, but the rate of technological innovation in the USSR generally was very low. The system that came into being in the 1930s was designed to maximize the output of a limited range of high priority products under centralized direction by known methods. While the system served its initial purposes well, expanding output and capacity in extensive and duplicative fashion, it has proved remarkedly resistant to change. Change is needed partly because, as the number of producing units has increased and the range of products produced has broadened, planning and control procedures have proved less effective.

More importantly, systemic revision is needed because an ongoing industrial revolution in the West has not been matched in the USSR. Major innovations in products and processes have steadily altered the economies of North America, Western Europe, and Japan while the USSR has participated only through limited imitation. The USSR argues that socialism in principle facilities technological innovation while capitalism by its nature represses it. Recent experience suggests that the reverse is true. Decentralized market economies encourage and facilitate innovation, while the Soviet system in its present form thwarts the actual introduction of improved processes and products.

The incentives and disincentives that shape the behavior of Soviet economic decisionmakers serve to block the acceptance of innovations. As shown in Joseph Berliner's authoritative and fascinating analysis, decisionmakers from top to bottom in Soviet industry seldom find it wise to replace old machinery and methods with new ones.[5] Innovation is risky and its rewards are outweighed by its dangers. Official policy has called for industrial innovation but in practice the system protects the status quo. Where industrial assets are owned and operated by the state, officials show a natural tendency to protect and preserve these assets. If an innovation undermines the value of existing plant and equipment, ministerial and enterprise officials associated with the old assets will resist their displacement. Competition in a market economy forces old technology off the stage, penalizing with bankruptcy those who fail to adjust. No comparable pressure exists in the USSR.

On the contrary, long standing Soviet tradition preserves old capital plant and equipment to an extraordinary extent. Maintenance outlays are extensive, and equipment service lives run far beyond Western practice.[6] This stubborn retention of aging and obsolete equipment means that the Soviet capital stock necessarily embodies antiquated technology. The difficulty is compounded by unusually long gestation periods for building and bringing fixed plant and equipment into operation.

Suppose that the time required from an initial investment decision to full operation of new capital plant and equipment varies from one year to eight years, averaging four years. This range of gestation

[5] The Innovation Decision in Soviet Industry (Cambridge, Mass.: The MIT Press, 1976).

[6] See Stanley H. Cohn. "Deficiencies in Soviet Investment Policies," pp. 447–59 in Joint Economic Committee, Soviet Economy in a New Perspective, (Washington: Government Printing Office, 1976), and below.

periods is roughly what prevails in the USSR. Large innovative installations are the ones requiring the longest construction periods. This means that from four to eight years of additional delay must be added on to whatever period is required for Soviet authorities to notice a Western innovation, evaluate it, and decide to adapt it for Soviet purposes.

The long gestation periods also tie up massive amounts of resources in uncompleted construction. If 25% of a growing GNP is devoted to fixed capital formation, year after year, then in due course each year's investment will be matched by a roughly equivalent amount of capital (from prior investment) going into operation.[7] However, a huge aggregate of unfinished construction, almost equal to one year's GNP, will be standing unproductively throughout the economy while the technology embodied in it is getting out of date.

The lack of slack in annual plans also militates against large scale acceptance of product and process improvements. When greater output using existing technology has top priority, taut planning has its advantages. The objective is "more," as quickly as possible. If enterprises have idle capacity, it should be drawn on. "Hidden reserves" should be uncovered, and no slack should be permitted.[8]

But under different conditions, if the focus shifts toward steady improvement in quality, sustained efforts to reduce costs, and prompt adaptation to changing circumstances, then slackness becomes functionally desirable. Enterprise directors under less pressure to produce more are able to respond to opportunities for product and process improvement leading to cost savings and/or higher quality. Supporting firms like machine shops, if they have room in their schedules, can give prompt assistance in grafting improvements onto existing equipment. What appears from above as under utilized capacity, producing less than its full theoretical output potential in the short run, nevertheless will in fact produce a stream of output incorporating lower real costs and greater quality improvements than what emerges from an extremely taut system.

Another unique feature of the Soviet economy is its lopsidedness. Because Soviet priorities over the last half century have focused on heavy industry and defense rather than civilian welfare, the economy displays large cumulative deficiencies in the stock of residential capital, urban social overhead capital, and the facilities required to supply public and private social services. In spite of a large nationwide program of urban residential construction over the last 20 years, there is still a serious housing shortage in the USSR, especially where urban population is growing rapidly.[9] Housing is a major form of output in all economies, especially where winters are cold, and if modernization brings mass migration from the countryside into towns and cities, adequate housing requires a huge commitment of resources.

Resources committed to urban housing in the 1930s fell far behind needs and under German occupation the housing stock was reduced substantially. Only in 1957 did a massive urban housing construction

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[7] See the example using 1930s Soviet evidence in my "Test of Five-Year Plan Feasibility," p. 286 in Judith Thornton, Economic Analysis of the Soviet-Type System (Cambridge: Cambridge Univ. Press, 1976).

[8] This was argued long ago in my "Optimum Tautness in Development Planning," Economic Development and Cultural Change, July 1961, pp. 561–72.

[9] See Henry W. Morton, "The Soviet Urban Scene," Problems of Communism, January–February 1977, pp. 73–77, and below.

program get underway. Though large in absolute dimensions, it produces low-quality residential quarters, and unless the program improves in both quantity and quality, an urban housing shortage seems sure to persist.

Soviet growth policies over the last half century have also given inadequate attention to improvements in water supply, sanitary facilities, and paved roads. There is still a large national backlog of unmet demands for water mains, sewers, paved streets, and sidewalks. This kind of social overhead capital is provided in response to local demands expressed through local governmental units. Their voice has been weak in the USSR. Outside major cities, and once off major inter-regional highways, one immediately steps into a pre-twentieth century setting that is shockingly at odds with the USSR's position as a super power.

Still another sectoral deficiency lies in the area of wholesale and retail trade. For sixty years the regime has been unwilling to make adequate provision for handling consumer goods and services; until recently, Soviet citizens could be appeased by comparisons between their genuine improvement and the extremely straitened circumstances of the 1930s and 1940s. Under current conditions, however, with more vivid awareness of contrasts between Western living standards and continued Soviet shabbiness, claims from this quarter can no longer be slighted. By comparison with Western Europe, North America, and Japan, the USSR is still stunted in respect to the developed needs of a mature economy.[10] Effective economic performance in the 1980s may require deliberate attention to these needs as a key instrument in maintaining morale, raising productivity, and eliciting sustained effort.

The lopsidedness of the Soviet economy reflects in part the secrecy and compartmentalization that have kept defense-related industrial innovations from spilling over into the rest of the economy. Several elements of contemporary Western technology received their initial stimulus from World War II applications and subsequent efforts in space. Computers, electronics, fractional horsepower electric motors, and various plastics provide examples. In the West these product and process innovations have spread quite promptly from the defense industries into civilian applications but this spread has been inhibited in the Soviet economy by several factors. One is the long standing Russian tradition of secrecy, not only toward the outside world, but also toward ordinary citizens, especially where military matters are concerned. Another factor probably is the lack of financial incentives for defense contractors in the USSR to investigate civilian markets for products using their innovations as components.

III. Elements of a Multifaceted Soviet Dilemma

Mounting evidence over the last several years has made it increasingly clear, both to Soviet leaders and to the outside world, that these strains in the Soviet economy require new answers. The input increases that formerly underlay Soviet output growth are no longer in sight. The pressure on Soviet labor supplies means that improvements in

[10] See Gertrude E. Schroeder, "Consumer Goods Availability and Repressed Inflation in the Soviet Union," pp. 37–47 in Economic Aspects of Life in the U.S.S.R. (Brussels: NATO, 1975), and below.

per-worker productivity, formerly merely desirable, are now crucial. Similarly the contribution of added capital plant and equipment, for several decades a central feature of Soviet growth, must somehow be raised to a new level of effectiveness. In both respects the economy is under pressure to shift from extensive to intensive methods, laying stress no longer on sheer quantitative increments but placing new emphasis on qualitative improvement. The drive for "more" can no longer be permitted to override the need for "better." In its late-twentieth century rivalry with other economies, the USSR needs to develop more sophisticated and more effective ways of operating its sprawling economy.

In casting about for specific ways to upgrade its economic activities, the USSR has become interested in a variety of Western high-technology areas. Giant projects like the Tolyatti passenger automobile plant and the Kama River truck plant symbolize the willingness to import advanced industrial technology in hopes of stimulating Soviet technological progress. Sophisticated equipment is being imported to improve resource extraction. Automated feed lots mark a comparable effort in agriculture.

In seeking to improve the effectiveness of economic planning and management, the USSR has been working out organizational blueprints for a very extensive system of information collection and processing designed to link all levels of production and administration into a national network of centralized economic management. The USSR in cooperation with Eastern European countries has developed a family of computers, modelled after the IBM 360 series, and has made substantial efforts to adapt to Soviet purposes the accompanying programming software. Though thousands of people have been involved over the last decade, it appears that effective implementation of the new control arrangements is still several years in the future.

It is already evident from Soviet experience to date that the transfer and application of contemporary Western technology in these fields requires a degree of flexibility that is simply not compatible with the present Soviet economic system. Large projects in heavy industry require a systems approach going far beyond specific aggregates of machinery.[11] An isolated product or process cannot be effective if put down in a surrounding economy that is incapable of supplying inputs of adequate quality and reliability. The typical high-technology product today achieves maximum effectiveness only as part of a complex network of suppliers, servicing facilities, distributors, and customers. Backward and forward linkages extend in many directions.

Effective technological transfer now requires a systems approach to the innovation, covering managerial aspects of production organization along with the narrow physical aspects. The present Soviet system, however, has great difficulty accommodating these relationships. In computer use, for example, it is standard Western practice for the computer manufacturer to make available very extensive servicing arrangements so that the hardware can be maintained and the user can be assisted in making effective use of the facility. These vendor services are utterly foreign to Soviet practice. But without prompt

[11] See John P. Hardt and George D. Holliday, "Technology Transfer and the Soviet Economic System," in Frederic J. Fleron, Jr., editor. Technology and Communist Culture (New York : Praeger Publishers, 1977), esp. pp. 212–18.

informed support of both hardware and software by a vendor organization, no computer user can learn how to make the computer deliver its full potential.[12] The unsupported user is likely instead to have an expensive and largely idle piece of equipment on his hands.

Most Soviet discussion of "automated systems of management" runs in general terms that make very little contact with the operational complexities of data manipulation and interpretation. Perhaps this is because general principles must precede the filling in of details. Perhaps also it reflects the longstanding Soviet practice of treating most economic evidence as restricted material, to be withheld not only from foreigners but from most Soviet people as well. In any case, it appears that an enormous gulf lies between the Soviet vision of a multi-layered network of computer based information flows and managerial controls, on the one hand, and a flexible, efficient, decentralized set of effectively operating Soviet enterprises on the other.

In the sphere of agriculture, a somewhat similar dilemma confronts the regime. Western observes have long been critical of the costly and ineffective performance of giant Soviet state farms at one end of the organizational spectrum, and tiny peasant private plots at the other. Intermediate size farms, operated under on-the-spot guidance, diversified and decentralized for alertness to local conditions and responsiveness to local opportunities, are missing from the Soviet scene. Yet it is in this direction that the greatest promise lies for lowering costs and improving capital and labor productivity in agriculture.

The dilemma appears to be that the organizational changes required to meet the new conditions confronting the Soviet economy do not fit within the present economic and political institutions of the USSR. Powerful vested interests in the Party and the state bureaucracy find changes along these lines to be unacceptable. Decentralized agriculture would give free rein to the "petty-bourgeois soul of the peasant proprietor." A systems approach to technological innovation would concede major initiative to plant management both as salesman for the plant's products and as free ranging purchaser of inputs. It is evidently feared that enterprise-level initiative would permit "localist tendencies" to divert resoures from the Party's priorities into profitable consumer-oriented activities.

IV. Three Alternative Scenarios for Soviet Economic Policies

It is risky but reasonable to speculate on the policy responses that Soviet authorities are likely to make to the many-sided dilemma described above. As the Kremlin grapples with these problems, and as leadership changes come about, new policy directions are at least possible. An analysis of alternative prospects can perhaps benefit from a systematic effort to sketch a few plausible scenarios, each made up of consistent elements in a policy package. The three set forth below involve, first, continuation of present trends in a "muddling through" scenario. Alternatively, a "liberal scenario" is sketched, incorporating numerous elements of relaxation and reform. Thirdly, a "conservative scenario" is outlined; it pulls together a series of stern and retrogressive tendencies immanent in the Soviet system.

[12] See N. C. Davis and S. E. Goodman, "The Soviet Bloc's Unified System of Computers," Computing Surveys, June 1978, pp. 93–122, and S. E. Goodman, below.

A "muddling through" scenario for Soviet economic policy would involve continuation of centralized bureaucratic management of the economy. Politically-determined resource allocation, primarily through administrative procedures rather than response to market forces, would remain impervious to reform efforts. As a result, technological progress would continue to be slow and improvements in factor productivity would continue to be modest.

The "muddling through" approach would involve continued overstaffing of enterprises throughout the economy. Management would stockpile workers in order to handle intermittent spurts of effort, and most workers would continue to benefit from tenacious claims to job security. As a result, output per worker would continue far below Western levels and would not rise rapidly. Given all the non-consumption claims on aggregate output, this approach would continue to generate aggregate purchasing power exceeding the value of available consumer goods. The imbalance would thus continue to create inflationary pressure and stimulate "second economy" activities.

In the "muddling through" scenario the pattern of investment allocations among heavy industry, light industry, national defense, and other government activities would remain unchanged. The effect would be to continue the economy's unique lopsidedness; lagging sectors would make no progress. The downward drift of capital productivity would continue.

The available quantitative evidence suggests that under these conditions Soviet gross national product would grow more slowly than it has grown during the 1970s. Income per capita and consumption per capita would still be rising, but so modestly as to be accompanied by a good deal of popular frustration. If the share of national defense outlays in GNP remains constant, slower GNP growth would bring smaller absolute defense increments than if GNP continued to grow at earlier rates. Nevertheless the annual defense outlays would be very substantial, so additions to Soviet stocks of missiles, aircraft, submarines, naval vessels, tanks, etc. could be very large. The share of GNP going into investment would remain very high but the yield on this investment, not being augmented by significant technological progress, would continue its decline.

In sum, the detailed developments that would unfold in a "muddling through" scenario would disappoint Soviet authorities, would frustrate the Soviet public, and would fail to solve the basic problems confronting the Soviet economy.

A second scenario, derived from suggestions for improvements made by innumerable Soviet and Western economists,[13] can accurately be called a "liberal scenario." It would involve acceptance by the Party and government of arrangements for economic management permitting enlarged initiatives at the enterprise level and encouraging adoption of new products and processes. Resource allocation would reflect more accurately the true opportunity costs of input use, and the influence of market forces would gain at the expense of traditional administrative procedures. A revised set of incentives and disincentives would effectively shift emphasis from quantity to quality, from the

[13] See Alec Nove's informed and vivid account in Dimitri Simes and Associates, Soviet Succession, vol. VI, No. 59 of The Washington Papers (Beverly Hills, Calif., and London: Sage Publications, 1978), pp. 59–72.

safe to the innovative, and from output maximizing to cost minimizing.

In the "liberal scenario," procedures for laying off unnecessary workers, retraining them, and helping them into new jobs elsewhere, would be given major attention. Labor would be shifted into the sectors being expanded in order to reduce the economy's inherited lopsidedness. This would have the two-fold consequence of simultaneously making workers more productive, and reducing the inflationary overhang of excess purchasing power by increasing the flow of desired consumer goods and services. The change could have some effect in shrinking the "second economy," and in reducing the wasted time consumers spend standing in queues. Public morale would be raised and labor productivity might thereby benefit.

In the "liberal scenario" there would be reduced pressure for investment in heavy industry and less stress on a handful of giant projects. Investment would shift toward light industry and toward projects in all sectors that could be quickly finished. As a consequence, the output-increasing effectiveness of investment would be raised, and the advanced technology embodied in new capital plant and equipment would have its impact more promptly.

Under the "liberal scenario" GNP would grow more rapidly than under the "muddling through" scenario. Income per capita and consumption per capita would rise more rapidly because the changes would promote labor productivity, spur public morale, and shift attention to forms of output pointed toward consumer needs. The outcome for national defense seems indeterminate; with faster GNP growth, absolute annual increments for national defense could equal those in the "muddling through" scenario while still constituting a smaller share of GNP. Even if the share of investment in GNP were lower than under the "muddling through" scenario, a higher rate of technological progress would raise the yield on investments carried out.

Still a third logical possibility is what might be called a "conservative scenario." This set of policies would involve reversion to even more centralized controls, stressing sporadic campaigns for top-priority objectives ("storming") in the old Stalinist manner, an emphasis on quantitative targets, and administrative rather than economic criteria for resource allocation.

In a "conservative scenario" the labor force would be concentrated in giant projects, high priority activities, heavy industry, and national defense. There would be overstaffing at these points and lack of attention to the output of consumer goods and services. As a result one could anticipate an increase in inflationary overhang, lopsidedness, and the role of the second economy. Output per worker would suffer, frustration would be high, and the rate of technological progress would be held back as initiative was throttled and innovation discouraged.

The authorities in a "conservative scenario" would be likely to squeeze the consumption share of GNP in favor of investment and national defense. If GNP grew as rapidly as under the "muddling through" scenario, an increased share of defense in GNP would generate larger annual defense increments under the "conservative scenario," assuming that consumption was squeezed in favor of national

defense. If output growth slowed, a higher share for defense could at least generate the same absolute increments as under "muddling through." In this approach investment would be focused on giant projects, heavy industry, and long period construction. Technological progress would probably be even slower than under a "muddling through" approach.

Interaction among these forces would most likely produce a slower rate of GNP growth than under the "muddling through" scenario. Income per capita and consumption per capita would surely rise more slowly, reflecting diversion of resources away from these sectors accompanied by impaired popular morale and sagging labor productivity. Slower technological progress would mean a reduced yield on investment. The mass of unfinished construction would increase and overall efficiency would deteriorate. Internally, then, the "conservative scenario" would be more likely to bring the economy to an impasse than to lead it out of its present difficulties.

V. Implications for Soviet External Economic Relations

These speculations have concentrated so far on the domestic economy. This is because the Soviet regime, like every government, is primarily concerned with its domestic problems. Retention of power at home has first claim on the attention of Soviet leaders. Adequate management of the domestic economy is a key factor in their survival. The Kremlin also, of course, devotes some attention to external threats, responsibilities toward its allies, and opportunities for gain abroad.[14]

Soviet domestic economic prosperity depends to some extent upon the USSR's economic relations with the outside world. After relatively little contact in the 1950s and 1960s, the USSR has deliberately opened itself to increased economic interchange with the outside world, especially with the developed West. What are the implications of each of the three scenarios for Soviet external economic relations?

In the "muddling through" scenario, it can be assumed that Soviet authorities will continue their reluctant recognition of the need for a substantial inflow of high-technology imports. They will try to obtain the "fruits of the scientific and technical revolution" without changing the way the Soviet economy operates. In this scenario they will also be reluctant to make the changes necessary to enhance the exportability of Soviet goods in the world market. In general, therefore, the "muddling through" scenario is one in which exports grow slowly, and imports therefore grow slowly as well.

The cautiousness and rigidity of Soviet domestic policy in the "muddling through" scenario will be accompanied by continuation of a similar general foreign policy. The inherited traditional great-power interest in expanding Soviet influence abroad will lead the Kremlin to take advantage of opportunities for political gain, wherever military strength (even though unexercised) could sway events.

In the "liberal scenario," the logic of Soviet external economic relations would be perceptibly different. As part of the changes designed to improve the economy's performance, Soviet leaders would be more willing to accept the advantages of reciprocal interdependence between

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[14] See Morton Schwartz, The Foreign Policy of the U.S.S.R.: Domestic Factors (Encino, Calif.: Dickenson Publ. Co., 1975).

the USSR and its major trading partners. In opening itself to technology transfer, the USSR would absorb both software and hardware, would adopt both new methods and new equipment. In particular, the authorities would perceive that the international transfer of technology occurs through the movement of persons more effectively than through the movement of publications and products, and recognize that Soviet restrictions on the movement of persons are "perhaps the major reason that the Soviets are not members of the international high-technology club." [15]

Under the "liberal scenario," Soviet industry would pay more attention to developing the adaptability and flexibility required to spur Soviet exports to the world market. Success in stimulating the growth of Soviet exports would in turn make possible a greater volume of Soviet imports from the West. Provision of adequate spare-parts supplies, attention to customer services, improved reliability as to delivery dates and quality specifications—these peripheral but essential aspects of successful commercial relations would all be promoted in a "liberal scenario."

Under these conditions Soviet leaders would lay stress on competing with the West through demonstrating their internal success in raising living standards, solving social problems, and meeting socialist ideals. Effectiveness along these lines would put competitive pressure on Western economies to display similar achievements. The USSR would be seen, not merely as a threatening military power, but also as an advanced, mature, successful society.

The external aspects of a "conservative scenario" would be very different. The leaders' outlook would become more nationalistic and xenophobic. Soviet publicists, especially spokesmen for the Great Russians, would protest against the export of natural resources. The human contacts associated with technology transfer would be reduced. After the 1980 Olympics, foreign intrusions into the USSR would be cut back. Dissident views in the USSR would be quelled, patriotism stressed, and ideological conformity demanded. An outlook of this sort might be a response to Islamic fervor along the USSR southern frontier or to US-Chinese rapprochement.

The effect of all these tendencies in a "conservative scenario" would be to bring the volume of Soviet trade with the outside world back down to a very low level. Even trade with Eastern Europe would be constrained. The Kremlin would be inclined to tighten up on its alliances and apply coercion wherever possible. The political atmosphere would increase the likelihood that opportunities for aggrandizement would be seized wherever possible. The USSR would project itself, not as a successful society, but primarily as a powerful military force.

VI. United States Concerns

Since Soviet affairs are shaped mainly by domestic forces, the United States can have only a very indirect and peripheral influence on their evolution. We make up only a small part of the environment within which Soviet policies are set. It is appropriate nevertheless to comment briefly on some United States concerns, especially in regard to eco-

[15] Berliner, op. cit., p. 515.

nomic relations between the USSR and the non-Communist West.[16]

As a matter of settled principle, the United States seeks international economic relations that will promote the mutual and balanced advantage of all participants. Official US policy is directed toward international trade as open and free as possible. Official Soviet doctrine likewise blesses trade for mutual and balanced advantage, so that in a formal sense, at least, there is common ground between the USSR and the United States. Practice falls short of theory, but in recent years mutually acceptable arrangements have expanded markedly.

Under a series of agreements since 1972, the two countries have worked out a number of science and technology exchanges. These bilateral arrangements are intended to provide benefits for both sides as they exchange ideas and experience in attempting to deal with common problems. In many aspects of science, medicine, public health, urban affairs, pollution control, and meteorology the United States and the USSR have found that these exchanges improve each side's understanding of the other's practice, while tending also to relax tensions between the two countries.

The last decade has also seen a massive growth in "technology transfer," i.e., in Soviet imports from the West of plant, equipment, and licenses embodying advanced Western technology. To a lesser extent the transfer has also involved advisors and intangible know-how, as Soviet specialists have spent time in the U.S. or as U.S. specialists have spent time in the USSR. The United States has been deeply concerned to minimize the transfer of technology directly related to modern weapons systems, and some U.S. observers have grave doubts about all industrial technology transfer.

Nations with an industrial head start have long been reluctant to see their neighbors catch up, ever since the 1600s, when the Low Countries sought to prevent British acquisition of new methods in textiles manufacture and other fields. It has, however, proved impossible to prevent the diffusion of modern technology; at most it can be slowed down. In most fields at present, the USSR has alternative sources of supply if the United States is reluctant to make high technology products and processes available. Moreover under mutually satisfactory terms of trade technology transfer can serve as a positive means of improving understanding on both sides of the exchange.

Technology transfer is most effective when the importing society adapts the new technology to its own unique setting. In carrying out the transfer, both the seller and the buyer improve their understanding of the society and economy taking in the innovation. This means specifically that, for example, U.S. firms associated with the installation of Western equipment at the Kama River truck works have a joint opportunity with Soviet industrial managers to uncover optimal ways of making the imports effective. Company officials involved in starting up the automative feed lots for Soviet livestock are similarly in a position to throw new light on raising effectiveness in Soviet agriculture.

The purchaser and the seller of high technology have a joint interest

[16] For a thoughtful analysis of interaction between U.S. policies and Soviet interpretation of these policies, see Morton Schwartz, Soviet Perceptions of the United States (Berkeley: Univ. of Calif. Press., 1978).

in making the technology effective in its new setting. Full effectiveness will cut costs and raise the revenue out of which the purchase can be financed. Fully satisfactory performance increases the likelihood of further sales. Successful adaptation of the technology in a setting that is different from that of other economies enlarges the seller's understanding of the product's properties and potential. Thus the gains from technology transfer are by no means limited to the buyer's side.

But successful technology transfer requires adequate information about the receiver's situation, and here the USSR has proved a reluctant cooperator. Western scientists, engineers, technology specialists, and business officials have had great difficulty in obtaining the information needed to make technology transfer fully effective. Relevant statistics are typically withheld. Access to plant facilities is often denied. Direct contact with operating personnel may be difficult to arrange. Soviet lack of openness in these respects subtracts markedly from the potential effectiveness of technology transfer.

Even the broad economic information normally made available in all developed economies is restricted in the USSR. Standard statistical information is withheld, not merely from foreigners, but from the Soviet public as well. This traditional secrecy lowers the effectiveness with which domestic economic decisions are made, since on any specific matter only a handful of people are well-informed. An advanced economy needs accurate widely-available economic information, and Soviet authorities hamstring their own efforts through continuing their secretiveness.

Recently several categories of economic information have been cut back, and this shrinkage in data is a step backward in Soviet external economic relations. The annual foreign trade handbook now provides significantly less detail than before on exports and imports of several commodity groups. The statistical handbooks for Soviet Republics have cut back on information concerning the population, labor force, and industry in their regions. Suppressing this information harms economic cooperation with the outside world.

Mutually advantageous economic relations between the USSR and its major Western trading partners would be greatly facilitated by a substantial increase in the availability of Soviet economic information. Western sellers will be in a far better position to fit their offerings into the Soviet economic setting in an optimal way. This is obviously a critical point when the high technology import is to be paid for through the proceeds generated by Soviet exports. Both parties are concerned to assure the quality and reliability of Soviet exports to the world market. Even without such a direct link, efficient performance of any product or process coming into the USSR through technology transfer improves the ability of the Soviet economy to be a steady and attractive trading partner. In the broadest terms, it can be argued that an ample flow of economic information about all aspects of the Soviet civilian economy would reassure the outside world about Soviet purposes. If secretiveness breeds fear and suspicion, openness can help to dispell them. Thus in selecting its economic policies, the USSR would do well to recognize the potential gains that openness could bring. Data restrictions is a retrogressive step; its reversal could be a welcome signal that the USSR is not opting for the conservative scenario.

THE POLITICAL SETTING

(By Paul K. Cook)

CONTENTS

I. Overview

Guns, butter, *and* growth are the official policy goals in the economic sphere as the Brezhnev era winds down. In one form or another these goals have been pursued since the advent of the command economy under Stalin 50 years ago. But at various times, one or the other has predominated, usually defense, followed by growth, and only then butter. Pursuit of all these goals simultaneously in the present political environment has exacerbated the problem of resource allocation, which together with planning for transfer of power when Brezhnev leaves the scene, is perhaps the most crucial problem facing the Kremlin leadership other than war or peace itself.

Decisions on economic priorities are taken by a handful of men in the Kremlin who are also responsible for such varied tasks as: the preservation of the Party's supremacy in the Soviet system of rule; national security abroad and internal order at home; and the development of what has at times been called "the new Soviet man," i.e., the educational attainment and cultural outlook of the entire citizenry.

As a result, economic decision-making is inextricably intermixed with all other aspects of the Soviet political process at the macro- and often at the micro-level.

A permanently operating factor, to use a favorite phase of Stalin's, is the fact that the Kremlin takes these decisions in what it perceives as a hostile world environment. It is one of history's ironies that a regime which acts as if it invented the "peace and friendship" theme and incessantly proclaims that it constitutes the wave of the future, often acts as if it were being victimized by a capitalist encirclement determined to negate The Bolskevik Revolution. And persists in this despite—or is it perhaps because of—the creation of a "Cordon Sovieticus" in Eastern Europe and the coming to power of socialism in the world's most populous nation, China. Or, as Brezhnev put it in 1978 following his Siberian whistlestop tour, the Soviet Union has enemies to the East as well as to the West.[1] Indeed, there is reason to believe

[1] Pravda, Apr. 8, 1978.

that the Kremlin views the Chinese People's Republic, not the U.S., as "Enemy No. 1."

Similar insecurities are manifest at times in Soviet domestic policies. Despite six decades of rule, the communist authorities act as if they believe if they "loosened the bonds" on the population, to borrow an old pre-revolutionary phrase, anarchy would inevitably ensue. In this context, the thought of private groups overseeing the implementation of solemn commitments of the government, like the Helsinki Monitoring Groups, is seen as sheer effrontery and at times as anti-Soviet.[2]

National security needs as perceived on the domestic front dictate the maintenance of a vast police apparatus—the KGB/MVD. Together with the demands of the military establishment, therefore, internal security requirements place severe constraints on the leadership's freedom of choice in allocating resources.

At the other end of the spectrum—and in the recent past it was truly a distant end—stand the Soviet consumers as claimants. Throughout much of Soviet history they were the proverbial residual claimants. In the 1930's, to cite an extreme example, wheat was exported to pay for imports of technology and machinery while huge numbers of people literally starved to death.

But with the passing of Stalin and recovery from the devastation of World War II, standards of living have risen. The Soviet Union is now undergoing a modest second revolution, that of rising consumer expectations. Ideological exhortation has proven increasingly ineffective in motivating the labor force, material stimuli—the availability of consumer goods, for example—have become more of a determinant in raising labor productivity.

It is also possible that standards of living could decline because of such "objective" developments as a major upsurge in the arms race or a decline in energy supplies. The Kremlin, however, has become most conscious of the need to keep the shelves and larders full if national goals are to be attained. The 1970 and 1976 Polish workers riots gave added impetus to Soviet desires to give sustenance to the Brezhnev era slogan: "Everything for the benefit of man." But consumer expectations in a sense are insatiable.

The decisions to advance/defend Soviet interests abroad without risking too much, while balancing off widely disparate demands at home, come from a leadership whose vitality is being eroded by actuarial realities. Members of the Party Politburo average 15 years in office. The ranking members first attained national status under Stalin, who died more than a quarter of a century ago. They are all over 70 years of age.

President Brezhnev and his colleagues can justifiably point with pride to the fact that the Soviet Union has been at peace longer, and the lot of its citizenry is easier, than at any time in its history. But while they take satisfaction in these real attainments, one suspects they do not view the present, much less the future, with equanimity.

To the extent that it is possible to generalize about the often contradictory policies of the Kremlin leadership, one is tempted to speculate that the leadership is primarily concerned with passing on to its successors a mighty nation at peace. In this sense, pursuit of a more

[2] This outlook was manifested by the 1978 trials of Ginsberg, Orlov, Shchgranskiy, and others.

closely integrated Warsaw Pact and Council for Mutual Economic Assistance (CEMA), Peace and Friendship Treaties with Third World countries, and perhaps especially SALT and MBFR can be viewed as attempts to codify gains already won. To be sure, pursuit of targets of opportunity continues and at times threatens attainment of other goals.

II. Historical Background

To understand the Soviet present, much less indulge in futurology, one must study the history of the USSR. For Soviet history is alive; it is constantly being rewritten to prove that black is white or vice versa, or in any event that red—current policies—are always right.

In the Soviet context, economics is politics and, to a large measure, politics is economics. This is in part because of the Marxist-Leninist ideology enshrined in official dogma which has as its base the philosophy of economic determinism. In part it is also due to the fact that when the Soviet State was founded, the economy was in shambles as a result of the depredations of World War I. Lenin and his colleagues socialized scarcity, not plentitude, and the Kremlin has been playing catchup ever since.

If the domestic scene was a mess at the beginning, the international setting was worse. The war raged on. Germany invaded the Ukraine, the Allies were in the far North, the South, and the Far East. Civil war broke out. And three years passed before a modicum of order was restored. Strenuous efforts were then made to temper relations with immediate neighbors, and at home a limited free enterprise system was encouraged.

By the end of the twenties, with Lenin dead and war commissar Trotsky in exile, Stalin and his then allies proceeded to lay the basis of the present economic system. The most prominent features were centralized planning; industrialization at a forced pace which emphasized quantity, not quality; and an agriculture regimented under the guise of collectivization.

Some 6 million souls are estimated to have perished as a result of the famines caused by collectivization;[3] and additional 15 million are estimated to have died in purges which caught up not just so-called well-to-do peasants but also many of the Revolution's "finest," who fell under suspicion of the OGPU/NKVD.[4] Millions were uprooted and sent to the camps memoralized by Solzhenitsyn. A Gulag shroud covered the country.

Despite the cost in human suffering, the resultant social order did provide Stalin and his ever-changing palace guard with the capability to force the pace of industrialization and to build up the armed forces. The purges, however, almost destroyed the Red Army officer corps on the senseless charge of collaboration with fascist Germany. Just enough survived to organize a resistance to Hitler after the initial routings of World War II. Four years later, the Allies triumphed. But for the Soviet Union, the cost was 20 million killed and untold billions of rubles worth of capital destroyed. The land lay in ruins.

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[3] Dana Dalrymple, "Soviet Famine of 1932–34," Soviet Studies (January 1964), pp. 250–84.

[4] Robert Conquest, The Great Terror (London, 1968), p. 533.

The victorious but war-weary nation turned to peace with high expectations, only to be disappointed again by the now near-paranoid Stalin. Freed Soviet prisoners of war were sent off as traitors to the burgeoning archipelago. The "Zhdanovshchina," harsh discipline accompanied by renewed terror, was imposed, and the anti-cosmopolite (read Jewish) campaign unleased.

Abroad, the destruction of World War II alliance was symbolized by the siege of Berlin and the Berlin airlift. The cold war replaced the hot.

Stalin died in 1953 and *The Thaw* began.[5] While the temperature has fluctuated since then, the Soviet Union has moved away from the iconoclastic, autarkic world ruled by Stalin through gross applications of terror.

Highlights of the Khrushchev era would include promulgation of the doctrine of "many roads to socialism," revelation of Stalin's crimes, and recognition of the need to raise living standards, so-called goulash communism. Also included of course, would be the crushing of the Hungarian Revolution and the Cuban missile crisis, followed by the 3–E Test Ban Agreement.

The record of the Brezhnev years in foreign affairs would have to begin with the violation of Czechoslovakia's experiment of "socialism with a human face." Stress would have to be placed, however, on the detente process, first with the Quadripartite on Berlin, and then summitry as we know it today. Also included in any assessment would be Angola, Ethiopia, and some would say, Afghan if not Iranian adventurism.

On the domestic front, since the end of World War II, the economy has grown impressively. Industrial output has risen from 30 percent of that of the US in 1950, according to inflated Soviet statistics, to 80-odd percent at present.[6] It grew so impressively that several years ago Western specialists were speculating when—not if—it was going to catch up and surpass that of the US. Khrushchev went so far as to predict in 1959, upon launching the first but now forgotten 7-year plan, that 1980 would see the Soviet Union overtake the U.S.[7]

In recent years, however, sharply declining rates of growth, coupled with periodic harvest shortfalls, have focused attention on Soviet economic weaknesses. Industrial labor productivity, again according to Soviet sources, still amounts to only 55 percent of that of the U.S., and agricultural labor productivity to only 20–25 percent.[8] Energy supplies are becoming increasingly costly in time and resources to exploit. Increments to the labor force, a traditional source of overall economic growth, are falling markedly. And now distinguished Western economists are predicting crises in the 1980s when all these factors could come to a head.

There are times, however, when both the optimists and the pessimists overstate the evidence. At the macroeconomic level, it is true that the boom days of 6+ percent annual growth of the fifties have gone for-

[5] The Soviet novel, The Thaw, by Ilya Ehrenburg, is viewed by many as symbolizing the reawakening of Soviet political life after the death of Stalin.
[6] Narodnoye Khozyaystvo SSR za 60 let (Moscow, 1977), p. 95.
[7] Vreocherednoy XXI S'ezd Kommunistichiskiy partiy sovetskogo soyuza. Stenograficchesky otchet (Moscow, 1959), vol. 1, 12–120.
[8] Narodnoye Khozyaystvo SSSR za 60 let (Moscow, 1977), p. 96.

ever, that roughly half that rate seems in prospect for the coming decade. Yet, 3–4 percent is considered by many nations to be quite respectable. At the micro-level, the US is still producing almost 9 million automobiles a year—but may be about to spend an hour waiting to buy gas. The Soviets still must wait a year or more to buy a car, and the automotive infrastructure is in its infancy. But more cars are being produced than ever before and more are planned. But, who is to say that private vehicles are the best solution to transportation problems?

III. The Current International Scene

The view from the crenellated Kremlin walls must be worrisome. Gains to the South, Afghanistan and Ethiopia most recently, are at least partially offset by the normalization of relations between Peking, Tokyo, and Washington. And progress on major arms and control measures, especially SALT and MFBR, has been painfully slow.

Have Brezhnev and Company materially advanced Soviet interests commensurate with the growth of Soviet military might? The answer has to be mixed. Has the Soviet Union become so powerful that no problem of any significance anywhere in the world can be solved without taking into account Soviet interests, as Gromyko proudly proclaimed at the 24th Party Congress.[9] Hardly, as the Egyptian-Israeli peace treaty, the Sino-Vietnamese war, and a host of other developments testify.

The world has proven far more complex than Karl Marx foresaw in the 19th century. Superpower status enables a nation to flex its muscles in new ways, but it also can lead to its becoming muscle bound in others. But Moscow knows that its new prestige stems largely from its military strength. In economic terms, it recognizes that while the USSR is somewhat more populous than the US, when allies are added the West has twice as many people (see table 1).

TABLE 1.—COMPARATIVE ECONOMIC STRENGTH, 1977

Category	United States	U.S.S.R.	United States and allies	U.S.S.R. and allies
Population (in millions)	217	259	759	379
GNP (in billions)	$1,887	$932	$4,907	$1,292
Per capita GNP	$8,704	$3,600	$6,348	$1,164
Electric power (in billion kilowatt-hours)	2,209	1,150	4,727	1,540

Source: U.S. Department of State, Special Report No. 49, "Indications of Comparative East-West Economic Strength" (December 1978).

The US GNP is twice that of the USSR, and together with their respective allies, the West's lead is almost 4 times larger. Measured in per capita GNP, the differences are even greater: the US leads by 2.4 times, and with allies, almost 5.5 times.

Relations with the US have not fulfilled the heady Soviet expectations of 1972. The mix between cooperation and confrontation has varied considerably.[10] Slow, painstaking progress in arms control

[9] Pravda, April 4, 1971.

[10] For an expanded treatment of the subject, see Colette Shulman, rapporteur, "A Symposium on United States–U.S.S.R.: Confrontation or Cooperation," Yale Seven Springs Center (November 1978), passim. See also, Senate Committee on Foreign Relations, Perceptions: Relations Between the United States and the Soviet Union (USGPO, 1978).

negotiations has been paralleled by sharp exchanges on human rights. Agricultural trade has been at high levels but industrial trade remains below possibilities, according to Moscow, because of artifical US barriers (read the Jackson-Vanik and Stevenson amendments). For their part, the Soviets have opened the tap somewhat on Jewish immigration: in 1978 over 30,000 were allowed to leave, and the flow during the three months of 1979 suggests as many as 50,000 could leave this year.

The overreaching problem remains SALT. In his January 10, 1979 exchange with Senator Baker and others, Brezhnev said:

> The earliest conclusion of a new SALT would be a big step (toward mutually advantegous development of relations in the most diverse fields). The agreement, being of importance by itself, would also seriously improve prospects for other talks on disarmament and would promote a leveling up of Soviet-US relations as a whole.[11]

A clearer statement of positive linkage is hard to find.

But few weeks earlier, in his interview with *Time* magazine, Brezhnev denied linkage while defining "détente." "Détente," he said, "means a willingness to resolve differences not by force or threats but by peaceful means at the negotiating table." [12] He went on to claim a legitimate interest in supporting so-called national liberation movements in the Third World; that is, negative linkage in effect is outside the concept of détente.

A Congressional delegation led by Senators Ribicoff and Bellmon attempted to clarify the discrepancy and ran into a buzz saw, even though the Soviets clearly were giving them a red-carpet treatment.[13] The misperceptions on the Soviet side, according to the Senators, included statements—such as Politburo member and Leningrad Party boss Romanov's—that President Carter could compel members of the Senate to vote for SALT by threatening to withhold money from their future campaigns.

It is clear, however, that the Soviet leadership wants to conclude SALT and other arms limitation and reduction measures. It believes these measures are in the Soviet national interest, in part because they would ease the burden of armaments and, in part, be an earnest desire to ease bilateral tensions. To what extent the leadership will modify its behavior to achieve these ends remains to be seen.

In the background during the long SALT negotiations is China. Soviet sensitivities have risen geometrically as Peking has moved out into the world to play its "China card." Perhaps the biggest Soviet foreign policy failure has been Moscow's inability to bring China back into the communist fold as defined by Moscow. Instead, China moved first toward Japan and concluded a Peace and Friendship Treaty containing an anti-hegemony clause which Moscow had fought to have deleted. Then came normalization of relations with the US. The Sino-Vietnam border war probably did not lessen Soviet fear that a Sino-Japanese-US consortium is in the making, one that will be anti-Soviet and, inter alia, tilt the latter countries' investment and technology away from Siberia.

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[11] Moscow Tass in English, Jan. 10, 1979.
[12] Time, Jan. 22, 1979.
[13] For a frank account of the visit, see Robert Kaiser, Washington Post, Dec. 31, 1978. Other recent visitors to Moscow have encountered similar abrasiveness, even at scholarly institutes, such as IMEMO, whenever neuralgic points like the Middle East and China were brought up.

On the other side of the geo-political scales, Moscow has been pursuing what some consider expansionist policies along its southern periphery and in Africa, and probably benefits from Vietnam's conquest of Kampuchea. Soviet naval combatants have visited Cam Ranh Bay. Similarly, the Cubans are building a submarine base at Cienfuegos which the Soviets may end up using. Thus, though some of Moscow's victories may contain the seeds of its future defeats, as in Egypt, the USSR is now better positioned to influence developments, say in southern Africa, either directly or through its Cuban surrogates, than ever before in history.

From Moscow's perspective, its European front has been relatively quiet. The Conference on Security and Cooperation in Europe (CSCE), a Soviet initiative, proved somewhat embarrassing over human rights (Basket III) during the Belgrade meeting—but evidently was successful enough for Moscow to agree to a further meeting in Madrid in 1980. Gains were registered on the security side, such as notification of maneuvers involving 25,000-plus personnel, and the Soviet Union can be expected to push hard to add other military related matters to the agenda in Madrid. On the economic front, trade and credits apear to be moving satisfactorily but Soviet cutbacks in energy supplies are worrisome.

This has been especially true in Eastern Europe, where Moscow seems determined to force its clients onto the world oil market. Consumer unrest, especially in Poland where the election of a Polish Pope generated new expectations for at least religious freedoms, is on the rise. And Moscow is faced with the dilemma of where to ship oil and natural gas, for if it does cut back in Eastern Europe to earn hard currency in Western Europe, it runs the risk of generating serious labor disorders with political overtones. Romania, too, has its labor problems, and Ceausescu has publicly criticized Soviet attempts to strengthen the Warsaw Pact vis-a-vis China and to raise defense expenditures to counter NATO guidelines calling for an increase of 3 percent in each member's military budget.

IV. Political Dynamics

One of the most remarkable features of the Brezhnev era has been the regime's ability to mask the dynamic nature of the Soviet political process to the extent that Western commentators tend to avoid the subject altogether or persist in applying simplistic "hawk-dove" criteria to every development.

One reason is the absence of a charismatic leader like Khrushchev, whose penchant for innovation, hare-brained schemes as they were subsequently called, kept him constantly in the headlines. The very stolidity of his successors, a trait which endears them to the vast army of bureaucrats who actually run things, has obscured the continuing vitality of the Soviet political process.

Another reason, of course, is the continuing monopoly of control over all public media. To be sure, samizdat (unofficial, and risky self-publishing) and the govorya ("they say") network help fill some of the crevices but few of the chasms. What other nation, for example, could unceremoniously dump its President, in this case Podgorny

in 1977, without providing any explanation whatsoever to its citizenry? [14]

The Communist Party of the Soviet Union (CPSU) continues to dominate political life. General Secretary Leonid I. Brezhnev chairs the weekly meetings to the policy-setting Politburo (see chart I) [15] and, since 1977, formally chairs the Presidium of the Supreme Soviet (see chart II), hence his title of "President."[16]

The 22-man Politburo currently has 13 voting numbers, 3 of whom are non-residents of Moscow; and 9 non-voting members, 4 of whom are non-residents. In addition to the 4 voting and 1 non-voting members of the Politburo who comprise the ranking members of the Central Committee Secretariat, there are 6 other party secretaries, all of whom work in Moscow.

These 28 men—only one woman, Ekaterina Furtseva, ever attained membership in these organs—in effect rule the USSR. In addition to General Secretary and President Brezhnev, they include his de facto "second" secretary, Kirilenko, Premier Kosygin, and his now sole First Deputy, Tikhonov; ideological overseer Suslov; and Ministers of Foreign Affairs Gromyko, of Defense Ustinov, and of Culture Demichev.

Since the 25th CPSU Congress in 1976, there have been 9 changes in this elite group. In addition to the Podgorny ouster, they include:

Full Polituro member and Party Secretary for Agriculture Kulakov, the second youngest voting member, who died at age 60.

Full Politburo member and First Deputy Premier Mazurov, who resigned for reasons that are still obscure but may include poor health.

Candidate Politburo member Chernenko, 67, who was promoted to full member, setting off speculation that he was on track to succeed his patron, Brezhnev.

Long-time Gromyko deputy Kuznetsov, 78, who was made a candidate Politburo member after becoming Brezhnev's Vice-President (for protocol);

Georgian Party First Secretary Shevarnadze, 51, who was made a candidate Politburo members, as was Tikhonov, 73, who became Kosygin's First Deputy.

Among the Party Secretaries, Gorbachev replaced Kulakov, and Ryabov was named a first deputy chairman of GOSPLAN, the State planning agency.

Although almost one-third of the composition of the Politburo and Secretariat has changed in the last three years, attention has focused on the fact that renewal has not meant rejuvenation. Since the 25th Congress, the average age of full Politburo members has crept up to 69; all the ranking leaders are 70-plus. Brezhnev is 73, Kosygin is 75, and Suslov is 76 (see table 2). Expressed differently, Brezhnev and

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[14] The Western press noted him sitting among the run-of-the mill delegates at a subsequent Supreme Soviet session, but not his failure this year to be elected to the body he once headed. His current circumstances are as obscure as those of surviving members of the 1957 so-called anti-Party group of Foreign Minister Molotov, Premier Malenkov, and economic tsar Kaganovich.

[15] The author is indebted to his colleague, Steven Coffey, for preparation of charts I and II.

[16] According to the 1977 Soviet Constitution, the President also selects the membership of and chairs the Defense Council, the highest ranking organization dealing with military-security affairs.

Kosygin became members of Stalin's enlarged Presidium (now Politburo) in 1952; Suslov was named a Party Secretary in 1947; and both Ustinov and Kosygin became ministers of the U.S.S.R. in 1939. The age situation is only somewhat better in the Central Committee where "only" 57 percent are over 60, compared with 75 percent in the Council of Ministers and 80 percent in the Politburo.

TABLE 2.—AGE GROUP COMPOSITION OF THE SOVIET ELITE, 1978

[In percent]

Age group	Politburo	Council of Ministers	Party Centra Committee
Less than 45			1.4
45 to 49		4.7	7.5
50 to 54	4.5	9.4	17.6
55 to 59	9.0	10.8	16.4
60 to 64	18.0	19.6	23.7
65-plus	68.5	55.5	33.3
Total members	22	128	414

Note: Based on calculations by Robert Blackwell and William Duncan. It should be noted that these represent double and triple counting, e.g., all members of the Politburo and Council of Ministers are also members and candidate members of the Party Central Committee; and Kosygin and several others are members of both the Politburo and Council of Ministers in addition to the Central Committee.

The fact that the leadership has not brought young blood into its ranks, and has kept its younger members, such as Ukrainian Party boss Shcherbitskiv, 61, and his Leningrad counterpart, Romanov, 56, in their provincial posts rather than bring them to Moscow to gain experience at the national level, has generated speculation that the Party elders plan to hold on to power as long as possible.

V. Economic Organization and Operations

The basic structure and style of the Soviet economy have not changed appreciably since last examined in 1976.[17] It remains essentially a command economy administered by a vast bureaucracy under tight centralized controls. Heavy-defense industries dominate; the consumer sector still appears to be a residual claimant to resources; and agriculture remains an unreliable but increasingly important sector.

The rate of economic growth continues to decline but still remains at a respectable level by Western standards. The need to improve output quality has increased the demand for introduction of new technology, much of which is to be imported, especially since the labor force is approaching a zero growth rate.[18] And the Soviet Union, one of the world's largest producers of oil, coal, and natural gas, is beginning to experience an energy shortage which could retard future development.

The organizational structure and modus operandi are basically those inherited from Stalin. The Communist Party Politburo sets policy and oversees its execution by the Council of Ministers (see

[17] "The Soviet Economy in a New Perspective", pp. 3–16.
[18] See below, Feshbach, "Prospects for Massive Outmigration From Central Asia During the Next Decade."

chart II) through a network of several hundred thousand professional Party officials known as the *apparat* ("apparatus"). In U.S. management terminology, there is a redundancy of controls. The basic philosophy is "democratic centralism," in which the most important rule is the subordination of lower organs to higher ones.

Brezhnev usually chairs the weekly sessions of the Politburo where spokesmen for various groups thrash out large and small issues. During his not-infrequent absences in recent years, Brezhnev's long-time associate Kirilenko usually has taken over. The Central Committee Secretariat provides the chair with both substantive and administrative staff support. It is the Politburo that lays down the guidelines for the annual and five-year plans which are then expanded upon in extenso by the government planning organization, GOSPLAN.[19]

The Politburo reviews the drafts and recommends their acceptance "in the main" to the Central Committee, or CPSU Congress [19a] in the case of five-year plans, which, in turn, approves them. They are then formally promulgated by the USSR Supreme Soviet or government "legislative" arm, thereby giving them the force of law.

Decisions in these organizations are believed to be reached on the basis of a concensus. What few votes are published are below the Politburo levels and with only one exception—Old Bolshevik Molotov's refusal to vote for his own expulsion in 1957—all have been reported as unanimous. There is presumptive evidence, however, that serious differences do surface in Politburo and perhaps other deliberations.[20]

For example, the excision of Kirilenko's picture in the May Day, 1979 leadership lineup in one Moscow newspaper suggests personal as well as policy rivalries. And the dumping of President Podgorny noted above, without giving him even a modicum of honorifics suggests considerable pique, perhaps at his failure to yield his post voluntarily to Brezhnev.

Politburo decisions are usually promulgated in the name of the Central Committee, to which the Politburo is formally subordinated. The reverse is really the case. Membership in the Central Committee is formally bestowed by Party Congresses, whose members are selected on the basis of a series of indirect elections in which the rank-and-file participate only at the first stage. Actually, membership in the Central Committee appears to go with the full-time position an individual holds. Jobs of this importance are on the nomemklatura or patronage list administered by the Politburo through its Secretariat staff. The leadership is thus a self-perpetuating oligarchy from which one departs by reason of age, ill health, or death, or in political disgrace.

If the Politburo is the national command center, then the Party apparatus headed by the Secretariat is the central nervous system. Also chaired by Brezhnev, it too meets weekly to check on the execu-

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[19] As Brezhnev indicated in his speech to the 1978 November Plenum of the Central Committee (Pravda Nov. 28), there is considerable dissatisfaction with the performance of GOSPLAN. The assignment of Ryabov, the Party Secretary responsible for overseeing defense production, as a First Deputy Chairman of GOSPLAN, may reflect an attempt to apply Party-defense expertise to GOSPLAN.

[19a] See fold-in at end of paper.

[20] These were, for example, notable differences in the leaderships 1979 "election" speeches: e.g., Brezhnev, Kosygin, Gromyko, and Andropov stressed the possibility of improving relations with the West, especially the United States; but Suslov, Ustinov, Romanov, and Ryabov were more restrained and failed to mention SALT, expansion of trade, etc., with the West.

tion of decisions and to draft reports for the Politburo, using its internal staff of several thousand Party officials. The Secretariat is organized as a functional duplicate of Soviet society; there are departments responsible for monitoring industry, agriculture, propaganda, education, and the armed forces and police. It is the channel through which decisions are passed through the Party system for execution and verification in every administrative-territorial division down to the basic Party organization formed in every institution, plant, or farm where there are at least three Party members. Each echelon in this system has its own smaller version of the Secretariat which controls and monitors activities within its own jurisdiction.

Though the Party formulates policy and oversees its execution, it directly administers little aside from propaganda agencies. The government furnishes the muscle that gets things done. Head of Government Kosygin chairs the 128-man USSR Council of Ministers [20a] which administers the entire economy. It determines the output of all major commodities, investment, military production, consumer goods, foreign trade, housing construction, prices and wages, etc. In effect, it owns and operates the productive plant and trade organizations and also is the sole stockholder in all financial institutions.

The government functions at present in a highly centralized fashion, a reversal of Khrushchev's short-lived experiment with limited local control. There are ministries at the all-union, union republic and republic levels. The all-union ministries are located in Moscow and directly supervise production facilities throughout the country; examples are the defense and aviation industries. Union-republic ministries have a central headquarters in Moscow and subordinate ministries in the republics; the central ministry directly controls major enterprises under its jurisdiction, whereas the subordinate ministries administer the remainder. Typical union-republic ministries are agriculture and light industry. Republic ministries usually handle industries of purely local significance. There are also three major supra-ministerial agencies. They are:

The State Planning Commission (GOSPLAN), which is supposed to be able to identify the needs of the economy and mobilize the resources necessary to meet those needs;

The State Committee for Material-Technical Supply (GOSSNAB), which theoretically is able to ensure the availability of all requisite materials but more often than not is barely able to keep abreast of demand; and

The State Committee for Science and Technology (GOSTEKHINKA), which is charged with developing and encouraging the adoption of new approaches by production agencies. It is the agency behind much of the drive to computerize the Soviet economy, to develop new management techniques, and to raise capital and labor productivity.

Much has been said in the Soviet Union and in the West about the need for reform of the economic organization and operations to provide stimuli/incentives and to raise factor productivity to revitalize growth rates. Reform rhetoric, however, has remained just that.[21]

[20a] See fold-in at end of paper.

[21] For an expert description of the ceaseless search for economic panaceas, see below, Gertrude E. Schroeder, "Soviet Economy on a Treadmill of 'Reforms'."

The Brezhnev leadership has continued the proclivity of its predecessors to tinker with the system of management. In 1965 it adopted a so-called economic reform which was mistakenly labelled in some Western publications as "creeping capitalism" because one of the success criteria was profit. Unfortunately, since the centrally set pricing system chronically lags far behind actual costs, managers began to produce what was profitable for their enterprise and slighted assortment. This led to disproportions on a scale comparable to that which existed when weight and value were the prime determinants.

Administrative reorganizations have been a favorite mechanism. In 1973 self-financing "production associations" were introduced in place of numerous budget funded enterprises in industry and construction (in Western parlance, these "associations" resemble medium-sized vertical and horizontal trusts). Initial conversions accomplished the aims of the changeover, largely because the units initially selected were the most efficient. More marginal gains have been registered as less well endowed units have been converted. The 25th Party Congress, nevertheless, decreed the extension of this form of management to agriculture—but little has apparently been done in this area.

The Congress also endorsed the creation of Manhattan Project-scale organizations for undertakings involving long time periods and many agencies, such as the Baykal-Amur Main Railroad (BAM). In this context, it has been rumored recently that a number of super-ministries are to be formed. On the other hand, ranking officials, including Politburo member Romanov, have urged the creation of "complex" plans for territorial divisions, like Romanov's Leningrad-dominated Northwest Economic Region, which would encompass all economic activity in the area regardless of subordination. This approach bears a superficial resemblance to Khrushchev's *sovnarkhozy* (regional economic councils) and represents the latest attempt to balance off local versus central interests. At this writing, its fate is by no means certain.

VI. Prognosis

The foregoing leads to the conclusion that barring national catastrophe continuity, not change, is likely to predominate in Kremlin policy over the near term.

Soviet foreign policy, whether it is primarily reactive, opportunistic, or expansionist, is likely to remain cautious. Deliberate provocations to either the East or the West will be few because of the new relationships between them. Miscalculations, however, can and perhaps will produce confrontations of sorts. But the Soviet leaders are not likely to be adventuristic. Once having committed themselves, however, they will be most reluctant to back off.

At home, movement toward some form of market socialism or genuine reform to revitalize economic growth appears unlikely. Calls for extensive improvement of planning and management are likely to generate only additional bureaucratic restructurings. Meanwhile, the downward trend in economic growth rates will continue, and it is possible that the search for solutions will get caught up in succession politiking.

The seeming absence of any heir apparents to either Brezhnev or Kosygin, other than their stand-ins, both 73, further suggests that when they depart the scene, no generational turnover will occur. If

indeed their deputies or other elders do succeed to the top positions, odds are that these successors are not likely to meaningfully alter extant policies which they helped form and now administer under Brezhnev's aegis.

One can never exclude from consideration, however the possibility that whoever succeeds might turn out to be far more dynamic once he has the gavel in his hand. Certainly Khrushchev was not a Stalin, nor Brezhnev a Khrushchev. But 15 years have passed since Brezhnev took over and perhaps as a result of his penchant for consensus-style decision-making, there does seem to be a basic agreement on systemic questions among the elite generally. Actuarial realities also suggest that the tenure of the successors will be short and that another succession will take place by the mid-eighties.

In the meantime, guns, butter, *and* growth will remain the declared policy. The practical impossibility of attaining all these simultaneously will continue to make economic decision-making, especially the allocation of resources, among the most important—and contentious—features of Soviet politics.

THE SOVIET UNION IN THE WORLD ECONOMY

(By William Diebold, Jr.*)

CONTENTS

Summary

Large changes in the world economy invite speculation as to whether the U.S.S.R. may play a more active part in international economic relations in the future than it did in "the Bretton Woods world." While there has been an increase in Soviet foreign economic activities (trade, industrial cooperation, borrowing, shipping) it has not been matched by great Soviet interest in multilateral cooperative arrangements. The essay suggests some reasons why this may be so and analyzes a series of issues to see what kinds of factors might influence future Soviet action in these matters with particular attention to obstacles arising primarily from systemic differences. Still important, these latter are less general than is often realized but there are many other sources of difficulty. Without predicting Soviet behavior or prescribing policy for western countries, the paper tries to show how future relations among market-oriented and developing economies could affect east-west economic relations.

This paper is not based on expert knowledge of the Soviet economy or any special qualifications for divining the real meaning of Soviet statements or actions. It has two quite different starting points. One is the effort, over a period of years, to detect and understand the major changes that have been taking place in international economic relations. These go back quite a long time but have been larger and more vivid in the '70s than before and will, no doubt, continue in the '80s. The other starting point is the sense that in a changing world it is unwise to leave out of account the possibility that the U.S.S.R. may come to be more involved in international economic affairs than it has been in the past. At least, one should not take it for granted that the forces inside and outside the U.S.S.R. that have limited that country's participation in international economic cooperation during the past few decades will continue to dominate. They may, but no unexamined assumption has much intellectual value in a changing world. That one

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may not be able to provide an altogether reliable alternative assumption (or, for that matter, even confirm the old premise) is no ground for not ventilating the question. In the nature of things, one cannot expect precise and definitive results from such an inquiry. What follows is essentially an interpretive essay drawn from the impressions of one observer.[1]

The Post War Decades

Many people forget that the Russians were at Bretton Woods. They got what they wanted on some issues and not others but subsequently drew back and the Soviet Union never became a member of the International Monetary Fund or the World Bank. The U.S.S.R. did not even join in the preparatory work that led up to the abortive Charter for an International Trade Organization (ITO) and the General Agreement on Tariffs and Trade (GATT). While the full story of Soviet policy in these matters is not public, most explanations would emphasize the failure of the U.S.S.R. to get a substantial recovery loan from the United States (itself a story with different versions) and, by 1947, the Cold War. While there were some Americans who attached a high value to enlisting Soviet cooperation for the building of a new international economic order, others never believed it was a serious possibility and some thought it would jeopardize the whole endeavor if the U.S.S.R. took an active part. On the face of it, it looks as if neither getting into the process of economic cooperation nor spoiling it was a major objective of Moscow.

What would have happened if the Soviet Union had in fact been in the main stream must be moot. The basic fact is that the processes ran remarkably well for a period of years without the Soviet Union and that the difficulties eventually encountered by what may conveniently be called the Bretton Woods system [2] had little to do with East-West relations. What was lost by the virtual exclusion of the U.S.S.R. from this process was the experience that would have been gained in dealing with two sets of problems that remain relevant to the present and future. First there are those that come from the need to connect two quite different kinds of economic systems; the arrangements that were made in anticipation of this event, such as the state trading rules of GATT and the ITO, were known to be inadequate to the purpose and were thought of as providing a starting place from which it might eventually be possible to arrive at new understandings and a body of practice that might lead to new principles. The second loss was of the chance to discover whether economic cooperation could tolerate a higher level of politicization than it was subjected to so long as East-

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[1] Most of the work on which this paper is based has been done over a period of years in the preparation of a book for the Council on Foreign Relations on American economic policy toward the Soviet Union and eastern Europe which will be published in 1980 by the New York University Press. A different treatment of some of these issues appear in "East European Countries in the World Economy," in "The Soviet Union and East-West Relations." by John C. Campbell, New York: McGraw-Hill (forthcoming 1979). For the 1980s Project of the Council on Foreign Relations. My debts to scholars, officials and others in a number of countries who have discussed these issues with me are too numerous to detail but I must mention the Institute of World Economics and International Affairs in Moscow at which I was a guest in the spring of 1977 and the Soviet-American Parallel Studies Program of the United Nations Association of the U.S.A. with whose economic panel I have been associated since 1973.

[2] It went far beyond what was accomplished by the original financial and trade negotiations to include the Marshall Plan, the partial integration of Western Europe, the finding of an unprecedented place for Japan in the world economy and a long list of other arrangements, mostly cooperative.

West tension was dealt with outside the system. The experience on both these points gained from the growth of East-West economic relations starting not long after the Korean War was largely of a different sort since these developments were more or less ad hoc and rarely regulated by more than bilateral understandings.

Stalin's description of a world economy divided into two parts, whatever its theoretical or empirical weaknesses, was not far from being an accurate picture of the state of affairs in the '50s and '60s. But like most simple models it fell short of reality as the Russians seemed to recognize when in the mid '50s, after Stalin's death, they launched a program of aid to developing countries that involved the expansion of trade relations as well. By then development aid was a well established western practice and much more prominent than it had been in the original Bretton Woods arrangements. Some thought that the Soviet Union was largely concerned not to be left out of what appeared to be an important element of great power activity in the modern world. It was more common, however, and a sign of the times, for such efforts (along with some others) to be seen as adding up to a "Soviet economic offensive." By either interpretation the Soviet Union was coming further into the international economy without necessarily subscribing to any of the goals or commitments of anyone else except perhaps of some developing nations. It did, however, play a part—through a rather limited one—in the economic activities of the United Nations which also came to focus more on development issues than on other economic relations.

By the end of the 1960s the Soviet involvement in the world economy was greater than it had been for years but less than that of any other major country. There was, however, a new willingness to increase that engagement and a school of thought had emerged in the Soviet Union stressing the benefits of still further participation in the international division of labor. This view and the need to deal with a variety of consequences flowing from the expansion of trade and other external economic relations naturally stimulated the Soviet interest in various forms of cooperation. These still fall notably short of any major efforts to enter into the broad multilateral processes which were most characteristic of the Bretton Woods world. Whether this is just a lag or something more lasting is far from clear. An answer to that question cannot be entirely in the old terms of whether the U.S.S.R. will "join the Bretton Woods system" because that system, however broadly conceived, is undergoing changes of such magnitude that it must be thought of quite differently from before.

The Changing World Economy

In explaining the changes in the world economy it would be possible but unwise to put primary emphasis on changes in world politics. It is possible because the relative rise of power in centers outside the United States and the Soviet Union, the common understanding of the need to maintain the bilateral strategic balance of those two superpowers and the kinds of power struggles those conditions permit in various parts of the world all significantly affect the world economy. It would be unwise, however, to put primary emphasis on this set of factors because one must go a long way down the analytical road

before arriving at propositions about the constellation of power that determine one set of specific economic factors and rule out alternatives.

There is no doubt, for instance, that the spread of productive and technological capabilities around the world and the existence of many sovereign governments limit what the United States can do by unilateral action to affect the Soviet economy more than did the circumstances of thirty years ago. But the statement is not equally true of every field from food through computers and there is no preordained assurance that the diffusion of power means that commercial competition will always outweigh the willingness of governments to act together to limit east-west economic relations for political reasons. To take another example, the argument that détente will generate increased economic relations that will bind the Soviet Union inextricably to the rest of the world economy has to be balanced against the view that unless positive steps were taken to stimulate economic relations détente will deteriorate (and then one has to reexamine the economic consequences of increased tensions in international life). In a short paper it is better to set these issues aside than to pursue them but it is essential that changes in world politics be kept in the mind as factors conditioning what is said about changes in the international economic system.

These changes have been so much written about in recent years that there is no need for a detailed catalog. It will, however, help our analysis to bear in mind that the changes are of quite different sorts. When people rather exaggeratedly speak of the "breakdown of the Bretton Woods system," they usually have in mind the replacement of the fixed exchange rate system with floating rates, instability of money markets and the displacement of the dollar. But in trade many of the changes stem from the success of the Bretton Woods system. Because tariffs have been so much reduced and other trade barriers removed, a new need has arisen to deal with non-tariff barriers and all sorts of national measures that affect the flow and structure of international trade even though they are directed largely toward meeting domestic economic needs. Closely related are the issues raised by the great growth of international direct private investment. Stimulated by the liberalizing Bretton Woods measures, these activities are not the subject of anything like the complex multilateral understandings that deal with trade and payments. One need not dispute the precise boundaries of each category in recalling that not merely the investment process but the behavior of multinational enterprises at home and abroad is a subject of international concern. Though a growing element in most economies, many services have been dealt with only sporadically in international arrangements. Though the fundamental importance of agriculture was recognized at the outset (the Hot Springs Conference that led to the Food and Agriculture Organization came before the Bretton Woods conference), it has not lent itself to the same kind of international trade liberalization as other products and is now likely to be thought of primarily in terms of world food needs. Economic development, its aims, strategies and finance, have become subjects of international concern on a scale out of all proportion to the place accorded them in the original Bretton Woods arrangements. The growth of industrial production in a number of

countries in Asia and Latin America has, in turn, outrun thinking that still divides the world into two categories, the "industrial" and the "developing." Energy is another subject that has greatly changed its character as an international issue. The problems of adaptation that increased oil prices have posed for many countries are part of a larger set of issues concerning the effects of structural change on the reshaping of the international economic system.

New problems, neglected problems that now seem important and new manifestations of old problems make up a formidable agenda for international economic cooperation. Almost all of them have some bearing on east-west economic relations which has its own list of special problems. It is rare, though, to find an issue of general concern to the international economy that is principally rooted in east-west economic relations. It would also be wrong to think only in terms of the debate about the "New International Economic Order." While the so-called north-south and rich-poor issues are of great importance, some of the most fundamental issues about reshaping the world economy arose in relations among the OECD countries. While the oil crises, persistent stagflation, international financial instability and the recession of the middle of the decade put the mark of the '70s on many of the most drastic changes in the world economy, the process was well underway, largely visible and partly predictable in the mid '60s and before.

Even so abbreviated an account of the changes in the world economy shows that it is none too easy to see what their implications are for the international position of the Soviet Union. Later we shall speculate a bit on why the voice of the Soviet Union was not heard more often in a debate that is by now more than ten years old on some issues. But in the absence of a clearer record, one has to analyze the changes themselves to see what bearing they might have on our subject. Several tests seem relevant. One might ask whether the systemic differences between state-controlled and largely market oriented economies seem to present as great difficulties as they did when the original Bretton Woods arrangements were worked out. One would give special attention to products of which the Soviet Union was an especially important producer or consumer, both to assess the potential interest of the Soviet Union and to judge how much difference it might make to the rest of the world whether the Soviet Union did or did not take part in any international arrangements that might be made. Similarly one may ask whether the Soviet Union has a significant part in activities that are now of greater international interest than they used to be. Or the emphasis might be on reasons why the U.S.S.R. might have a new interest in some international activity. To find that it did not make a great deal of difference to the success or failure of some activity whether the Soviet Union took part in it, might not just lead to dismissing the subject. It could become an argument for using such cases as testing grounds for cooperation if weight were given to the widespread concern in the western world that the inclusion of the Soviet Union in these efforts would be likely to be damaging. Finally, in looking for relevant issues, one must not forget the points made earlier about the changing political situation which makes some economic relations far more sensitive than others.

How the Changed Circumstances Could Affect East-West Economic Relations

It is not only changes but the totality of the present and foreseeable situation that concerns us. What leaps to the eye is that the systemic differences remain profound and present real problems. How can a centrally controlled and planned economy with arbitrary prices and inconvertible currency fit into a system of economic cooperation that was largely motivated by a concern to remove governmental barriers to trade and payments? Not at all well, is the only possible answer, in 1979 as in 1944. But that is not all there is to say. There is, in the first place, the question whether the bridges that could be built between the two systems are good enough to be made more use of. And in the second place there is the fact that the western system involves much more than simply liberalization and freeing the play of market forces.

Money, where it all began, provides the clearest case, though a somewhat paradoxical one. Big as the changes in the west have been, they have not altered the systemic differences that limit the participation of the Soviet Union in the world monetary system. While other currencies have been inconvertible without thereby being ruled outside the system, the ruble's inconvertibility is so deeply rooted in the nature of the Soviet economy that it has to be treated as a necessary characteristic. Major changes would be needed in the nature of Soviet prices and the planning of production before the ruble could be made freely convertible into goods or foreign money. Such kinds and degrees of limited convertibility as are reasonably conceivable (for outsiders for limited purposes, for other Comecon countries up to a limited amount of the system's external assets or to widen the use of the transferable ruble within the system) all fall short of altering the fundamentals. A change in the Soviet system sufficiently radical to make the ruble truly convertible goes beyond the range of possibilities allowed for in this paper.

There is, however, a monetary bridge between the systems which is at least as good as it ever was: the use by the U.S.S.R. and its fellow bloc members of western currencies for foreign transactions. The burdens of this method fall essentially on the eastern countries themselves though westerners are sometimes inconvenienced by the devices the Soviet government resorts to to avoid giving up hard currency. There is, however, no terrible burden on the international monetary system that would make its western managers especially concerned to find ways of bringing the socialist countries into whatever new arrangements are worked out in the course of time. Thus for the foreseeable future it is hard to see how the Soviet Union could become one of the makers of the system instead of remaining a taker of what others provide.

As a taker, the U.S.S.R. along with the other socialist countries of eastern Europe has found the Eurocurrency market attractive.[3] Fluidity, size and the absence of the controls found in the national capital

[3] In spite of occasional references of this sort, it should be emphasized that this paper confines itself to the U.S.S.R. and does not deal with the substantially different situation of the smaller east European countries. Consequently, it also leaves out any systematic consideration of the U.S.S.R.'s position in Comecon and its effect on other aspects of Soviet foreign economic relations.

markets and applying to national procurement have all played a part, especially for a country whose payment record has long been an article of faith among western branches. While the possibilities are not limitless, the urge of western banks to lend (and western suppliers to sell on credit) been strong enough to leave the U.S.S.R. in a reasonably comfortable position and with a "reserve" of unused credits from some western European governments. Its essentially conservative financial managers have sought other ways as well to hold down indebtedness (perhaps partly to leave the margin of discretionary borrowing freer).

When we turn to trade the situation is more complicated. There is still a large systemic difference because of the amount of world trade, especially in manufactured goods, that moves across relatively low barriers in response primarily to market forces. The misfit of east-west trade in this system has two sides. As seen from the west, the basic issues about exports are summed up by the classic question of how the Soviet Union should be asked to reciprocate for most favored nation treatment. The possible answers are about the same as they were in 1947 and no more satisfactory. There has been experience with various bilateral arrangements that provide access to the Soviet market and it is worth thinking whether there would be much point in seeking to transform these into multilateral understandings. As the U.S.S.R. spends what it earns in hard currency, "the west" as a whole may have no complaints but any given seller faces a bureaucratic monopoly to which ordinary standards of market access have no relevance.

On the import side (as seen from the West), the historical worry was that of unfair competition. "Soviet dumping" is the old shorthand for whatever combination of political or economic motives would cause Soviet sellers to lay down products at prices undercutting western suppliers and in quantities felt to be damaging. During most of the postwar period this had not been a very serious problem because western countries have shown they could act effectively to control imports and the U.S.S.R. has for the most part been to conform to western ideas of orderly marketing in the interest of maximizing its returns on its exports and avoiding worse penalties. As markets sagged during the recession and Moscow put increasing emphasis on buy back arrangements; these practices came under some strain but the fundamental formula seems likely to remain manageable. The question of "dumping" in third countries is not adequately dealt with but this is also a weak spot in arrangements among western countries as well.

Will the Multilateral Trade Negotiations (MTN) change the situation? Unlike most socialist countries, the U.S.S.R. did not take part in these negotiations and east-west trade issues were not given major attention. However, "fair competition" was a central issue and if the codes about subsidies other than tariff barriers and about safeguards against market disruption prove effective, the results could have a bearing on how trade with the Soviet Union is treated in the west. The subject is too complex and "iffy" to warrant lengthy discussion at this point but there are, roughly, two contrasting tendencies at work. One moves toward refining international standards of fair and free competition and thus, in principle at least, perfecting the working of market forces. The codes on antidumping, customs valuation and government procurement can largely be thought of in these terms. The

stiffening of rules on export subsidies may belong in this category but the major part of the new subsidies code and its principal innovations exemplify the other tendency. The effort is not to rule out particular practices as inevitably falsifying competition but instead to accept the fact that for any number of reasons governments are going to continue to provide special assistance to some of their producers and to limit their international responsibilities to cases in which they thereby damage producers in other countries. The approach to safeguards is much the same, asking not why import competition has become more severe but only how to deal with the difficulties it causes.

Should either of these tendencies come to dominate, there would be implications for east-west trade. A more nearly perfect market with a freer and fairer play of competitive forces than ever before would clearly heighten the contrast between the systems. But the more the western world moves in the other direction, concentrating on the effects of national economic measures rather than on their forms or whether they interfere with "fair competition," the more the controls thought justified for trade in general come to resemble those used to prevent "Soviet dumping." The conjunction seems accidental and the fit is not at all precise or logical, so too much should not be made of the matter but it should also not go unnoticed in a survey such as this.

"Managed trade"—if that is what we should call it—also increases in importance whenever some product or sector is made an exception to the normal set of rules governing import and export policies. Steel is the most striking recent example but the list includes the products covered by American Orderly Marketing Agreements (OMA) and the numerous arrangements European countries have to hold down imports from Japan. Efforts to deal with excess capacity in shipbuilding and perhaps chemicals and other industries will, if they are successful, further limit trade (though they may leave some play for competition). These may prove to be temporary arrangements, as their proponents usually claim, but the fact that the cotton textile agreement dates back to the early '60s and was extended in the '70s to cover man-made fibres and woolens is a reminder of the potential durability of such measures. The significance of these arrangements for the present subject is not just that they increase the area of managed trade in which a state trading monopoly could be given a negotiated share in a way that is impossible then market forces dominate. It is also that sectoral arrangements are usually made among a relatively small number of countries. OMAs are likely to involve an important market and one of a few suppliers; the steel arrangements are based on tacit or explicit bargains among the United States, the European Community and Japan; the textile agreements are largely shaped by the major importers. In the nature of things, bargains, burden sharing and reciprocity of one sort or another are worked out among the participants and often at the expense of outsiders.[4]

The targets of such arrangements are usually not just a general ex-

[4] The textile agreements work a little differently in that an outsider may escape trouble if he is a small or prudent enough supplier; but if he grows important enough for larger importers to act against him, there is an incentive to join the agreement since it sets at least minimum standards for what the importing country can do. My essential point, however, is the one stated more generally in the text, that in one way or another an outsider is likely to be in a weaker position than a participant when governments get together to manage trade and thus implicitly allocate production.

cess capacity but the exports of certain countries. These have not yet included the Soviet Union but those who worry about the supply and prices of basic chemicals frequently refer to that country. And even if it were not a primary target, the U.S.S.R. might find its export possibilities restricted by efforts on the part of a number of western producers to accommodate one another in an agreement covering some major industry or products. Then the intriguing question would arise whether it might be possible to work out an agreement that took the U.S.S.R.'s interests into account, and how. A particularly interesting dimension would be given to the problem if the effort was not just to deal with a temporary difficulty but, in a much more ambitious way, to adapt the industry to changing circumstances more constructively than by simply offsetting one country's protective measures or subsidies with those of another. We have not had this kind of effort in the west but the possibility remains real as governments become increasingly concerned with the difficulties of structural adjustment and the dangers of pursuing it on a national basis alone.

Another segment of international trade that does not fit the traditional free market model with numerous buyers and sellers is the exchange of goods within multinational enterprises or, at least, among closely affiliated companies. These exchanges are not immune to market forces or unaffected by governmental trade barriers but up to a point they internalize some of the costs and absorb the impact of distortions. For present purposes, however, their primary interest is that transactions among affiliated enterprises can provide links between the planned Soviet economy with its arbitrary prices and the world markets in which multinational corporations do most of their business. This is already happening in a number of instances of industry cooperation between western companies and Soviet enterprises. When the western partner takes goods simply as a substitute for money, the significance of the arrangement depends on its duration and what the products are; there still may be an important advantage to the U.S.S.R. since the western company takes over responsibility for selling to western markets. The risk of encountering antidumping measures or other restrictions is also reduced. When the relation is a lasting one and the western partner actually wants the products he takes because he can use than in his normal activities, then the industrial cooperation serves to integrate Soviet production into the world economy.

Among the Soviet products that westerners want most are raw materials, oil and gas. But even without any western partners, the Soviet relation to the rest of the world in energy, minerals and lumber is significantly different from that in manufactured goods. A major producer and frequently large exporter, the Soviet Union has a strong position and substantial bargaining power. To ruminate at any length on how this bargaining power might be used would be idle without making quite a few assumptions about the future of the world's raw material economy. The situation is fairly obscure (leaving energy aside for the moment).

The specters of widespread cartelism and a general shortage of raw materials conjured up by OPEC and the Club of Rome have largely disappeared. The pessimistic forecasts resulting from the very low

mineral prices of the recession are giving way in one product after another. Expropriation and other measures by governments in many producing countries caused firms based in the OECD world to shift the emphasis of their exploration and new investment toward North America and other "safe" sources. But the industrial world's longrun needs pretty clearly call for substantial imports so governments, businesses and banks are trying to work out new ways of blending producer and consumer interests in a durable fashion. Objectively, one would say that an interest in diversification of sources and the expansion of output plus a preference for stability in the producing area on the part of western companies must improve the Soviet position. But when western producers contemplate the costs and commitments of the kind of "investment" they would have to make to help maximize Soviet production, they find themselves facing well-known doubts and difficulties.

Another widespread expectation of the early '70s about raw materials has not been realized. Instead of numerous commodity agreements providing support for LDC export earnings we have very few additions to the small number that already existed. Few people would expect to see a great reversal of prospects soon. Whether an increase in the number of commodity agreements would tend to draw the Soviet Union into them is hard to say. As an exporter, it would have to assess the "security" provided by material commitments against the bargaining power of independence; as an importer it would be as concerned as the next one with the effects of such agreements on prices or the stability of supply. As the alternative to commodity agreements is not necessarily free markets and the Soviet Union is as capable as any western private or public entity of entering into long term agreements, questions of systemic differences hardly arise.

The situation with regard to energy has been so thoroughly discussed as to need no recapitulation here. As in the case of raw materials, the question about a potential increase in Soviet involvement with the rest of the world rests on calculations of interest and policy inside and outside the U.S.S.R., not on systemic differences. That is also true of food but there the great difference is the large effect on international supply and demand that can come from shifts in the domestic position of the U.S.S.R. because of its huge consumption. First its exceptional need for wheat (and the possibility of a recurrence) and now the implications of Soviet livestock plans for sustained imports of feedstuffs underline the positive interest of the U.S.S.R. in plentiful world supplies and relatively open markets with competing sellers.

For a time earlier in the decade, it looked as if worry about shortages and the longrun growth of world demand would lead western countries to create international stockpiles of some sort and try to set standards for the use of export controls by producing countries. Had things developed that way, there was a serious prospect of the Soviet Union's taking on some obligations to help insure its supplies. That possibility may reopen but meanwhile a combination of enlarged world supplies plus a revival of the belief that market forces will work better than stockpiles (except for disasters) is creating a situation in which it must be reasonably attractive for Moscow to keep its hands free. The commitments involved in the bilateral agreement with the United States can be thought of as the cost of insurance against difficulties in periods of some tightness in world supplies.

There are many other aspects of the world economy that could usefully be reviewed but we are already pressing on the limits of this paper. The extension of national sovereignties offshore with its effects on fishing and the seabed plus whatever the future holds by way of new ocean regimes are all matters affecting the Soviet Union and in which it has played some part. The striking emergence of a merchant fleet paralleling the growth of the Soviet navy has turned some of the standard views on their head. Here the state trader is a champion of competition and the western operators seek ways to enforce agreements setting rates and, sometimes, dividing traffic. To be sure, the obscurity of eastern costs may well hide competition that is "unfair" in a variety of ways but in the world of shipping western standards are also not crystal clear. There are private, moneymaking operations that are competitive by almost any standard but there is also a network of subsidies on building and operating, stateowned fleets, much public regulation and also private agreements of a sort generally thought of as restrictive. The situation lends itself to compromise, at least in liner arrangements, with two key factors being when the Soviets feel they have gained a large enough share of the market to be willing to stabilize and how far the public powers in the west will go to force the issue. Just what kind of agreement would work in tramp shipping is less clear. A further dimension of some interest is the interaction between the Soviet move and the effort of some developing countries to obtain for their national merchant marines carriage of a negotiated share of their foreign trade. The working out of this issue will be worth watching for what light it may cast on possibilities in other fields.

It would be misleading to try to sum up this section in a simple statement. Even three may not suffice but perhaps enough has been said to suggest the following. (1) Systemic differences continue to present obstacles to fitting the U.S.S.R. into a variety of international economic activities. (2) There are other very significant areas of activity in which the U.S.S.R. as a state monopoly can perfectly well participate if it and others wish. Here the calculation, on both sides, is of interest, importance, reliability, the extent to which common objectives are thought to exist and the trade-off between commitments and independence. (3) The U.S.S.R. has shown far less interest than most western countries in engaging itself heavily in international economic activities, influencing international agreements and institutions or exploring the possibilities for further cooperation. Or so it seems to a western observer though there are clear signs of increased interest in some fields and indications of possibilities in others. On the whole the changes in the world economy over the last decade and a half have enlarged these possibilities.

The View From the Soviet Side

It would be interesting to know whether economists sitting in Moscow have cast up a balance of the changes in the world economy in anything remotely resembling the terms used in this paper. Certainly there are many who study the changes in the world economy and not least that of the capitalist world but one who probes from the outside finds remarkably little disposition to discuss these changes in terms

of the possibilities they open for the Soviet Union to join in the process of remaking the world economy or altering how it is likely otherwise to be made. I must leave it to others to pursue these questions more deeply in the Soviet literature or the back rooms of the academic and ministerial bureaucracies but a few impressions and reflections are relevant to the purpose of this paper and may also suggest points at which further inquiries could be pursued.

One large exception to what has been said concerns the Soviet approach to the developing world. Here there is, after all, a good bit of Soviet experience and an appropriately large literature. The impression is widespread that, as in the west, knowledge has been gained in this process and old ideas altered but insofar as the focus is on development strategies the subject is beyond the bounds of this paper. With regard to the Soviet record in the discussions of a New International Economic Order, western commentators are pretty much agreed that there has been much rhetoric and little performance and that under growing pressure from the LDCs to do something significant, some larger but still limited response is not impossible. Guessing about the response leans toward something bilateral or arrangements involving other Comecon countries. It is not inconceivable, however, that Moscow should make at least a gesture toward western suggestions that it join in more general efforts to increase development financing. Probably the least likely result is a movement toward a new central role for the U.S.S.R. in development activities but it is also unlikely that the Soviet Union would stay out of any major set of U.N. activities on the subject.

The Soviet stance with regard to various international economic activities seems quite sensibly based on its own interests. One can hardly be surprised that the U.S.S.R. should not be greatly interested in proposals to "organize" the world grain market unless other countries seem about to take measures that might restrict its freedom of action or set conditions for its access to supplies. As an active borrower (and to some degree lender) in the Eurocurrency market, the U.S.S.R. enjoys the flexibility of the institution. But would it try to assert an interest and influence if western governments or central banks tried to establish some restraints on the liquidity of that market or the terms of access to it?

It is less clear why, in the decade or more that there has been active reconsideration of the international monetary system, so little has been heard about what the U.S.S.R. would like to see happen. Perhaps the easiest explanation is the sense of a lack of locus standi for Moscow in these matters and the wish to avoid a rebuff. Maybe the association of monetary disturbance with the long predicted general crisis of capitalism added to the inhibitions, though this seems not to have been important in guiding policy in other fields and there is clearly considerable recognition that the U.S.S.R. has a stake in the more or less satisfactory functioning of the western economies. One cannot help wondering what part may have been played by the fact that in monetary matters the Soviet Union is the home of ideas about gold, real values, and the like which, although not unknown in the west, are no longer even a conservative orthodoxy. The abandonment of the fixed exchange rate system must also have been bothersome to Soviet

thinking with its strong set in favor of "stability" (though the question must have occurred in the east as well as the west whether it was not the failure of the fixed rate system to provide stability that contributed much to bring it down). Perhaps there was just a dearth of ideas in a field where talent or originality were not likely to be well rewarded within the U.S.S.R.

The Soviet approach to international trade seems to be highly pragmatic whether the issue is raising oil prices, dividing oil and gas deliveries between Comecon and the west, marketing diamonds through the syndicate or agreeing to respect price and quantity limitations so as not to be excluded from western markets for a variety of products. Apart from an insistence on most-favored-nation treatment, which seems to have become a symbol of acceptance as a fully sovereign entity in world trade, there seems to be relatively little Soviet interest in much beyond bilateral trade agreements. One exception is the issue of a trade agreement between Comecon and the European Community. Another might be the proposal for a new International (or World) Trade Organization that makes its appearance from time to time, but this seems to envisage largely a reordering of U.N. bodies (and the possible absorption of GATT) without much clarity as to what kinds of rules or commitments might be introduced. Some kind of Soviet adherence to GATT is, on the whole, an unlikely development that raises issues far too complex to be gone into here. But the fact that the MTN codes apply only among the countries adhering to them raises interesting questions. A number of them are irrelevant or impossible for the U.S.S.R. for systemic reasons, but is it inconceivable that both the U.S.S.R. and other countries might find it interesting to explore the terms on which Moscow could usefully adhere to the Standards Code which aims to reduce the difficulties for international trade stemming from national rules about testing, certification and other measures to insure that products meet certain standards? Whether the Soviet interest in qualifying to bid for some government contracts in capitalist countries would make it reasonable to see if the obligations of the MTN code on government procurement could be applied in Moscow is probably another matter.

Enough has been said in the previous section about the possible interest of the U.S.S.R. in commodity agreements, especially concerning products of which it is a major exporter or importer. On balance it may be doubted whether its calculations in these matters are likely to be radically different from those of other large and diversified countries. Not so much a general approach as the merits of an agreement applying to a particular product and likely to be decisive. In many ways the more interesting questions about raw materials as a link between the U.S.S.R. and the world economy focus on the organization and financing of the future development of Soviet resources. The U.S.S.R.'s willingness to accept the costs and obligation of enlisting foreign capital and technology in order to get the advantages they bring is clear. It is not always prepared to go as far as foreigners think necessary in the terms offered or in establishing the conditions they think necessary for them to operate effectively. As in other parts of the world, the vast sums required and the long delays before there can be profits or, often, even products, are obstacles in themselves and also pose conundrums about how dependable the supply will be years in

the future. Still, so long as foreign "investors" can be found who will assist in the development of Soviet resources on the terms offered, usually because they want the product, there will be little reason for the Soviet Union to do things differently. It is, after all, in just about the same position as an increasing number of raw material producing countries which have broken the link of foreign ownership and control of production and yet remain able to draw on the benefits of foreign participation. But the foreign interest is not to be taken altogether for granted, the suppliers of suitable technology are not infinite and there are sometimes advantages to being linked to vertically integrated structures. So bargains have to be struck and it is conceivable that at some point the U.S.S.R. might find it advantageous to work out new ways of making its resources attractive to foreigners—but what these might be does not leap quickly to the eye. Perhaps in some cases the well known stability of the Soviet Union could be exploited to persuade foreigners that it was a better bet in matters of security of supply than less developed countries with more volatile societies.

Where the matter of attracting foreigners must raise real questions of Soviet policy is in the field of industrial cooperation, in manufacturing, processing and perhaps agriculture. For all the reasons suggested earlier, this is a kind of activity of great interest to the U.S.S.R. and there can be little doubt that the government would like more of this sort of foreign activity. Part of the interest is in insuring that foreigners not only provide the latest technology but keep it up to date by a continuing flow of developments and improvements. While a company that builds a turnkey plant may undertake to provide further help later on, there is little doubt that the best assurance of this process results from the self interest of a western partner who has a stake in the quality and volume of production in the Soviet Union. This is partly a matter of the western company's financial return, whatever its name or form, and partly the usefulness of the product if some of its payment is in that form. The arrangements the Soviets have been willing to make so far have left many western companies unwilling to commit themselves very heavily and there is little doubt that an argument is going on within the system about how much can and should be done to make the arrangements more attractive. Sometimes it seems as if the problem were largely one of people with different areas of responsibility having to learn what it is that makes the difference between having a foreigner work for one as a contractor or with one as a partner. At other times the dominant impression is that those who oppose further "concessions" do so because they consider the benefits not worth the costs in disturbance of the system and the upsetting of existing arrangements. Whatever results the debate eventually leads to will have a major influence on how closely the Soviet economy fits into the international economic system as a whole.

How far closer integration into the world economy would be desirable is clearly a matter on which Soviet views are divided. Whether the advocates of greater involvement are also gradualists or whether the familiar slow march of "two steps forward and one step back" applies here as elsewhere in Soviet life is an interesting question. Obviously differences in view about what kind of economy provides the greatest security and whether importing too much makes the country vulnerable are important issues in this debate. Stability in the society and the

effect of economic change on political control must be taken into account along with questions of efficiency and cost. No doubt the recession of the mid '70s, the troubled recovery from it in many countries, persistent unemployment, continuing inflation and international monetary instability have worried Soviet advocates of more international involvement as they have westerners. But did these concerns stimulate or dampen interest in what the U.S.S.R. could do to affect the world economy as a whole?

Perhaps all we can safely say is that there does not appear to be a substantial body of opinion in the Soviet Union—much less a significant group of policy makers—with well-formulated ideas about how the Soviet Union ought to try to influence the reshaping of the international economic system in its own interest. This is a situation that could change. Further Soviet involvement in the international economy seems to be inevitable. Perhaps there is new thinking that has not shown itself. What circumstances might bring about a change or what relevant shifts in forces within the Soviet administration are reasonably possible are matters that I am not qualified to judge. This section and some earlier passages have provided a very spotty and incomplete indication of some of the external factors that ought to be watched for signs of change. Something else that has to be taken into account is how far Soviet thinking or policy in these matters might be influenced by the situation of eastern Europe and China.

The smaller European Comecon countries are much more heavily dependent on the international economy than the U.S.S.R. Several of them have shown a good deal more flexibility in dealing with external economic relations, including industrial cooperation. All but Bulgaria and the German Democratic Republic are in GATT, each on a different footing, and Bulgaria took part in the MTN. Romania has joined the Fund and Bank, getting access to credits and loans, and has also established itself as an LDC in various arrangements. Hungary, Romania and Poland all get more favorable trade and credit treatment from the United States than does the U.S.S.R. But still the Soviet nexus is of fundamental importance to all these countries as an export market and a source of energy and raw materials at relatively favorable prices and sometimes credit. For the U.S.S.R. there is a tradeoff between permitting these countries to cultivate western economic relations which contribute to their welfare (in which it has a stake) and maintaining its own dominance in economic and political matters as well as the security sphere. In what ways these considerations might influence the Soviet approach to the international economy is a subject worth pondering. There is also the question of how the example of the smaller countries and the results they have had from their innovations might be seen in Moscow. While the calculus for the U.S.S.R. is different, the experience of the others is surely not irrelevant.

The China case is even more complex. Formerly the main challenge it posed with regard to the external economic behavior of the U.S.S.R. concerned the developing countries. As the exemplar of a unique set of development values. Peking easily outflanked the U.S.S.R. as a leader of the third world but did not altogether eliminate the attraction Moscow had for those more interested in growth than egalitarianism and self reliance in poverty. Now China seems to be some kind

of "reformist," willing to accept some of the rest of the world's values along with arrangements with foreign business that the Russians have found impossible.

The question of how far all this goes may bewilder the Russians as much as anyone else. One can, however, easily imagine three possible responses that might seem suitable to thinkers and policy makers in Moscow. One is that any inhibitions on moving closer to the capitalist world that stemmed from the resulting exposure to Chinese criticism could be dropped. Very likely the U.S.S.R. has more to offer the rest of the world than China, runs this argument, and might even draw foreign firms away from China, a poorer market. A second approach would be to take a hard look at external relations so as to maintain a sense of strong, independent and somewhat separate Soviet development, leaving China to the real and imagined fears of dependency, damage from the outside world, etc. A third possibility is that the Soviet Union should simply proceed to act more like a superpower and take a more active role in the world economy without necessarily "opening its doors" in the Chinese manner. But whether this would lead to more emphasis on multilateral diplomacy in international organizations or simply an effort to assert strength and importance by the preferred bilateral method is anyone's guess.

Alternative Futures

If one thing is clear from reflections on different aspects of the subject set out above, it is that no single line of development of future Soviet involvement in the world economy is inevitable. One major conditioning factor will be the state of the world economy. Another, closely linked, will be what other countries do to reshape the processes of international economic cooperation. This will be primarily in response to other things than east-west issues. The gamut of possibilities is great but it may be enough to think about four major variants: (1) an improved and extended version of the Bretton Woods system; (2) the creation of major new arrangements, often global in extent; (3) selective innovation, often involving different countries for different purposes; (4) the further erosion and eventual breakdown of multilateral cooperation. Obviously these are crude divisions and overlap. The content of each could vary enormously and to avoid ringing all possible changes we shall concentrate on the few points most significant for east-west economic relations.

In keeping with most people's mental processes, the first alternative starts as a projection of the familiar. It is, however, more than a strengthening and refurbishing of the Bretton Woods system. It requires that ways also be found to deal with the new problems and the neglected issues described earlier and that means some enlargement of the group of key countries to recognize new realities. While much of this process is incremental, it also allows for bigger breakthroughs at various points, such as the possibility of significant new measures regarding international investment and problems of adaptation to structural change on either a sectoral or more general basis. Otherwise it means pushing ahead with the kind of measures laid out in the MTN, improving matters in energy and food and generally furthering the process that Miriam Camps called "managing interdependence."

This would naturally require some significant improvement in the handling of the international monetary system, but just how is a matter that goes beyond the bounds of this paper.

While more countries would be involved in this process than just the key members of the OECD, the Soviet Union would again be largely an outsider. The questions about its possible role would be mostly those already discussed in this paper. A key issue, therefore, would be how far the main cooperative measures would move toward the effective use of market forces and how much increase there would be in the "management" of trade and other relations (as the term was used earlier). This does not mean that the matter of systemic differences is the single most important factor; Soviet and western ideas of what interests would be served by Soviet participation, would take precedence. It is, however, hard to find anything about east-west relations so compelling as to make it seem certain that the U.S.S.R. would play a larger part in this process.

An extensive remaking of the global pattern of economic cooperation would strike most people as the least likely of the three alternatives. It could be thought of as a kind of enactment of the New International Economic Order. The U.S.S.R. professes much interest but there is very little evidence that other major economic powers see very much advantage in this approach. Even developing countries tend to look to particular concrete arrangements to meet their needs. In any case, large new constructions are unlikely to be effective unless they are supported by the countries most directly involved with the problems with which they purport to deal. It is difficult to imagine very many comprehensive arrangements being made outside the U.N. framework and, in that case, one would expect the U.S.S.R. to be involved in most of them. In fact, the presumption would be that if the U.S.S.R. did not wish to take part, the burden of demonstration as to why should be on its own shoulders. Once engaged in the process, however, the U.S.S.R. might be hard put to confine itself to formulas which served its particular interests but it might then lean toward a fairly common U.N. formula which sets no detailed obligations for the majority of countries. Of all the alternatives, this is the one that seems least likely to deal in a satisfactory way with the most difficult problems of the world economy. It is also a hard alternative to think about in specific terms since one has to hypothesize so many unlikely events. A safe prediction is that it is the alternative most likely to call forth the fullest Soviet response in words.

The third alternative is eclectic. Selective cooperation is certainly not incompatible with the first possibility and can be thought of as the most plausible approach to the significant new patterns of cooperation contemplated in the second. Essentially what is involved here is a suggestion that even if a wide range of "core" cooperative activities continues to center on the countries most active in the OECD, GATT, the IMF, etc., there would be different combinations of countries that were of decisive importance for different sets of problems—as the mention of those different organizations already indicates. This is roughly the kind of formula that is being used in the MTN codes concerning non-tariff barriers which are to apply to those countries acceding to them and not generally to all members of GATT; it is the same with regard to organizations concerning shipping, aviation,

particular commodity agreements and so on. The tendency is to enlarge the number of countries whose assent is vital to positive action, but to make possible progress in one sphere even if there are difficulties in another. Of course, the handling of the monetary system and to some degree the maintenance of open trading relations are essential to all the rest. While the number of countries needed for each of these activities is larger than before, there is still a heavy concentration on some core countries. For example, while trade cooperation will deteriorate if no good way is found to deal with the needs of the NICs (the Newly Industrializing Countries), it is hard to see how that can be done except with the full participation of most of the older industrial areas. Some OPEC countries should be given a voice in monetary matters, but they could do nothing without the governments of the great financial centers.

The key point about selective cooperation, however, is not that a smaller number of countries than those formally responsible for something really have the key role (as in GATT or the IMF). It is that even if liberalization of trade and payments continues to be essential to much of the cooperation, quite different activities and countries would be involved when, say, energy or food was the central subject and that would almost certainly be the case with regard to particular types of commodity agreements, sectoral arrangements in troubled industries, etc. As we have seen, the selective pattern is the one that comes closest to representing the kinds of activities in which the Soviet Union has taken part. As the most flexible formula, it must be seen as the one under which the largest increase in Soviet participation in international economic cooperation would be likely to take place. Again, though, the emphasis must be on the other factors which bear on Soviet (and western) behavior rather than merely the existence of opportunities. One determining factor is likely to be the world economic climate.

The successful operation of the Bretton Woods system is closely associated with thirty years of remarkable expansion of the world economy. This helped persuade people of the value of the measures that were being undertaken in cooperation with other countries or to live up to international obligations. Perhaps more important, it also helped greatly in making some of the substantial adjustments that were required by the removal of old barriers to trade and payments without undue dislocation. It also provided a kind of cushion for errors in policy and for living with difficulties no one was ready or able to remove. A temporary advantage that is now beginning to look like a long run disadvantage is that the general improvement permitted most countries to avoid facing certain difficult problems of adjustment or permitted them to stick to wasteful policies that were politically and socially more acceptable for the time being than economically more efficient measures would have been. The accumulation of such resistances may well be one of the major factors contributing to present difficulties. A sense of how hard it is to make large changes after such delays and in unfavorable economic circumstances may itself be holding back full recovery from the recession that, by normal standards, should have been well behind us some years ago (and not just in the United States).

On top of this, there are a number of good reasons to expect that growth in the industrial world will be slower in the next decades than in the past. If this happens, few people doubt that resistances to change will increase even though the need for change becomes greater. Trade protectionism is the most obvious example but the same process is manifested in all fields. Expecting this to happen, people act so as to help bring it about, for example, by refraining from investment because returns will be low or on account of uncertainty about future governmental policies. Precisely because the situation is so threatening, a strong case can be made for cooperation among a number of key countries to avoid doing damage to one another and to increase the ability of each to make use of a larger range of resources. This would mean that each one would have to make some "sacrifices" to accommodate the interests of others. It would be hard to carry out such measures except among countries willing to work closely together on a number of basic issues. The OECD countries or some more limited number of them are not just the obvious but the essential candidates.

If that prescription is followed, what happens to the rest of the countries in the world? Those at the center are ambivalent. They know they cannot live in isolation and must be concerned about the welfare of others. But there is a limit to what their electorates will accept in the way of short run difficulties in the expectation of long run advantages. They have to treat one another as well as possible or the glue of their cooperation will dissolve. But who gets next best treatment? On the basis of most present thinking, it would be a number of developing countries, those with energy or raw materials to sell (or even ration) and those with markets to offer, especially for capital goods. Their growth is expected to be faster than that of the older industrial countries. There might well also be political reasons to treat some or all of these countries as well as possible. The Soviet Union, and perhaps the smaller communist countries, also offer markets and may have some products to bargain with. There are a variety of reasons for arguing that they should not be badly treated but there is at least a serious case for believing that they are likely to find themselves on the bottom of the list. It does not necessarily follow that there could be no steps forward in Soviet involvement in international economic cooperation—and there might be a positive stimulus for Moscow to cultivate its relations with developing countries—but one can hardly believe that the climate would be favorable.

There is, however, still another version of this story, the real fourth alternative. The same problems that in the scenario just sketched led to a drawing together of the industrialized capitalist countries could drive them apart. Each one, trying to cope with the difficulties of slow growth, internal struggles over a limited pie and the barriers to making the structural changes that are most needed, could fail, in wish or ability, to strike a bargain with the other OECD countries (which are in many ways its competitors). Concerned about energy and raw materials supplies, its balance of payments, markets for its exports, especially of capital goods, and jobs for its workers, each would see advantages in coming to terms with a few developing countries. Division within the industrial world would sharpen and bilateral dealing would become increasingly the order of the day. The prospects of any

major progress along any of the three lines of cooperation noted earlier would be poor.

This would be a situation quite favorable to the U.S.S.R.—at least in the first instance. Whether it stood ahead or behind Brazil or Mexico or Saudi Arabia or Indonesia or Korea in the preferred list of one or another leading capitalist country would be less important than that it had things to offer all of them, especially if they were willing to finance the capital goods exports with credits and take payment in goods. Each deal it made would sharpen the appetite of another western competitor and at the same time limit the ability of the first partner to take in competing goods from someone else (or stimulate him to dump in a third market). There is little point in trying to dream up what kinds of structures of cooperation would be possible or impossible but there is little doubt that the result would be a greater involvement of the U.S.S.R. in the world economy.

To end on this gloomy and controversial note has at least the advantage of emphasizing what this paper has *not* been. It has not been a set of predictions about either the world economy or Soviet behavior, only an exploration of some possibilities. It has not argued that fuller involvement of the U.S.S.R. in the world economy was inevitable (though this does seem most likely) or that this would necessarily cause Moscow to take a greater part than in the past in cooperative arrangements. It has certainly not made the case for the view that either of these results would in themselves be desirable or that the world would necessarily benefit if the U.S.S.R. participated more fully in existing arrangements for international economic cooperation. The essay has only tried to suggest where such possibilities exist and where others may open up. It as not argued that the U.S.S.R. would be greatly tempted by such possibilities but it has suggested what some of the forces bearing on the matter might be and where to look for issues worth examining more closely. Most important of all, this limited essay has deliberately stopped short of even considering whether increased Soviet participation in international economic processes is desirable from the point of view of those who believe that new, improved and extended arrangements are needed to keep the world economy from getting into much greater difficulties than it already faces.

That is a whole separate subject which has to be joined with a consideration of western, or American, policy. What kinds of Soviet involvement are desirable and on what conditions? What measures ought to be taken to encourage, discourage or set conditions for the process? Given the fact that east-west economic relations are rarely the dominant element in international economic problems, how can they best be fitted into a structure of cooperation based mainly on other sets of relations? One would have to determine when Soviet participation would be helpful or even essential and when it would be acceptable, but only on certain terms. A good many people feel that the inclusion of the Soviet Union in various arrangements makes them harder to work. How justified is this view? Are there means of insuring that Soviet participation does not frustrate larger purposes? In the present state of the world it seems almost inevitable that westerners would have to try to devise a double track policy that would often leave the way open for constructive Soviet cooperation but not stop all progress until that result was assured.

POLITICAL–STRATEGIC FACTORS IN SOVIET MODERNIZATION: CONTINUITY AND CHANGE

(By John R. Thomas*)

CONTENTS

SUMMARY

Soviet modernization to date is a prime example of unbalanced national development. Instead of rounded economic, political, and general societal development, it has become increasingly military oriented. The resulting imbalance is attributable to overriding foreign policy and strategic considerations. In Lenin's and Stalin's days economic and military modernization was driven by the needs of sheer survival. Their post-WWII successors, however, have added a global Great Power dimension to Soviet foreign policy. The new expansive policy is reflected most prominently in USSR's growing activities on the world's oceans.

However, the new global Soviet policy is evoking a negative reaction of other major, non-communist nations and could lead to a new anti-

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Soviet alignment. This could serve to "self-fulfill" the traditional Soviet prophecy of a hostile capitalist world bent on USSR's destruction. Ironically, the hostility of fellow socialist states, e.g., China, has also been aroused, currently exceeding that of "the capitalist camp." In Soviet eyes, an even worse situation is in the making—collusion of both groupings against the USSR—and requires even greater military modernization. But given the increasingly poor performance of the Soviet economy, the USSR is faced with the need for drastic reform to improve efficiency. The Party's pervasive rule is greatly responsible for that inefficiency; this is raising the question of political reform from the Soviet elite groups outside the Party apparatus, focused on allowing professional competence to prevail.

However, their views are unlikely to effect any significant change in the near future: in over 60 years of control, the Party has created sufficient momentum in the system, reinforced by the world's most elaborate political control structure, to continue its sway. The more distant future of Party rule as it is now practiced is, however, open to question. The outcome will depend on whether the Party has enough organizational flexibility and intellectual creativity to transform itself in order to carry out systemic reforms needed to correct today's imbalance, or face the possibility of being overwhelmed by the many problems of the Soviet economy and polity and the external dilemmas created by its expansive foreign policy.

Introduction

Soviet modernization to date can be characterized as a prime example of unbalanced national development. Instead of rounded economic, political and general societal development, it has become increasingly military oriented. The resulting imbalance, due to overemphasis on heavy industry and defense production, is attributable directly to overriding strategic and foreign policy considerations. These have driven USSR's economic and military modernization from the very inception of the Soviet regime. In Lenin's and Stalin's days this drive was motivated by the needs of sheer survival. Their post-WWI successors, however, have added a global Great Power dimension to Soviet foreign policy without accompanying internal political reform. The new expansive policy is reflected most prominently in USSR's oceanic policy, requiring still greater development of military capabilities to support the enlarged Soviet aspirations.

However, the new global Soviet policy is evoking a negative reaction of other major, non-communist nations and could lead to a new anti-Soviet alignment. This could serve to "self-fulfill" the traditional Soviet prophecy of a hostile capitalist world bent on USSR's destruction. Ironically, to this prophecy has been added a development unforeseen by the Soviets, viz., the hostility of some fellow socialist states; in fact, China's enmity now exceeds that of "the capitalist camp led by the US." In Soviet eyes, an even worse situation is in the making: explicit or implicit collusion of both groupings against the USSR. Such a counter-reaction, in the Soviet view, requires an even greater effort of Soviet military modernization. But given the increasingly poor performance of the Soviet economy, the USSR is faced with the need for drastic reform to improve efficiency. The Party's pervasive rule, greatly responsible for that inefficiency, is raising the

question of political reform centered on easing the Party's stifling hand. The Soviet elite groups outside the Party apparatus (the military, the scientific-technical community, economic planners, and industrial managers) feel it should reduce or eliminate its intrusion in matters in which professional competence and experience should prevail.

However, their views are unlikely to effect any significant reform in the near future: in over 60 years of control, the Party has created sufficient momentum in the system, reinforced by the most elaborate political control structure in the world, to continue its sway in the near future. The more distant future of Party rule as it is now practiced is, however, open to question. The outcome is likely to depend on whether the Party has enough organizational flexibility and intellectual creativity to transform itself in order to inspire and carry out systemic reforms needed to correct today's imbalance; otherwise it will face the possibility of being overwhelmed by the many problems of the Soviet economy and polity, and the dilemmas created by its expansive foreign policy. These are certain to multiply if not appropriately dealt with.

Soviet Drive for Modernization Under Stalin

In physical terms (e.g., the number of *literate* people, the size of its educational establishment, the percentage of trained scientists and technologists, and the industrial-military indicators such as the annual output of steel, oil, tractors, machine tools, aircraft, tanks, missiles and nuclear weapons) the USSR undoubtedly qualifies as a modernized state, even if it suffers from the lack of comparable efficiency. For its quantitative modernization the Soviet Union is indebted to Stalin; he was determined to transform a basically rural Russia into a highly industrialized state as quickly as possible because of the danger to USSR's survival he perceived if he failed to do so. As he put it in the often remembered speech in February, 1931:

> To slow down the tempo (of industrialization) means to fall behind. But the backward get beaten. And we don't want to be beaten. . . . The history of old Russia was, among other things, one of being continually beaten because of backwardness. . . . Such is always the law of exploiters—to beat the backward and the weak. This is the capitalist law of the wolves. If you lag behind, if you are weak, then you are wrong and you can then be beaten and enslaved. If you are strong, then you are right and need to be treated with wariness.
>
> This is why we can no longer lag behind.[1]

Less noted was Stalin's determination not only to drag Russia from industrial and military backwardness but to develop production capabilities to a level that would, by extension, enable the USSR to become militarily superior to the capitalist world. In fact, he declared that the Soviet regime could not endure unless it ultimately outstripped the industrial capabilities of the capitalist states.[2]

The German attack in 1941 prevented Stalin from accomplishing his goal: it placed the USSR's very existence in question before the

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[1] J. Stalin, Sochineniya (Collective Works), State Political Publishing House, Moscow, 1951, vol. 13, pp. 38–39.

[2] See his report on the results of the 1st Five-Year Plan to a Central Committee plenum in January 1933. Ibid., p. 173. It should be underscored that Stalin's determination to obtain such an overwhelming defense production edge was expressed at a time when U.S.S.R.'s backwardness made his singlemindedness seem to be an impossible dream.

intended industrialization plans could be fully implemented. In fact. the shattering experience of the Nazi invasion and the earlier (1918–20) Russian Civil War, in which the survival of the Bolshevik regime had similarly been in question, also prevented Stalin from initiating a truly global foreign policy.

But a dynamic policy abroad, driving USSR's military modernization not only out of sheer survival and defensive needs but also in active pursuit of influence far beyond Soviet borders, was initiated and is currently being implemented by his successors. It accounts for USSR's on-going military modernization on a scale that has produced Soviet military capabilities equal to or exceeding those of the US.

A dramatic measure of how the Soviets have closed the military gap is represented by the strategic weapons delivery system. For example, in land-based ICBM's, the US lead of 1,000 to 200 for the USSR in 1962 (at the time of the Cuban Missile Crisis) was changed in 1977 to a lag of 1,054 compared to 1,469 for the Soviets. A similar reversal occurred in sea-based systems: for example, in 1970 the US had 656 to 289 for the USSR; by 1977, the US inventory of 656 (which had remained unchanged) was exceeded by USSR's 878.[3]

USSR's confirmation of the strategic change was reflected in its reaction to the US proposal of March 1977 for a drastic arms reduction; Soviet spokesmen derided the US proposal as a calculated effort to obtain unilateral advantage over the USSR now that the Soviets had overtaken the US. And, in broader and more euphemistic terms, encompassing non-military as well as weapons factors, the Soviets have marked the strategic change, which has capped USSR's military modernization to date, by citing "profound changes in the correlation of forces in favor of the Socialist commonwealth."

The strategic parity with US achieved by the USSR has given substance, in military terms, to Stalin's dictate of the Thirties: the Soviet need "to overtake and surpass" the US, as the leader of the capitalist world. It also provides the military muscle for USSR's increasingly expansive foreign policy. Soviet oceanic policy and activities embody this post-Stalin global reach.

Soviet Oceanic Policy Under Stalin's Successors

USSR's current oceanic policy has developed in response to the imperatives of an expansive post-World War II foreign policy, the resultant strategic problems and opportunities, and domestic political-economic developments. In turn, the oceanic policy has been the driving modernizing force behind the full span of Soviet capabilities that are visible on the world's oceans today. These range from warships making "courtesy calls" and "showing the flag" at many foreign ports to Soviet ships carrying foreign goods, fishing off distant coasts, and being engaged in scientific research on all the world's oceans.

New Expansive Policy

The beginning of this transformation of the USSR from an insular landlocked nation—the interests of which the West at one time totally

[3] For a comparison of these and other U.S.-Soviet military trends, see John M. Collins, American and Soviet Military Trends Since the Cuban Crisis, CSIS, Georgetown University, Washington, D.C. 1978.

ignored even in areas as close to the USSR as the Middle East—to a worldwide, oceanic competitor of the United States, can be dated to the mid-fifties. It was then that the Soviet leadership asserted global aspirations.

Thus, in classic, non-communist terminology, Khrushchev declared the U.S.S.R. to be a great power (*velikaya derzhava*, a term used in Tsarist Russia) with worldwide interests and without whose participation no problem on earth could be successfully resolved. The current, post-Khrushchevian leadership reaffirmed his views with even greater vigor, though in less colorful style. The Soviet Foreign Minister Gromyko put it most explicitly:

> The Soviet Union is a great power situated on two continents—Europe and Asia, but the range of our country's international interests is determined not by its geographical positions alone . . .
>
> The Soviet people do not plead with anyone for a say in the solution of any question concerning the maintenance of international peace, the freedom of and independence of the peoples and our country's extensive interests.[4]

To sum up the fundamental change, U.S.S.R.'s expansive foreign policy has now been enshrined in the new (1977) Soviet Constitution. Unlike its 1936 predecessor (the so-called Stalin's Constitution), the new basic charter proclaims that Soviet foreign policy is "directed toward ensuring favorable international conditions for . . . strengthening the position of world socialism, the support of the struggle of peoples for national liberation . . . ." [5]

To underscore the significance of this change, Brezhnev, in a report to the Party's Central Committee in May 1977, focused on what he called "the key principal issues underlaying the new Constitution." In this connection, he pointedly noted that for the first time a Soviet Constitution features a special foreign policy clause. This was inserted because of "radical changes in the international position of the Soviet Union," and thereby "in the social-political profile of the world." He explained further:

> The capitalist encirclement of the U.S.S.R. has been ended. Socialism has been converted into a world system . . . The position of world capitalism has been substantially weakened.[6]

In effect the new Soviet Constitution has been used as a formal capstone to mark U.S.S.R.'s activist policy abroad and the changes it has wrought.

To date, a major thrust of that policy has been toward the oceans, i.e., by definition, activities beyond the Soviet periphery. In its formative stage, Gromyko telegraphed the expanding Soviet oceanic policy by declaring:

> Equal rights in all sectors and in all spheres of activity in the international arena, including the adoption of measures to protect the vital interests of the Soviet Union, its allies and friends . . . freedom of navigation for ships and fleets, no lesser than that for the ships and fleets of any other power—all this determines our prospects and responsibility in world affairs.[7]

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[4] A. A. Gromyko, Consistent Policy of Peace, Report to the U.S.S.R. Supreme Soviet on June 27, 1968, Novosti Press, Moscow, 1968, pp. 37–38.

[5] Konstitutsiya S.S.S.R. (Constitution of the U.S.S.R.) Publishing House Izvestiya, Moscow, 1977, p. 14.

[6] L. I. Brezhnev, O. Provekte Konstitutsii SSSR. (On the Draft of the Constitution of U.S.S.R.), Political Literature Publishing House, Moscow, 1977, pp. 4 and 12.

[7] A. A. Gromyko, Ops. Cit., p. 39.

Somewhat later Brezhnev, in reacting against external criticism of Soviet military policy, confirmed U.S.S.R.'s new interest in freedom of the seas around the world:

> . . . The U.S. propaganda machine has initiated a whole campaign concerning the Soviet fleet. In Washington, it seems, a threat is envisioned from the appearance of our ships in the Mediterranean, in the Indian Ocean, in other seas. But in this situation, American politicians consider it normal and natural for the Sixth Fleet to be continually in the Mediterranean, which can be called the underside of the Soviet Union, and for the Seventh Fleet (to be) at the shores of China and Indo-China.
>
> We never did and do not consider it an ideal situation in which the navies of a great power for lengthy periods cruise around scores of lands away from their own shores. And we are ready to solve this problem, but to solve it, so to say, as equals.[8]

Having received a cue from their political chiefs, the Soviet military leaders thereafter echoed the new policy line by similarly expanding their definition of the mission of the Soviet armed forces to cover the greater scope of Soviet interests. According to Marshal Grechko, the late Soviet Defense Minister, the USSR Armed Forces serve to defend the extensive gains of the socialist commonwealth now that "under the impact of the growth of the international authority of the USSR fundamental changes in the world have occurred . . ." and "capitalism has ceased to be the indivisibly dominnant force in the world." [9]

General Yepishev, the chief political officer of the Soviet Army, extended Grechko's appraisal by indicating that "the international tasks and obligations of the Soviet Armed Forces have widened and deepened and their responsibility for fulfillment (of these tasks and obligations) has increased." [10]

In the oceanic policy context, Admiral Gorshkov, the Soviet Naval Commander, further underscored the change in Soviet foreign policy by noting the consequences for his command: the USSR has created a new type of armed forces—an oceanic navy which, "with its long range capabilities, guards Soviet state interests on the world's seas and oceans." [11]

As in the case of marking the post-Stalin changes in Soviet foreign policy, the new Constitution formally recognizes and enshrines the role of the Soviet Armed Forces. Thus, Brezhnev noted that special reference to their mission appears for the first time in the Soviet charter.[12]

Pursuing new global aspirations and missions, the USSR had leapfrogged into distant areas, beginning with massive economic and military aid to Egypt in the 1950's and following up with diplomatic and economic contact with nations in Africa, Latin America and Asia in

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[8] L. I. Brezhnev, O. Vneshnei Politike KPSS I Sovetskogo Gosudarstya (On Foreign Policy of CPSU and Soviet State), Political Literature Publishing House, Moscow, 1973, p. 376.

[9] A. A. Grechko, Vooruzhennlye Sily Sovetskogo Gosudarstva (Armed Forces of the Soviet State), Military Publishing House, Moscow, 1975, p. 96.

[10] A. A. Epishev, Partiya I Armiya (The Party and the Army), Political Literature Publishing House, Moscow, 1977, p. 5.

[11] Boevoi Put' Sovetskogo Voennomorskogo Flota (The Fighting Course of the Soviet Navy), Military Publishing House, Moscow, 1974, pp. 5–6. To further highlight change, this work traces the transformation of the Soviet fleet from a defensive to an offensive arm of the U.S.S.R.; it notes that for the first time in its history, the Soviet fleet has long range, strategic capabilities which can fundamentally affect the outcome on oceanic and continental war fronts.

[12] Brezhnev, O Proekte . . . ., op. cit., p. 12.

the 1960's and 1970's. As a result, Soviet material aid and military and technical personnel have been sent to many areas of the world which have never before seen Soviet presence.

Both the assertion of global aspirations and the resulting implementing activities are a clear reversal of Stalin's cautious foreign policy. With the exception of ideological rhetoric about supporting international proletariat and of secretly financing of communist parties abroad, Stalin's policy abroad was relatively modest. Moreover, he never claimed for the USSR great power interests on a global scale, much less acted on them. And his use of Soviet capabilities, particularly military, were confined closely to the Soviet periphery. Indeed, even here his behavior was very cautious: he drew back when confronted by determined Western opposition. For example, in 1946, Stalin withdrew Soviet Army units from Iran after President Truman threatened strong US action to force such a withdrawal. (The Soviet forces, together with allied troops, had entered Iran during World War II to insure the flow of allied aid to the Soviets; but in contrast with the allied withdrawal, they remained in Iran after the end of the war despite an earlier agreement for removal of all forces six months after the end of the war.)

But the foreign policy, inaugurated by Stalin's successors, was not only a radical break with his policy but also impacted profoundly on Soviet strategy.

The Impact of the New Policy on Soviet Strategy

The post-Stalin expansive foreign policy has revived the traditional strategic threats to the Soviet Union; it also has created new complexities for the USSR. Thus, it has: resurrected the traditional two-front challenge to the USSR on the Eurasian continent; intensified the strategic challenge of the US as a powerful adversary; and, triggered USSR's effort (also new) to project its support and influence to the developing countries far beyond its immediate periphery.

GEOPOLITICAL SITUATION

In the main, these strategic problems have arisen from and have been heightened by USSR's geopolitical situation. The Soviet Union is in a geopolitical bind unlike any other nation in the world. Striving to be a global power like the US, the Soviet Union has not, because of its location on the Eurasian Continent, had the advantages of the US. In a balance of power context, it does not have the US option of playing an offshore role in a major conflict on the Eurasian continent, if that is considered to be the main arena of US and Soviet interests. Again, unlike the US, the Soviet Union does not have the option of detaching itself from either Europe and Asia or both. While unlikely to do so, the US nevertheless has the choice of "walking away" from either Europe or Asia, or both.

The Soviet Union's two-continent location also imposes on it strategic disadvantages which do not confront the other major European nations. Thus, while Western Europe faces a direct threat only from the East, the Soviet Union potentially must consider a challenge

from both Eastern and Western directions. Consequently, Soviet capabilities cannot be measured by simply matching them against those of either the US and West Europe, or both, since this does not reflect the full magnitude of Soviet Union's disadvantages. Even apart from those of the US, West Europe's manpower, economic and military capabilities objectively are, or potentially can be, equal to those of the Soviet Union; this is particularly true if considered against the USSR's current need to divide its strength between the West and the East to meet potential threats from both directions. West Europe's main problem is political: the will to put aside its differences and unite to meet a common challenge.

As to projecting its power beyond the Eurasian Continent, the Soviet Union is again handicapped by its geopolitical situation. Its direct and easy naval and maritime access to the global oceans and seas is impeded in key areas by geography: its ships have to pass through narrow straits, e.g., in the Black and the Baltic Seas; but these passages are controlled by others and can serve as easy targets for "bottling up" Soviet ships.

THE TWO-FRONT THREAT

The geopolitical context described above suggests the magnitude and complexities of the strategic problems facing the Soviet Union which have been evoked by its expansive foreign policy and which are likely to serve as constraints on Soviet freedom of action abroad. As a first problem, it faces a two-front challenge on its Eastern and Western flanks. The two-front threat is deeply imbedded in Russian and Soviet psyche by past and recent history. This includes invasions from the East and West which date as far back as the 13th Century when the Mongol hordes and Teuton Knights devastated Russian soil. The incursions by the Japanese and the Germans in the 1930's and 1940's were the modern versions of this threat to Russia.[13]

In the current context the potential challenge is posed by West Germany and China. Regarding Germany, a traditional continental rival, the Soviets assume that West Germany, due to its size and strategic location, will dominate any future alliance arrangements in West Europe, particularly if the US should reduce its role in Europe. (Germany is already the dominant European member of NATO.)

The Soviets also believe that Germany is likely to enhance its strength in the future by acquiring or having direct access to nuclear weapons and missiles. Even if there is no objective basis for assuming such an eventuality, the Soviets perceive this will or may occur. They already consider the current US-West German dual arrangements as giving the Germans a finger on the nuclear trigger. Moreover, the USSR is convinced that even now the Germans are capable of independently producing missile weapons but are constrained at present

[13] The two-front threat is so ingrained in the thinking of Soviet strategists that even seemingly unrelated activities are put in context of that classic threat to Russian security. Thus, as a young naval officer, Adm. Isakov, the one-time Soviet deputy naval chief, conducted a study of the World War I attack by Japan on German-held Tsingtao in China; this attack occurred while the Germans were pre-occupied in the West. His biographer indicates that Isakov later analyzed the lessons of that incident for its application, under comparable circumstances, to a U.S.S.R. simultaneously threatened from the East and the West. (See V. Rudny, Dolgoye, Dolgoye Plavanie (Long, Long Cruise), Moscow, 1974, pp. 102–3.)

only by political expediency.[14] In the Soviet view, this German self-restraint is susceptible to erosion, and will change. But, even in the worst case of national acquisition of nuclear-missile armaments, West Germany would offer relatively little concern to the Soviets if, alone and unaided, it posed the only threat: they could successfully meet it by the superior ground forces and nuclear-missile capabilities which they have developed and acquired since World War II.[15]

But, China, as a potential enemy, has added another—very large—dimension to Soviet strategic problems, almost overriding all others. With the defeat of Japan in 1945 and the Communist victory in China in 1949, the Soviets assumed that they had permanently solved the two-front threat posed before World War II by Germany and Japan. However, since the eruption of the bitter Sino-Soviet dispute in the late 1950's, the USSR has had to assume a hostile China, either alone or in open or implicit collusion with West Germany or others. (Soviet perceptions of possible alliances against the USSR are discussed later.)

Indeed, the major impact of Communist China on Soviet policy has been to transform Sino-Soviet relations into a state of armed hostility and force the Soviets to view China as an active threat to their national security. Consequently, the Soviets have been forced to build up their forces on the China border to some 50 divisions and with over half-million men.

This tremendous build-up, unanticipated and unplanned for in Stalin's days, has been accompanied by organizational and command changes which indicate the Soviet expectations about the permanency of the China threat. In 1969, the Soviets established a new Central Asiatic Military District with all that this implies in terms of Soviet military contingency planning for and integration of forces at an important sector of the Sino-Soviet border. (This move may be compared to the Soviet organization of a special military command in the Far East, just prior to the Soviet attack on the Japanese in Manchuria at the end of World War II. On that occasion, the Soviets organized a new command under Marshal Vasilievsky with three operational fronts designed to capture Manchuria from the Japanese.)

With regard to command changes, General I. G. Pavlovsky—then a relatively junior officer—was promoted in 1967 from Commander of the Far East Military District, which he had headed since 1964, to Deputy Defense Minister and Commander of the Soviet land forces. He was originally sent to the Far East apparently to modernize the Soviet forces in the area. It can be surmised that he was subsequently brought to Moscow in order to do contingency planning for a possible land conflict with China.

And in 1968, General Tolubko, the Soviet deputy commander of the Soviet strategic rocket forces prior to that date, was sent to the East

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[14] As far back as 1964, the Soviets interpreted West Germany's manufacturing of missiles for meteorological use by non-German consumers as masking capabilities for producing combat missiles. (The Soviet views on this matter were stated in Pravda, Feb. 4, 1964). By implication, the Soviets suggested a parallel with German manufacturing of weapons after World War I in violation of the Versailles Treaty. They conveniently omitted, however, the fact that in the 1920's they gave the Germans a big start by allowing the Reichswehr to manufacture and test tanks, aircraft, and other weapons on Soviet soil.

[15] U.S.S.R.'s confidence in its ability to handle a German threat, separate from the United States, was expressed even at a time when Soviet strategic capabilities were far less than they are today. (See Party Secretary Leonid Brezhnev's declaration to the 23rd party Congress, Pravda, Mar. 30, 1966.)

to take command of the Far East Military District. It can be assumed that he was detached from the central missile command in order to use his experience in organizing possible new missions for Soviet strategic and tactical missile forces based in the Far East; the contingencies undoubtedly include possible attack against Chinese nuclear-missile facilities, alone or in combination with any land force operational plans developed by Pavlovsky. (Subsequently, Tolubko was promoted to full general and replaced Marshal Krylov as commander of USSR's strategic rocket forces; this meant that the command of the most important arm of the Soviet armed forces was placed in the hands of a man very familiar with the threat in the East.)

The increasing severity of the Sino-Soviet conflict to date threatens to make it the overriding major strategic concern of the Soviets. This has been spurred by the Chinese willingness to risk use of force to act on their perceived grievances. Thus, the Chinese initially provoked the 1969 border clashes along the Ussuri River, which involved regimental size units, even at a time when the Soviets had overwhelming military superiority. China's continuing willingness to use force for "punishment" or "border rectification," as occurred against the Vietnamese in February 1979, only serves to further feed Soviet concern.[15a] That is likely to increase even more in the future, if the present Chinese goals related to large scale military modernization, proclaimed by Deng Xiaoping, are carried out.[15b]

THE CHALLENGE POSED BY UNITED STATES

On top of the traditional two-front threat, the US has added an entirely new dimension to post-war Soviet strategic concerns. In the Soviet view, the US challenge differs from any Eurasian threat for the following reasons: the US is a non-continental power, and hence beyond the reach of Soviet ground forces; the US currently still has an overall edge in nuclear-missile capabilities, if the reported US qualitative lead is valid; and, most important, the US has actual or potential economic and technical resources to increase its military capabilities which the Soviets would be hard put to match in the foreseeable future; therefore, unless the US deliberately permits it, the USSR cannot get a permanent, overwhelming edge over the US.

Thus, the Soviets have already noted their concern about the US using its superior economy to pressure or exhaust the USSR in an unbridled arms race. A Soviet military organ put it this way:

> . . . Imperialism fears new successes of socialism and tries to disrupt them by political, economic, and spiritual means. Imposing on the socialist countries an arms race, the military-industrial establishment is counting by these means to trigger economic and other difficulties for the States of the socialist commonwealth. The increase in military activity of the imperialist aggresive bloc increases the military danger . . . .[16]

[15a] Gen. Yepishev noted "the criminal ease" with which Chinese "militarists" resorted to arms on that occasion. (See *Kommunist Vooruzhennykh Sil,* Communist of Armed Forces, No. 9, May 1979. p. 14.)

[15b] Party Secretary Rusakov underscored Soviet concern by noting that of the "four PRC modernizations"—agriculture, industry, science and technology, and military—the stress was on the last. (See his speech on February 5, 1979, as cited in FBIS Daily Report Supplement, March 8, 1979, p. 34.)

[16] *Kommunist Vooruzhennykh Sil* (Communist of the Armed Forces) February 1979, No. 4, p. 18. Another Soviet spokesman reflected Soviet concern that the "imperialist" pressure may be extended beyond economic to military and political areas. (See V.D. Kuchin, Imperializm-Vrag Svobody I Progressa (Imperialism—Enemy of Freedom and Progress), Publishing House DOSAFF U.S.S.R., Moscow 1978, pp. 77–78).

Consequently, a possible US-USSR confrontation poses almost insoluable problems for the Soviets. Unlike a German attack on the Soviet Union, which at worst could be blunted by the traditional Russian strategy of trading space for time, a US nuclear-missile attack cannot be met by a similar strategy. Indeed, for the first time such an attack threatens Soviet political centers without a need for a foreign foe to invade Soviet territory. The impact of such a possibility must be viewed against the background of the 1941 Nazi attack. Even without the capture of such key centers as Moscow and Leningrad, the German invasion almost led to the USSR's collapse.

In recognition of the unprecedented danger posed by a possible conflict with the US and the effect on the USSR, the Soviet regime has noted the need for special conditioning of the Soviet people. As one Soviet spokesman puts it:

> The second most important circumstance which increases the significance of the morale factor in modern war is the radical, revolutionary transformation which has occurred in the equipping of armies, above all with the appearance of nuclear-missile weapons. . . . It is natural that with the threat of the use of nuclear weapons the danger grows by leaps and bounds which demands from the personnel of the armed forces and the entire people special morale-psychological conditioning.[17]

The Soviet spokesman further notes that the psychological preparation of the Soviet people is particularly important because the lack would impact on people's bravery, risk-taking, initiative and other requirements necessary to insure victory.[18]

The conditioning is also necessary because of Soviet leadership's concern that its people and armed forces might be subjected to panic or "political immaturity" in the event of a nuclear war. The immaturity is a thinly veiled reference to the disloyalty to and defections from the regime that were displayed by many Soviet citizens in the early months of the 1941 Nazi attack.[19] A Soviet conflict with the US might see history repeat itself if such a war did not degenerate into an all-out, unrestrained nuclear death spasm.

THE STRATEGIC PROBLEM OF THE DEVELOPING WORLD

In addition to perceived two-front and U.S. threats, the Soviets face a problem with regard to the developing areas. Like the Soviet-postulated threat from the U.S., this is also a new postwar challenge: how to effectively project U.S.S.R.'s military power and influence beyond its periphery, regardless of whether the need is attributed to Great Power imperatives or ideological requirements for the support of "national liberation struggles." In Stalin's days, this problem did not confront Soviet strategists since he neither asserted overseas objectives nor did the Soviets have the capabilities for attaining them. Indeed, he viewed the Developing World as a strategic reserve of "Western imperialism"; given the latter's control over the reserve areas, they could only be undermined through an attack on the "homeland" capitalist bastions. In this context, Stalin viewed the then few

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[17] E. Lauronin, Leninskaya Politika Mira I Dal'neiisheye Ukrepleniye Oboronosposobnosti SSSR (Leninist Policy of Peace and the Further Strengthening of Defense Capabilities of the U.S.S.R.), Political Literature of Ukraine, Kiev 1978, p. 48.

[18] Ibid., p. 49.

[19] For an examination of Soviet views during the formative years on the implications of a nuclear conflict, see the present author's "Limited Nuclear War in Soviet Strategic Thinking," Orbis, spring 1966.

ex-colonial areas which had gained their independence from the mother-countries, e.g., India, as "lackeys of imperialism" since these new nations would not blindly follow his lead. The Soviet view then was relatively simple: those who were not with them were against them.

After Stalin's death, Khrushchev drastically reversed Soviet policy: even if the developing countries chose not to be totally subservient to the Soviet cause, they could serve Soviet interests as long as they were anti-Western. The new policy opened up a vast arena for Soviet political action; but it also confronted the Soviet strategists with a similarly new problem of how to concretely exert influence in areas beyond U.S.S.R.'s periphery. This was a particularly challenging problem at that time because the Soviets lacked both naval and air capabilities for delivering Soviet material support over long distances or for showing the flag. Indeed, when World War II ended, the U.S.S.R. had only a coastal, defensive navy and no strategic air force or air transport capabilities.

In sum, the Soviets, as a result of post-Stalin aspirations, have been confronted by the overarching problem of developing separate and non-interchangeable capabilities to deter or defeat a nuclear-missile attack from the U.S., to deter or defeat a ground attack on the Eurasian continent from either or both the East and the West, and to support non-peripheral "national liberation" struggles. The creation of this problem has impelled the Soviet military modernization, as reflected in the implementation of U.S.S.R.'s expanding ocean policy.

Oceanic Policy Imperatives Driving Modernization

STRATEGIC

Soviet economic, and particularly military, modernization is being driven by strategic challenges facing them. This requires an increase in capabilities, including oceanic, either "to solve" the problems created or to capitalize on the opportunities offered. Thus, to counter the two-front threat, the Soviets perceive a need not only for land forces but also for naval capabilities in order to outflank from the sea both China and NATO, particularly West Germany as the European keystone of the alliance.[20]

Regarding the challenge posed by the U.S., the Soviets perceive a need, in addition to strategic missile forces, for appropriate naval capabilities both to interdict U.S. assistance to NATO in the event of an armed conflict in Europe and, if necessary, to attack the U.S. directly from the oceanic depths.[21] Such a naval capability in particular is required because the U.S., as a power outside the Eurasian continent, is beyond the reach of the U.S.S.R.'s land forces and hence cannot be dealt with in a "traditional" manner of being overrun by those forces.

In a similar vein of a new challenge not amenable to a traditional solution, the Soviets have had to confront an unfamiliar problem of

[20] Soviet Navy's need for a capability to strike objectives deep in the rear of an enemy is detailed in *Boyevoi Put.* op. cit., p. 493. In this connection. Adm. Gorshkov indicates the Soviet Navy has capabilities to affect the outcome of a conflict on continental as well as ocean war theaters.

[21] A discussion of how the sea lanes of a potential oceanic enemy must be disrupted and his home territory targets hit is contained in ibid., pp. 491–92.

projecting Soviet presence and influence in the developing world; the latter, like the US, consists of areas beyond the USSR's immediate periphery. As a result, the Soviet perceive a need for appropriate naval and maritime capabilities. Since the mid-fifties, they have addressed the problem by developing airlift and sealift capabilities as well as organizing amphibious and airborne forces. These are intended to meet the Great Power requirements of being able to "show the flag," e.g., Soviet war ships now make frequent port calls in many areas of the world. At the same time, the increased capabilities are also needed to meet the ideological requirements of being able to support "struggles for national liberation" via military advisers and materiel, as was the case, for example, in Vietnam and, more recently, in Angola and Ethiopia. The list of examples is growing.

POLITICAL-ECONOMIC IMPERATIVES

The development of Soviet oceanic policy and the build-up of maritime capabilities have been further fueled by economic and agricultural problems in the USSR. Since World War II, the post-Stalin Soviet leadership has been under political pressure to increase the Soviet standard of living. This effort has been retarded by continuously poor performance of Soviet agriculture, despite some investment in fertilizer manufacturing and mechanization. As an alternative, the Soviet leaders have been forced to "turn to the sea"; the USSR has built floating "fishing factories" in order to "harvest" and process oceanic catches. Illustrative of the increasing role of fish in the Soviet diet is the plan of USSR's leaders to shift internal consumption from meat to fish. For example, a first effort goal was set in 1976 to increase the sale of fish by 25 percent.[22] The disastrous impact of the low grain yields in the 1970's has added urgency to Soviet plans; because meat is scarcer than ever, the Soviet people will have to shift to fish regardless of their preferences. (The Soviet people are officially on one meatless day per week; in reality, meat is often not obtainable on additional days.)

Then, too, the Soviet Union has been under pressure to acquire its own large merchant fleet; the latter is needed both to carry Soviet goods as a way of conserving scarce hard currency, and to carry the goods of other nations as a way of earning such currency, needed to finance the purchase of Western technology and know-how for use by the Soviet economy. The strength of the Soviet imperative to expand its merchant fleet is suggested by the fact that the build-up is taking place at some political and economic cost: because of its own limited ship-building capabilities, the USSR has had to place orders with others, e.g., with East European shipyards. Undoubtedly, the Soviet leaders would prefer to have the ships built at home, both as a matter of prestige and money.

Political and Foreign Policy Dilemmas

While the current economic and military modernization is attempting to respond to the imperatives noted above, Soviet oceanic policy driving that modernization has been, and is, affected by numerous

[22] This was according to plans announced by N. Baibakov, Head of the Soviet Planning Agency (Gosplan), on Dec. 2, 1975.

dilemmas and obstacles. These are rooted in: (a) Russian history and culture; (b) the internal Soviet political system; and (c) the USSR's attempt to be simultaneously a great power nation-state, a claimant to ideological leadership of the Communist world, and a moving force in the non-Communist developing world.

HISTORICAL AND DOMESTIC POLITICAL FACTORS

In developing its oceanic policy and perfecting its maritime capabilities, the Soviet Union, as a successor to landlocked Tsarist Russia, does not have a long maritime tradition and experience to draw on. This has necessitated developing in the Soviet people an awe for Russia's naval glory and a feeling for the seas; then, too, the Soviet regime has had to supplement this with appropriate training for survival of Russian "landlubbers" in the unfamiliar environment of the oceans. Then, too, the Soviet regime feels compelled to thoroughly indoctrinate its youth in the traditions of the Russian navy and the history of its exploits, even if the latter by comparison with the Western maritime powers are few; then the indoctrination is capped by exposing them to the growth of USSR's own oceanic prowess.[23] After the youth become sailors, they are exposed to long training cruises designed to give them sea legs and an "at-home" feeling on the oceans.[24] Equally important, the Soviet regime feels the need to combat the worry and home-sickness that develops in young sailors when they are far from native shores.[25]

But by expanding their ambitions to the oceans and involving their people in the effort, the Soviet leaders have heightened a political dilemma. They have generally always been nervous about any contact between their people and foreigners. This was reinforced by the massive defections in World War II. The official concern applies with even greater force to activities that call for Soviet personnel to range beyond USSR's borders. It has been fed by numerous defections which have occurred, and continue, in the post-World War II period.

In particular, the Soviet regime has been most wary about one of the most important groups in the Soviet system—its military. As a result of their experience abroad, the armed forces in some instances have become ideologically "contaminated" and have even provided the seeds of dissidence.

The regime's concern about the military stems from recent experience. In the final stages of World War II, the Soviet troops advanced into East Europe and were exposed to local economic conditions; as poor as the latter were in comparison with those in West Europe or the US, they were superiod to those in the Soviet Union and accordingly affected the attitude of Soviet personnel. For example, Soviet soldiers, many of whom came from rural parts of the Soviet Union and were of peasant stock, saw first hand that even the poorest peasants in Poland or Hungary were in many ways better off than the richest

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[23] A description of typical indoctrination and training, focused on the Soviet youth in the Far Eastern Province, is contained in V. Goryunov. Put v Okean (The Road to the Ocean), DOSAAF Publishing House, Moscow, 1974.

[24] Soviet publications note that the training of Soviet naval personnel must be very thorough, concerning itself even with such minute details as to how to avoid or cope with sea-sickness. A detailed discussion of such training is contained in Voina, Okean, Chelovek (War, Ocean, Man), Voenizdat, Moscow, 1974.

[25] Ibid., p. 107.

Soviet kolkhoznik. Because the Soviet soldiers made unfavorable comparisons, they were not allowed to return directly or promptly to their homes at the end of the War. Instead they were first "decontaminated" by being sent elsewhere.

This wartime experience led the Soviet leaders after the war to isolate their forces serving outside the USSR, e.g., in East Germany, Hungary, and Poland, in their barracks; they were not allowed to freely fraternize with the local population as was the case with American GI's.

The foregoing examples illustrate the source of Soviet regime's distrust of its citizens, whether in uniform or in civilian capacity. The regime's lack of confidence in the loyalty of its people evokes, in turn, a negative reaction up to and including dissidence. The latter is most telling once again in the case of the Soviet armed forces. In an oceanic context, the alienation is most applicable to the forces based in the Baltilc Sea area. In the postwar period the Baltic Fleet has produced a number of dissenters, including reportedly in the 1960's some submarine officers who are the cream of an already elite group that makes up the Soviet navy.[25a]

It should be noted parenthetically that any dissent in the Baltic Fleet draws on past history, both in the Soviet and the Tsarist context:

(1) The Decembrist uprising in St. Petersburg in 1825 was led by Russian officers who during the war against Napoleon marched to the West and were exposed to Western political ideas.

(2) Sailors of the Baltic Fleet were the mainstay of the Bolshevik Revolution in 1917 (in fact, they could be considered lineal descendants of the Decembrists in terms of playing a major role in the uprising against the Tsar).

(3) It was also these very same sailors who revolted against the Soviet regime at the Kronstadt Fortress in the Baltic in 1921 because they believed Lenin had betrayed the revolutional ideals (the sailors were brutally put down by the Bolshevik forces led by Tukhachevsky; ironically, as a future marshal, he was himself purged by Stalin in 1937 after becoming disenchanted with Stalin's rule).

The foregoing historical background has particular relevance to USSR's oceanic policy: the regime has to depend on its people to implement that policy. But many of these must of necessity operate beyond the Soviet borders and hence beyond the pervasive, internal control system. But, in being abroad, this personnel is exposed to "alien influences" and can, in addition to itself being affected, on returning home "infect" other Soviet people. The Soviet regime's sensitivity on this score is reflected in commentary which warn its personnel abroad against being taken in by seductive but false Western ideology and appearances.[26]

[25a] The most recent large scale example of dissent was the meeting in November 1975 of the personnel of the anti-submarine warship *Storozhevoy*. (See W. H. Manthorpe, "The Soviet Navy in 1976," US Navy Institute Proceedings, 1977 pp. 208 and 210.)

[26] For example, the main Soviet naval organ has noted that Soviet sailors in foreign ports are subjected to "attacks of bourgeois propaganda"; it calls for strengthening their vigilance and for preserving their "class feeling." (See Morskoi Sbornik, No. 8, 1975, p. 7–10). Because more of them are abroad than ever before, they are exhorted to lead an ideological counterattack. (See Rear-Adm. I. Petrov in *Kommunist Vooruzhennykh Sil*, No. 8, April 1979, p. 59.)

The USSR also faces numerous foreign policy and ideological dilemmas related to its oceanic policy. These arise from the Soviet need on differing occasions to side "with" or "against" both the advanced nations of the West and the developing countries. In building up and using its oceanic capabilities in pursuit of its great power aspirations, the USSR (in common with the advanced nations) has developed a vested interest in oceanic issues such as preserving unrestricted passage of straits and limiting the expansion of territorial water claims. But this has put the USSR in an undesired conflict with many developing nations, even though it would prefer, on the basis of ideological imperatives and competition with the West for influence among those nations, to lead them against the "imperialist" or "neo-colonialist" West.

Their ambivalence on many oceanic issues of interest to the developing nations has exposed the Soviets to political exploitation by China, its arch-rival in both the Communist camp and the non-Communist developing world. Now that it has acquired a vested interest on some oceanic issues in common with the West, the USSR is accused within the Communist world of having betrayed the revolutionary cause by siding with the West; within the non-Communist developing world, the USSR is attacked for being unqualified to lead the developing nations because, as an advanced state, it cannot possibly understand their needs and promote their interests.

The Soviets have tried to counter the Chinese attack by joining the developing world in "anti-colonialist" votes against the West. But in doing so the Soviets are caught in still another dilemma affecting their oceanic policy. Even as it expands its oceanic capabilities at the expense of the West in response to strategic and political imperatives, the USSR has been forced at the same time to turn to the West for technology and know-how in order to help the Soviet economy improve its poor performance. The latter is due to the central internal problem: the Communist Party has maintained its pervasive control over the Soviet system even when this has been done at the expense of economic efficiency, as has been true to date.

Of course, the problem can be solved by fundamental economic and political reform. But to avoid this and still mitigate the negative impact of their pervasive control over the economy, the Soviet Party leaders modified their policy toward the West in the early 1970's; among other things, they have promoted detente to obtain Western technology and industrial production management skills. In this situation, any large-scale U.S. response to meet their material needs would enable the Soviets to continue the current expansion and modernization of their oceanic capabilities by freeing their own resources for such a build-up. However, since such an expansion has been taking place at its expense, the U.S. could balk at providing the Soviets with technological assistance that could be used to undermine its own interests.

Future Soviet Policy and Developments Affecting Modernization

USSR's Perception of Threatening Foreign Developments

U.S. withholding of its technology might ultimately be only a part of a much larger, negative foreign reaction to USSR's expansive policy abroad. Indeed, a significant first sign of such a reaction is reflected in increasing US defense expenditures.[26a] The Soviets already exhibit awareness of such a possible reaction and perceive threatening developments, most particularly in the strategic area involving the question of national survival.

Thus, with regard to the two-front challenge, the Soviets envision the possible anti-Soviet collusion of China in the East and West Germany in the West. The first seeds of this potential threat were sown, in Soviet eyes, in the 1960's when the strongly anti-Soviet Christian Democratic Party was in control of West Germany. In the Soviet view, the possibility of such collusion continues even though the Social Democrats may be in power, particularly when the government is headed by tough-minded leaders such as Helmut Schmidt, an old opponent of the Communists.

The Soviet views of West German Socialist leaders must be put in an historic context that is nevertheless highly relevant today. The Social Democrats have always been the arch-rivals of the Communists because they compete for support of the same group, the workers. The Social Democratic Party (SPD) leadership in general has been described as a capitalist tool, serving by its policies of reform to divert the German workers from the true revolutionary path. And, SPD leaders such as Schmidt in particular, with a history of vigorously opposing the Communists, have been described as uncompromising enemies of the USSR in the long run, despite any tactical compromises of the moment.

The current rapprochement between the USSR and Germany, represented by Bonn's conciliatory policy toward the Eastern bloc (Ostpolitik), has only temporarily muted Soviet distrust of SPD's intentions. Even so, the Soviets have taken due note, for example, of Schmidt's continuing championing of the maintenance of NATO's unity and strength and of his efforts to keep up Germany's own defense budget and have it play a major role in NATO.[27]

Moreover, in the Soviet view, Ostpolitik, whether formulated by the Christian or Social Democrats, has the following long term objective: by establishing friendly links in Eastern Europe (distinct from the USSR), West Germany intends to undermine Soviet influence in the

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[26a] In the key area of defense research and development, which has provided the basis for the US qualitative lead over the USSR to date, the US has even now accelerated its expenditures from an average annual increase of 1.5 percent in 1969–74 to 8.2 percent in 1978–79. (See "An Analysis of Federal R & D Funding by Function," National Science Foundation, 1979, p. 7.)

[27] For a description of the historic roots of the Soviet distrust for the SPD and its leaders, see N. A. Trunin. Militarizatsiya FRG i Politika Sotsial-Demokraticheskoi Partii (The Militarization of the FRG and the Policy of the Social-Democratic Party), Social-Economic Literature Publishing House, Moscow, 1962.

area and ultimately to obtain German reunification at the expense of Soviet interests.[28]

It is from the foregoing perspective that the Soviets have drawn their own conclusions about possible Sino-German collusion. In this connection, Schmidt's visit to Peking in November 1975 and the sentiments of parallel interests expressed by him and the Chinese on that occasion did not go unnoticed by the Soviets. And, to complete the picture, Soviet concern is further fed by China's urging NATO to retain its unity and strength against Soviet hegemony, thus paralleling Schmidt's views on NATO.[29]

Any full-scale Sino-German collusion could alone drastically step up Soviet alarm, given their almost irrational fear of a two-front threat. But compounding Soviet concern is the possibility that the Sino-German collusion could be widened to include Japan. However remote the possibility may appear to others, the Soviets do not exclude it, again in the light of their reading of past history which has seen Japan and Russia as bitter enemies. Even now, the Soviets are supersensitive to any Japanese contacts with China. The latter has been deliberately manipulating Japan for advantage over the USSR and has, in Soviet eyes, succeeded in part to date.

Thus, China pressured Japan to sign in 1978 a Peace Treaty that incorporates expressions of joint Sino-Japanese opposition to "superpower hegemony." While nominally intended to include the U.S., the Chinese effort on this score has been directed against the Soviets and the latter have interpreted it as such. In fact, prior to the signing of the Peace Treaty, the Soviets put heavy pressure on Japan to reject the Chinese overtures. But Japan resisted Soviet pressure and thereby fed Soviet concern. Indeed, Prime Minister Miki categorically rejected a heavy-handed attempt by Soviet foreign minister Gromyko, during his visit to Tokyo in January 1976 to obtain a Japanese commitment, to exclude the "superpower hegemony" clause in any treaty with China.[30] Japan's subsequent signing of the Treaty left it free to make whatever alliances it chooses in the future. Indeed, the Japanese military have already had contact with their Chinese counterparts, the first delegation having visited Peking in 1978.

Against the background of these and related developments, the Soviets view a future German-Chinese-Japanese combination as feasible because, among other reasons, all have latent or explicit territorial claims against the USSR. The Chinese, of course, have openly expressed their determination to regain ultimately the territories seized by the Russians under the unequal treaties of the 17th, 18th and 19th Centuries.[31] Relevant, too, is the fact that in the post-World War

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[28] For an extended Soviet analysis of the ulterior motives of Bonn's policy toward the U.S.S.R. and East Europe, see M. S. Voslenskii, "Vostochnaya" Politika FRG (the "Eastern" Policy of the FRG). Science Publishing House, Moscow, 1967. This work examines the anti-Soviet roots of both the Social Democratic and Christian Democratic Parties.

[29] The foundations and implications of Sino-German collusion are examined in A. I. Stepanov, FRG i Kitai—K Istorii Otnoshenii, 1949–1974 (FRG and China—On the History of Relations 1949–1974), International Relations Publishing House, Moscow, 1974.

[30] See Washington Post, Jan. 14, 1976. In fact, Miki asserted Japan's intent to sign as soon as possible a peace treaty with China that included such a clause.

[31] Soviet concern over Chinese pretensions has triggered not only a massive transfer of military power (some 50 divisions) to the China border but also an elaborate defense of the legitimacy of the territorial annexations under the Tsar. One of the most detailed Soviet rebuttals of Chinese claims is contained in a 288-page volume by A. Prokhorov, K Voprosu O Sovetsko-Kitaiskoi Granitse (On the Question of the Soviet-Chinese Border), Moscow, 1974. This work is described by the Soviets as an analysis of the legal groundlessnes of "Maoist territorial pretenses."

II period Japan has continually pressured the Soviets for the return of the four Northern islands seized by the USSR in 1945.

The pressure on the Soviets for territorial satisfaction, added to their perception of other common interests of Germany, Japan and China, such as economic affinity and the trio's historical antipathy toward Russia, shapes the Soviet image of possible future parallel, if not common, military policy against the USSR. Having itself formed strange, seemingly incompatible combinations with these very same nations in the past, the USSR attributes to them the ability to similarly unite for reasons of expediency.

Finally, overarching all these combinations is the possibility, in the Soviet view, that the U.S. might join the above-noted trilateral combination, either voluntarily or because of entrapment by previous commitments. This would lead to the most traumatic Soviet strategic nightmare: U.S. strategic nuclear-missile capabilities linked to Chinese, West German and Japanese ground forces.

In Soviet eyes, incipient developments bearing on a possible US "tilt" against the USSR have already occurred. This is currently represented foremost by the US seemingly hasty recognition of the People's Republic of China in December 1978 and the US stance toward China's invasion of Vietnam in February 1979. In the Soviet view, the US gave China the go-ahead for that attack as demonstrated by the fact that the Chinese attack came hard on the heels of Premier Deng Xiaoping's visit to the US during which he announced China's intention "to punish" Vietnam. This was followed by other US actions indicating, in Soviet views, US approval of the Chinese action. For example, the visit of Treasury Secretary Blumenthal was not called off by the US despite the Chinese invasion. In fact, the visit was made while the conflict was in full swing. The Soviets noted that by contrast the US has taken unfriendly moves toward the USSR under circumstances far less grave than China's use of force against an "innocent" neighbor. In this connection, they cite the postponement or cancellation of several scheduled meetings of joint US-USSR committees under the various US-Soviet agreements in the science and technology fields, e.g., the participation of Dr. Frank Press, the President's Science Advisor and US co-chairman of the Joint S&T Commission, was called off by the US in July 1978 in protest of the Soviet regime's treatment of its dissidents. According to the Soviets, this US move was unwarranted interference in their internal affairs, and, in any case, certainly did not equal the use of force as was the case in the Chinese attack on Vietnam.

Soviet concern over each collusion possibility, however, preposterous or unimaginable it may appear to an outside observer, has already been articulated. Indeed, it has served as part of the Soviet-asserted rationale for the sizable military capabilities the USSR has developed to date. On this score, the Soviets have asserted that no nation in the world has suffered the war ravages that the USSR has; moreover, no nation potentially confronts more threats than the USSR or has more cause to seek strategic insurance against suffering a repetition of the damage it received in World War II.

Euphemistically, the Soviets describe the danger to the USSR as stemming from the need to safeguard the "gains of socialism" since World War II, which are now threatened by an "adventurist" policy

of "imperialism." The latter is losing its grip under the pressure of the socialist world, led by the USSR. Given its social and economic superiority, socialism is leading to large-scale societal break up of the capitalist world. Unable to face such a development, that world, headed by the US, is making a tremendous effort to undermine the USSR. The miltary danger, say the Soviets, is heightened because for the first time in history, "imperialism" has succeeded in creating military-political alliances on an international scale, even though these alliances have sharp, internal contradictions. Moreover, the "imperialist camp" possesses modern weapons which threaten all. And, despite USSR's "peace-loving" policy, not a single socialist state has escaped persistent efforts of capitalist interference up to and including open military attack.[32]

Beyond this subjective view of capitalist hostility, the Soviets argue their need for large military capabilities because of their geopolitical situation. As one Soviet strategist puts it:

> The principles of military strategies are determined by the State's geostrategic position, the scale of potential threats and the length and nature of borders, and commitments to allies. Our country, as a State located in two continents and forced to consider the situation in Europe, Asia and contiguous regions, with a territory of 22.5 million square kilometers to be defended and borders stretching for 60,000 kilometers and without a so-called "forward based system" like the US has, is forced to take into account from a purely military standpoint, potential threats both on land and from the sea. And this obligates us to have forces strategically adequate to meet the threats.[33]

It is in the foregoing context that the Soviets imply that they need military forces, including oceanic capabilities, stronger than those of anyone else to meet the range of potential threats arrayed against them.

Their perceptions are reinforced by the traditional Soviet fixation on statistical and numercial superiority in general but in industrial production and military requirements in particular. This stress reflects insecurity and an attempt to overcome qualitative inferiority by greater numbers. It has relevance to Soviet modernization effort both in the economic and military areas.

Thus, in the economic arena the Soviets have aways striven for a quantitative lead over the capitalist world, to be reflected in greater output of steel, coal, and other key materials, as a way of demonstrating the superiority of the Soviet over the capitalist system. However, such production goals have often been met at the expense of efficiency and even real need. Indeed, the quantitative output fixation became so great that Khrushchev was finally driven, during his attempt to carry out some modernization reforms, to rail against what he called "the steel eaters." These were Soviet economic and political leaders who, in his view, were interested only in producing increasing steel tonnage even if other cheaper or better substitutes were available.

On the military side, the Soviet quantitative tendencies are reflected in past history and illustrated in World War II military operations. Typically, the Soviets did not attack until they had overwhelming (two and three to one) advantage even if this meant suffering heavy

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[32] For an example of Soviet rationale on the threat to the U.S.S.R., see E. Sulimov, Zashchita Sotsialisticheskogo Otechestva (Defense of Socialist Fatherland). Moscow, 1970, in particular p. 14 and p. 17.

[33] D. Proektor, "Problems of War and Peace; Two Approaches," Novoye Vremya, No. 48, Nov. 24, 1978, pp. 4–5, as translated in Foreign Broadcast Information Service, Nov. 29, 1978, p. A4.

losses in the process. For example, Marshal Zhukov did not launch the Soviet counterattack against the Germans advancing on Moscow in the fall of 1941 until he had built up irresistible superiority; he held up that counterattack even though this allowed the Germans to reach Moscow's suburbs within sight of the Kremlin walls and caused added thousands of Soviet military casualties. His attitude explains in large measure the current Soviet effort to attain military superiority over the West: a belief that numerical superiority has, even in the nuclear era, meaning for military victory, if deterrence should fail. Short of a nuclear cataclysm, the Soviets also believe numerical superiority, properly used, has political utility, e.g., to obtain concessions without the use of force as the "imperialist world" takes note of the change in "correlation of forces" in Soviet favor.

Soviet Reaction to Perceived Threats

Yet, in acting on their claims of needing military superiority within the framework of an expansive foreign policy, the Soviets could trigger an actual combination which is at this time only a figment of their subjective imagination. But should the political-military combinations that now concern them actually begin to form, the Soviets would undoubtedly react as they have in the past: to attempt to disrupt such alliances by making expedient deals with one or another of the several members.

Even now, in recognition of a two-front threat and challenge by US, the USSR has attempted to de-fuse its disputes with some adversaries (such as the US and West Germany); this it has done in order to concentrate its energies on facing what it considers to be the more immediate and direct threats (such as the one posed by Communist China) and to avoid confronting all rivals simultaneously. The practical effect of detente with US and Ostpolitik with West Germany to date has been to give USSR breathing time to build up its capabilities in the East against China and exploit other opportunities.

This general strategy is in line with traditional Soviet behavior. Historically, the Soviets have calmed disputes on one front while turning to face a challenge on another. This occurred, for example, in the late 1930's when the Soviets signed a non-aggression pact with Nazi Germany to forestall an attack from the West at a time when they were fighting Japan in the East; then, on the eve of the Nazi attack in June 1941, they signed a Neutrality Pact with Japan in order to forestall the latter from joining Nazi Germany in a simultaneous attack on the USSR.

But until a full-blown, "worst case" combination of US, China, West Germany and Japan materializes, the Soviets are likely to continue their expansive foreign policy, at least in the near future.[34] In

[34] Indeed, they may do so even when they should prudently desist to prevent the worst from materializing; they have miscalculated in the past and this constitutes a danger to all concerned. It should be noted, however, that the Soviets clearly want to avoid any miscalculations which could be fatal to them in the nuclear era. Thus, the Soviet military have in recent years been studying how wars broke out in the past, particularly those which the weaker parties, in defiance of logic, initiated against the stronger. This has current relevance because the Soviets now consider themselves stronger than anyone else, possibly not even excluding the United States. (As already noted, the U.S.-Soviet strategic relationship is described by the Soviets these days in terms of "the correlation of forces" having shifted heavily in favor of the "socialist world.") But given the nuclear danger, the Soviets presumably will continue to be sensitive to not triggering a desperate recation such as a US nuclear attack.

turn, their activities abroad will undoubtedly require a continuing military modernization effort to support that policy since it provided the major impetus for the current build-up in the first instance.

Future Developments

As the biggest country in the world, and with large human and material resources, the USSR probably can sustain the current high levels of military modernization for the next five to ten years, even in the face of accumulating economic difficulties and slowdown admitted by the Brezhnev leadership. (These include shortages of manpower and energy resources, economic mismanagement, etc., as noted in his November 1978 speech to the Party Plenum.) The momentum for continuing military modernization might be further sustained in this period by the fact that as yet there is no internal Soviet "revolution of rising expectations" comparable to that which has hit other countries. Moreover, internal public opinion is too weak to force the Soviet leadership to give up the current military-oriented effort.

Finally, the possibility of a self-fulfilling prophecy of collusion of US, West Germany, China, and Japan, that could be provoked by a continuing Soviet military build-up and expansive Soviet foreign policy, could provide the Soviet leaders with the traditional excuse that *Rodina* (the Motherland) needs still more arms to defend it against such collusion.

But continued or accelerated military modernization would exacerbate even more the already significant impact of such unbalanced development on the Soviet economy and society. These are already suffering from fundamental problems of low productivity, stifled initiative, etc. stemming from the traditional stress on defense production (at the expense of other Soviet needs) and excessive political control.

Indeed, keeping the USSR on a draconian course would require even greater expansion of pervasive party rule which is already viewed by the Soviet people as responsible for the basic problems afflicting the Soviet economy and polity. This political situation is likely to provoke in the long run increasing opposition of Soviet elite groups. Indeed, the post-Stalin political context has already changed significantly.

The Party's omnipresent and omnipotent hold on the Soviet system is being gradually eroded by societal conditions beyond its control. Increasingly it has to allow other groups a greater role: the military because they man the very complex modern weapons systems; the scientists and technologists because they are needed to develop the scientific-technical breakthroughs; the industrial-governmental bureaucracy because it is needed to run the increasingly complicated Soviet economy; and, the intellectuals because they are needed to muster the enthusiasm of the increasingly educated Soviet citizenry. The role of these groups is being played out against the background of younger Soviet generations which, with no direct links with the Stalinist past, are questioning this very past and thereby putting a strain on the older generations to defend the rationale of the Soviet system. This leads to what is the crucial long-range problem for the

Soviet leaders: the changing role of the Communist Party in the Soviet system.

In the earlier days when the Soviet industrial system was relatively primitive, the use of untutored party activists as watchdogs over all phases of Soviet life was a tolerable liability. Now the more complex and sophisticated Soviet economy cannot be run the same way. Thus, the system is operated by highly skilled personnel in the armed forces, industry and science. They now constitute a much greater portion of the labor forces, require more intelligent and subtle controls than the heavy-handed party system offers, and require a greater diversion of resources to satisfy their personal needs. Moreover, the Soviets are trying for technological breakthroughs that even the West has not yet achieved. This by contrast with the past when the Soviets could and did borrow less advanced technology from the West.[35]

Consequently, whether the new skilled Soviet labor force is giving its best to the Soviet system cannot be measured by party hacks or terror technicians of the secret police. At a minimum, the party man assigned to control functions must himself possess some scientific, technical or military skill. But in this case, his party loyalty may be diluted by professional pride; at the extreme, it may even make him question the need for the party to run the system since it may be apparent to him, as well as to those under his surveillance, that the system could be run more effectively without the party.

This process is being abetted by the growing inability of Marxist-Leninist ideology to provide answers to the problems of modernization generated by advancing technology. In fact, the modernization process has created the central dilemma facing the party internally. To modernize and develop the Soviet Union's national power, the party has been forced to educate the Russian masses. This has enabled and led many Soviet citizens, in pursuit of their professional duties, to ask precisely the kind of questions which the ideology cannot answer. As a result, many within the Soviet Union today consider Marxist-Leninist ideology, at a minimum, to be irrelevant to the modernization problems facing the Soviets, and, at a maximum, to be an obstacle to Soviet progress and efficiency. In turn, this poses a challenge to the party since its *raison d'etre* is based on the necessity and applicability of that ideology to Soviet progress.

The developing resistance of Soviet technocrats (military, scientific-technical, managerial) to the party's ideological indoctrination and rigidity in the face of changing conditions has several adverse effects from its viewpoint. First, because these groups consider ideology irrelevant or an obstacle, they tend to be increasingly pragmatic and apolitical in their approach to the solution of problems facing the Soviet system. The party cannot tolerate apolitical groups since according to the ideology, the revolutionary attitude of the Soviet people

[35] Even Stalin acknowledged this at one time. For example, in a message to the workers of the Gorky automobile manufacturing plant, built with U.S. help, in 1932 and in an interview in 1929 with a U.S. executive, he openly acknowledged his gratitude to U.S. technicians and freely admitted that the Soviets had much to learn from U.S. science and technology. (See his Collective Works, vol. 13, p. 124 for the Gorky Plant message and p. 149 for the interview with Campbell.) Later, in the early 1950's, and in more nationalist moments, he claimed the Russians invented virtually everything, from radio to aircraft.

must be maintained if the party's ultimate objective of a world communist victory is to be achieved. Therefore, if the technocatic groups lose their ideological fervor, the Soviet Union loses the revolutionary drive necessary to win the world to Communism, and the Party loses its ultimate claim to primacy within Soviet society.

Second, the new elites recognize that efficient operation of the Soviet system requires policy which is well defined and appropriate to new economic-technological conditions. Increasingly therefore these elites want to formulate policy themselves, not simply implement party directives. This, of course, is anathema to the party, since policy-making is the prime source of its control. Whereas the new elites are interested primarily in efficiency, the party, if forced to choose between efficiency and control, has always chosen control. The technocrats' own self-interest also comes into play, since they recognize that not only Soviet Union's national progress but their own role in the future of its society is dependent on substantial involvement in formulating appropriate national policy.

An example of this conflict has been the Soviet military's challenge to the party's role in the armed forces and its assessment of the strategic needs of the Soviet Union. Marshal Zhukov was purged explicitly in 1957 for trying to reduce or remove party interference in the professional military's responsibilities. And, Khrushchev's pronouncement in January 1960 that Soviet strategy would be based primarily on nuclear-missile forces triggered further military opposition since in effect such a strategy implied implementation at the expense of the ground forces. This met the opposition of the Soviet marshals and moved them to seek a voice in formulating as well as implementing strategy. The party's concern over such a development was reflected in its criticism in the 1960's of Marshal Sokolovsky's *Voennaya Strategia* (Military Strategy): this book, by a leading Soviet military leader, attempted to define modern Soviet strategy and was attacked for infringing on the prerogatives of political leadership in formulating grand strategy.[36]

Continuing tensions between the Soviet military and the party is suggested by the latter's continuing and strained effort to prove that even under *yedinonachaliye*—the concept of single command, nominally without political commissars—the military commander needs the help of the party activists in the Army to keep its morale and combat potential at a high level.[37] The party has had to respond to these tensions by easing the pressure for ideological conformity and by catering to the Soviet military, particularly the younger officers, whose solutions to USSR's current strategic problems involve even greater outlays on advanced military technology.

In his days, Stalin imposed his strategic concepts—epitomized by his so-called permanently operating factors—on the Soviet military and thus hamstrung their ability to keep pace with the changing tech-

[36] The Soviet military have also had reservations about the political leaders' implementation of Soviet foreign policy. For an examination of the developing differences on professional grounds, see present author's, "Soviet Foreign Policy and the Military," Survey, (London), No. 3, summer 1971.

[37] A particular critical period for that argument was the transition between Khrushchev's and Brezhnev's leadership as reflected in commentary at that time. (See Kommunist Vooruzhennykh Sil (Communist of Armed Forces), No. 23, December 1964.)

nology and advanced strategic thought in the West. Now the Soviet military have gained greater freedom to examine strategic problems in a less ideological context. Thus, the Soviet General Staff Academy has been examining such questions as why both non-Communist US and Communist Soviet Union were caught by surprise in 1941. In doing so, the military researchers since the mid-1960's are no longer bound by this catechism: Soviet strategy formulation is superior because it is based on "scientific" Marxism which enables the Soviets unerringly to forecast military threats and take timely action to disarm them.[38]

The negative reaction of the military and other elite groups to an ideological straitjacket and Party's control will undoubtedly grow. Therefore, over the long run the Soviet leadership must somehow reconcile the primitive and instinctive exercise of centralized control through the party with the needs of an increasingly sophisticated society whose future technological progress may depend on political decentralization. In this connection, the Soviet leaders' concern is reflected by their periodic examination of how the Soviet system will evolve in the future. With some strain, they try to prove that the proper foundations for the ideal Communist society were laid by both the Marxist ideology and the developments in the Soviet Union to date. But since the description of the development of Soviet society have undergone continual revision in Soviet history books, it is clear that developments to date have depended more on the whim of individual leaders than on the wisdom of either Marxist ideology or the party. By an logical extension, the question of the validity and utility of both the philosophy and the party must be faced. It is likely that the inability of Marxism to provide the needed guidance will contribute to an even greater withering away of ideology than has been true to date.

How the problem of party control is solved is fundamental. If it continues to adhere to an outdated ideology and to try to exercise the kind of pervasive control that worked in Lenin's and Stalin's days, it may risk a weakening or even fundamental disintegration of the system.

On the other hand, the party may undergo a change from a highly ideologically-oriented group with a vested interest in advocating and promoting world revolution to a more pragmatic group increasingly concerned with greater domestic Soviet progress. The first signs of such a possible future change surfaced during the last years of Khrushchev's rule. As part of an apparent attempt to reform the party, it was "discovered" that Lenin had foreseen the need to replace political agitators with economic organizers.[39] This seemed to be a first effort by the Soviet leadership to find and justify a new role for the party: having fulfilled the political aims of establishing communist rule, the party could now turn to economic specialization and thus transform itself into a necessary component of the Soviet Union's modernization

[38] The Soviet Institute of Military History established at that time reportedly was directed to identify the impact of past history and current technology on future strategy regardless of ideological strictures. (See Marshal Zakharov, *Izvestiya*, Nov. 4, 1966. Zakharov is the late Chief of General Staff.)

[39] See Pravda, Sept. 28, 1962, for the "discovery of Lenin's views on the importance of economics in Soviet policy and the appropriate "mix" between economics and politics. For discussion of party reforms at that time, see Carl Linden, Khrushchev and the Soviet Leadership 1957–64, Johns Hopkins Press, Baltimore, 1966, pp. 16–21.

progress.[39a] If the future leaders are successful in establishing such a role for the party, it will be converted from an organization providing ideological guidance to Soviet society from above to one providing specialized knowledge within the society. It is not suggested that such a transformation will occur in the near future since this is a political leap requiring leaders even further removed from Leninism-Stalinism than Bezhnev or his immediate successors. But a significant transformation in the long run cannot be excluded. Indeed, the party's ultimate survival may depend on its ability to find a necessary role in the general modernization of the Soviet Union, i.e. beyond the current, military-oriented effort.

Even now, Khrushchev's current successors have found it necessary to ease, however slightly, the heavy hand of the Party. By so doing they are establishing precedents for the eventual rationalization of the Soviet system. At the same time they are producing an atmosphere in which the Soviet leadership's decisions are no longer accepted without question. Witness the spectacle of foreign Communist parties sending delegations to Moscow in 1964 to question the reasons for Khrushchev's removal. Who would have dared to do so in Stalin's days! This questioning of the Kremlin's wisdom has been pushed further by the "Eurocommunists." In a rudimentary fashion, the questioning is also taking hold internally, particularly among some of the establishment elites such as the Soviet writers.[40] If and when this questioning extends through the whole system, it could signal a significant transformation of the Soviet system. Such a transformation will not necessarily make the Soviet system any less hostile to the West, but it may by its rationality avoid the excesses of one-man rule (inherent in Stalin's and, to a lesser degree, in Khrushchev's days) and even of one-party rule. Such a development might undermine the ability of any party zealots to embark on any "harebrained," "adventurist" schemes for speeding up world revolution or Great Russian ambitions.

The Soviet Union's ideological fervor may be further dampened in the future by the emergence of countervailing forces within the Soviet elite. These may oppose not only the party but any other institutional grouping that argues for overly ambitious expansion abroad or otherwise tries to enhance its own position by cloaking itself with the cover of advancing the world revolutionary cause. The military has always been able to argue for increases in their capabilities on the basis that these are necessary to serve the world revolutionary cause, as well as defend the USSR. As scientific-technological, economic-industrial, and cultural leaders within the elite gain some voice in policymaking, because of the political leadership's dependence on these groups to produce the sinews of USSR's power, they may be expected to challenge the sizeable and disproportionate investment in Soviet defense. The scientists, technologists, economists and industrial managers may argue that such investment is being made at the expense of fundamental scientific-technological breakthroughs and long range economic growth; the cultural figures, with their influence over Soviet

[39a] Khrushchev also tried to arrange for "new blood" to be infused into the Party management. In 1961 he proposed changing the Party statutes to require a regular turnover of Party secretaries at lower and middle levels. Though the initiative lapsed with his downfall in 1964, a future Party leader may revive his ideas.

[40] Their attitude is symbolized by the publication in 1979 of *Metropol,* a collection of literary works by writers who previously drew high praise from the regime.

youth and intelligentsia, could argue that the militarization accompanying such investments defeats the objective of presenting the Soviet Union as a free, creative, non-militaristic society worth emulation by others.[41] Such play of internal forces, along with increasing burden of unsolved economic and political problems, could eventually lead to decreased allocation of resources to the military and to a possible brake on the use of Soviet forces as "an arm of world revolution," including curtailing the current massive Soviet support of "national liberation wars." Ultimately, the Soviet military may be returned to the traditional role of defense against unprovoked external attack. This could broaden Soviet modernization from its unbalanced military orientation to date. But this is likely to happen only if Soviet leaders do not succeed in escaping from their internal dilemmas by exploiting externally their increased military capabilities. The weaknesses inherent in such dilemmas may be compensated by foreign policy successes: successful expansionism abroad can provide a substitute for internal reform. Only if this possibility is blocked, may Soviet orientation be deflected into primarily domestic policy channels.

Conclusions

In sum, the current Soviet military modernization is being driven by an expansive Great Power foreign policy with its resultant strategic and political-economic imperatives. This policy has radically transformed the USSR from a land-locked insular nation to a global competitor of the U.S., as demonstrated by the appearance of Soviet capabilities on all the oceans of the world. Yet, this transformation has given rise to political dilemmas and strategic dangers which may limit in the future the benefit the USSR may derive from its new status as a global superpower. Unsolved economic and political problems at home, resulting from burdens of expansive foreign policy and pervasive party rule producing economic inefficiency, may ultimately force the Soviet leaders to diverge from USSR's current military-oriented modernization.

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[41] There have already been running battles between the Soviet military and literary figures on the shape and nature of Soviet society. For example, in the recent past, former Defense Minister Marshal Malinovsky and other military leaders accused Soviet writers of generating pacifism among the Soviet people, of undermining the prestige of the military, and of dampening the political (and presumably, the revolutionary) fervor of the Soviet youth. In response, such literary figures as Tvardovsky reaffirmed the intention of Soviet cultural leaders to criticize both the political and military leaders for their errors and shortcomings, and to strive to influence the development of Soviet society. (See *Literaturnaya Gazeta* (Literary Newspaper), Mar. 18, 1967.)

FOREIGN ECONOMIC CONSTRAINTS ON SOVIET ECONOMIC POLICY IN THE 1980's

(By Lawrence J. Brainard*)

CONTENTS

Summary

The paper assesses the nature of foreign economic constraints facing Soviet policymakers in drawing up economic strategies for the 1980s. Primary focus is on the trade and credit relations of the Soviet Union with the West. The conclusions suggest that domestic factors hindering the effective trade in technology are the most serious constraints to Soviet economic policies for the 1980s. Market demand factors associated with geographical location are next in importance, followed by credit availability. Implications for economic policy in western countries are reviewed.

I. Introduction

In drawing up economic strategies for the 1980s Soviet planners face two emerging problems. One is the sharp slowdown and probable stagnation in the growth of oil production. The other is a slowing of economic growth due to lagging technological change and to a significant decline in the rate of growth of the labor force. There are many policy options open to Soviet planners to alleviate the effects of these problems. Those options in the foreign trade area are of particular interest; they are frequently thought to offer relatively large returns for a given outlay of resources. They may also have significant effects on western economies, e.g., by means of higher or lower flows of trade and credit. The options may also be partly or directly under the control of western policymakers, e.g., by restrictions on credits or sales of technology.

A key issue is whether Soviet policymakers will face constraints in their use of foreign economic options in seeking to offset the adverse domestic economic trends expected in the coming decade. Related to this is the issue whether Soviet access to such foreign options should be restricted or controlled as a matter of western policy.

In addressing these issues several concepts need definition at the outset. In referring to foreign economic options the primary focus will

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be on trade and credit relations with developed western countries during the decade of the 1980s. We will need to define how these options may act as constraining factors. A related task is to identify the role that foreign options may play in Soviet decision making. Before turning to these questions, the status of the Soviet long-term plan is briefly described.

II. The Long-Term Plan

Soviet efforts at long-term planning for the 1980s go back beyond 1975. A fifteen-year plan covering 1976–90 had been scheduled for approval at the communist party congress in 1975. The poor harvest that year, combined with the unexpected deterioration of the Soviet balance of payments due to recession in the West, caused a postponement of the long-term plan.

In 1977 Gosplan, the Soviet economic planning agency, issued a decree outlining the basic objectives of a revised plan which is now in the process of formulation.[1] The new plan has been renamed "General Outline for the Location of Productive Forces in the U.S.S.R. for the Period Ending 1990." The timetable called for the basic background work to be completed by the middle of 1978 in order to allow adequate time for the preparation by 1980 of the final version of the long-term plan and the next five-year plan for 1981–85.[2] It is expected that both plans will be formally approved by the communist party congress to be held in 1980. A special council has been set up in Gosplan to coordinate the work on the long-term plan.

III. Credit and Trade Options

The long-term plan must decide several interrelated tasks:

(1) The allocation of labor and capital resources among competing economic sectors (including the military) and also among geographical regions of the country.

(2) The setting of economic priorities and the timing of major projects.

(3) The desired pace of economic growth, the investment rate and the rate of technological change.

(4) The changes, if any, to the system of economic management.

Soviet trade and financial ties with the West are related to these tasks in several ways. There is the obvious augmentation of domestic capital resources through imports from the West. The size of such imports, though, is still relatively modest and is unlikely to change markedly in the future. Imports of machinery and transport equipment from the West accounted for only about 5½ percent of domestic machinery investment in 1975–76; this was up from a 3-percent share in the 1960s.[3]

Perhaps more important is the fact that western capital goods are typically allocated to priority sectors where their economic return may be very high due to their help in relieving critical bottlenecks. Such a role for western capital may help significantly in the settling of eco-

[1] Planovoye Khozyaystvo, 1977, No. 6; a summary of the decree is given in Soviet Geography, November 1977, pp. 699–700.

[2] I. Prostyakov, "Dolgosrochnoe Planirovanie: vazhnoe uslovie realizatsii ekonomicheskoi politiki KPSS," Planovoye Khozyaystvo, 1977, No. 1, p. 29.

[3] Philip Hanson, "Western Technology in the Soviet Economy," Problems of Communism, November-December 1978, p. 22.

nomic priorities and the timing of interrelated projects. Western capital may also help to raise the technological level of specific industrial branches; the mineral fertilizer industry is a case in point. Apart from a limited number of such cases where the contribution may be very significant, the size of western capital imports points to only a modest impact on the technological level of the overall economy. The same is also true of the economy's aggregate growth rate—a positive though modest contribution. Foreign options cannot contribute much to increasing labor resources or to economic reform.

This suggests that foreign economic options available to Soviet planners should be assessed from the following perspectives: (1) Their impact on decisions concerning economic priorities and the timing of major projects; and (2) their impact on the rate of technical progress in priority economic sectors. A further consideration is the nature of the obligations Soviet planners must accept in order to utilize these foreign options: Capital imports require credit and credits must be repaid by future exports.

A remaining question is how these foreign options might act as constraints. Foreign borrowing makes sense when a country is able to invest such resources to obtain a positive rate of return over and above the repayments necessary to amortize the credit. There are several aspects to this process: (1) The efficient use of the foreign capital being financed to manufacture the product; and (2) the sale of the product abroad to generate foreign exchange revenues. We will be interested in exploring situations in which constraining factors cause prospective investment projects to be postponed or cancelled. There are three general cases:

(1) A country having profitable investment opportunities may be unable to secure the necessary credits to implement such projects. In this case, credit is the constraining factor.

(2) A country is able to use foreign capital efficiently to produce a given output, but sales prospects in foreign markets are unfavorable or sufficiently uncertain to cause postponement or cancellation of the project. In this case, trade is the constraining factor.

(3) A country has profitable investment opportunities involving foreign trade and credit but is unable to implement them efficiently due to constraints of a domestic nature, such as shortages of labor, domestic capital (infrastructure) and inadequacies of management. In this case domestic factors are the constraining element.

The task is to identify situations in which trade and credit are constraining factors and to distinguish them from cases where domestic factors may be the real underlying constraints. In some cases, there may be multiple constraints.

IV. Credit as a Constraint

There are several notable features in the Soviet use of western credit. One is the importance of credits from western governmental agencies, such as E.C.G.D. in the United Kingdom, Coface in France and Hermes in Germany. Another is the major role of compensation or product buy-back agreements. By securing long-term export commitments these deals provide an assured repayment of the credits used.

At the end of 1977 official financing from western countries—guarantees, insurance and direct credits, totaled about 60 percent of the estimated $17.7 billion Soviet gross foreign debt. This proportion is the highest of any country in Eastern Europe. Official financing has been preferred by reasons of fixed rates of interest and generally longer maturities than for bank loans. Fixed interest rate on official credits average about 7½ percent, whereas commercial bank credits are typically based on floating market rates of interest. During 1978 bank interest rate on dollar loans to the Soviet Union rose from about 8½ percent to over 12 percent by early 1979.

A second reason is political. The Soviet Union has sought to expand commercial relations with the West primarily on the basis of government-to-government agreements. Such agreements are attractive to Soviet leaders because they help reduce risks they perceive associated with expanded commercial ties with market economies. If problems arise, the political agreement provides an assurance that the matter will be viewed in the context of government-to-government bilateral relations. As part of the agreement, the western country normally commits to provide official export financing for Soviet purchases of capital goods up to a stated total amount. The failure to reach a U.S.-Soviet trade agreement in 1975 after the passage of the Trade Act of 1974 has been and still remains a major stumbling block to improved U.S.-Soviet commercial relations. Lacking the political assurances of such an agreement, Soviet leaders have been unwilling to run the risks of developing closer commercial ties with U.S. firms since that time.

Soviet use of commercial bank credit accounts for most of the remaining 40 percent of Soviet debt. There are several interesting aspects to Soviet practice here as well. On the one hand wholly-owned Soviet banks are active in the major financial centers in Europe, especially in Paris and London. An extensive network of interbank relationships has also been built up over time with western banks. Bank-to-bank activities in money market, foreign exchange dealings and in short and long-term borrowing are actively pursued. At the same time, Soviet use of the syndicated Eurocurrency loan market has been very modest. This market offers borrowers the possibility of raising much larger sums of cash than through bank-to-bank credits. During the four years 1974–77, the Soviet Union borrowed $1.3 billion in syndicated loans. A further $650 million was added last year, but a large part of this sum was used to prepay several of the earlier credits.[4] Brazil, which exports about the same as the Soviet Union exports to the West, borrowed $13.7 billion by comparison during 1974–78. Up to now, the Soviet Union has apparently not felt the need to expand borrowing possibilities in this market.

The second feature of Soviet credit use, the compensation agreement, is frequently misunderstood. Compensation typically involves two separate contracts, one for the sale of technology by the western company and another for the sales by the Soviet agency which will supply the resultant product. In order for the Soviet capital imports to be financed, the two contracts must be legally independent. Commercial banks are willing to assume only the credit risk of the Soviet borrower, the Bank for Foreign Trade, and not the commercial risk that either

[4] Euromoney, March 1979, p. 124.

side may not meet the contract provisions. Hence, the compensation agreement by itself does not give a western bank any additional incentive to lend, since the bank receives the guarantee of the Soviet state in any case.

The link of compensation with credit is made on the Soviet side. Soviet planners have placed priority on compensation agreements because the long-term purchase commitment by the western firm provides an assured revenue source for servicing the project's debt. The value of these product buy-back agreements often exceeds the amount necessary to amortize the debt. The compensation agreement has also been linked to government-to-government agreements for large projects. This helps reduce risk to the Soviet side; by offering long-term supply commitments of needed raw materials, official financing can usually by secured for the entire package.[5]

Credits associated with compensation agreements account for over one-third of Soviet indebtedness currently outstanding to the West. The value of compensation agreements now totals an estimated $8 billion, including commitments on unfinished projects. Export earnings from these deals are projected to rise from $830 million in 1977 to about $4 billion in 1985.[6] These data point to a careful and conservative approach by Soviet planners to foreign borrowing.

Let us turn now to look at circumstances where credit may be a constraining factor in Soviet economic policy decisions. There are two general cases: (1) The total size of debt may become very large, causing banks to curtail further lending; and (2) the form of credits for specific deals may pose problems, due, for example, to the large size of individual projects or the desired maturity of the credit.

The possibility that Soviet debt could rise to very high levels may result either from the large-sized credits needed for new development projects, or because exports of oil may decline in the future, causing a fall-off in export revenue. As outlined above, credit makes sense if the associated investment yields a positive rate of return, net of repayment through export sales. Hence, any given level of debt must be related to a country's present and future export capabilities. One projection of Soviet credit needs for probable and possible major development projects arrives at a $30–35 billion figure.[7] This is a very large sum to be sure. But if the projects are economically viable in the sense noted above, there should be no cause for concern about creditworthiness. The debt will be large, but so will exports.

There would, of course, be a problem if western credits were used in a misguided attempt to develop non-viable projects. The evidence to date indicates that Soviet planners are taking a very cautious approach to the use of credit. As already mentioned, a large portion of Soviet debt is explicity linked to future export contracts. Further, the size of the future exports guaranteed by these contracts exceeds, in some cases substantially, the debt repayment obligations of the projects. There appears to be an evident dedication to export a certain portion of the output of virtually all major projects, whether or not

[5] The relationship of financing and compensation are discussed in detail in my "Financing Soviet Capital Needs in the 1980's," in The USSR In the 1980's (Brussels: NATO Directorate of Economic Affairs, 1978), pp. 165–72.

[6] Dennis J. Barclay, "USSR: The Role of Compensation Agreements with the West," in this volume.

[7] Barclay, op. cit.

the project is based on compensation and whether or not the needs of the domestic market for the product have been met.

There is also evidence that a major reassessment by Soviet planners of their borrowing policy has resulted in a more cautious approach to new projects. New orders for plant and equipment have leveled off and stagnated in 1977–78 and only one new compensation agreement was signed in 1978.[8] Soviet borrowing from western banks has also tapered off. Soviet net liabilities (excluding the CMEA banks) to western banks declined from about $2.3 billion at the end of 1976 to an estimated $900 million at the end of September 1978.[9]

The reasons behind this shift in Soviet credit policy appear to reflect a serious "indigestion" problem in absorbing the western capital already purchased. The indigestion is caused by an acute shortage of domestic labor and capital necessary to supplement the investment of foreign capital and by inadequacies of planning and management. The result has been delays in meeting many of the priority tasks set down by the Soviet leadership; many priority projects have been deferred beyond 1980. The costs to the economy of these deferrals are enormous:

> The costs are high indeed if the expensive multi-billion ruble projects, in some cases well underway, are not brought to a level of effective production in the Fifteen-Year Plan (1976–90). The gestation periods for these major projects, so central to improved future Soviet economic performance, are long in any event, but the possibility for converting facilities or utilizing partially completed facilities, once the commitments are made, is very small. Regional energy, metal and transportation facilities are sunk costs. The returns come only after completing the economic complexes which provide them.[10]

One example of the costs being incurred is given by the delays and indecision in moving ahead on the development of the resource industries along the new Baikal-Amur railroad, scheduled for completion in 1983. The railroad promises to be underutilized for some time after completion because of this. The same is true for the new Sayan dam on the Yenesei. When the dam is completed in the near future, there will be a significant lag before its power can be fully used due to delays in developing the associated energy consuming industries. Since the Soviet Union has not encountered any problems in securing credits, the constraints that have led to these delays must be primarily domestic in nature.

On balance, Soviet borrowing policy to date has been generally conservative. We do not know whether they will be seeking $35 billion in new credit. There will undoubtedly be an increase in credits for new projects as the economy moves into the 1980's. But there is little to suggest that Soviet planners will change their views about how credit ought to be used. Despite the slowing of the economy's growth rate, credit use will likely be closely linked to projects with assured export prospects.

There is, however, the question whether credit will be used to compensate for a fall-off in oil exports in the future. In a 1977 study the CIA projected a substantial deterioration in the Soviet balance of payments by the mid-eighties. The shift from current oil exports of 1

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[8] Barclay, op. cit., Appendix B.

[9] Based on data published by the Bank for International Settlements and my estimates of the net liabilities of the CMEA banks to western banks.

[10] John P. Hardt, "Military or Economic Superpower: A Soviet Choice," paper presented at U.S. Military Academy, West Point, New York, June 15–17, 1978, p.14.

million barrels a day to the West to imports projected at 2.7 million barrels a day by 1985 would cost $17 billion in 1977 prices.[11] It is not my purpose here to evaluate these projections, but to point out that credit does not offer a solution to the problem.

Credit can play a role in bridging unexpected or temporary balance of payments shortfalls, but it is no substitute for the necessary real adjustments in the economy to the causes of these shortfalls. Soviet planners are undoubtedly aware of this fact. In 1975, for example, the Soviet balance of trade with the West (including developing countries) worsened by $6 billion, moving from a surplus of $1.5 billion in 1974 to a deficit of $4.5 billion. Credit was used to cover the deficit and policy changes were introduced to correct the imbalance. By 1977, the balance moved back into a $1.7 billion surplus. It is unlikely that Soviet planners foresee using credit to compensate for a fall-off in oil revenue, except to aid temporarily in facilitating the real adjustment process in the economy. Credit, of course, will be used to support investments in the oil industry. The use of credit for specific projects such as these is discussed next.

The remaining issues regarding credit relate to the form of credit for specific projects. Some projects that have been discussed would require very large credits and long repayment terms. The Yakutsk LNG project for example will cost $7–8 billion according to current estimates,[12] and the term necessary for the amortization of these loans would likely be at least 15 years. The maximum term on official and bank credits is currently 10 years, but there have been a few loans with final maturities as long as 12 years. The financing of such a project would pose difficulties, though there may be ways around the problems.

Credits arrangements appear to pose problems to the implementation of such large projects, but so does almost every other aspect of these projects. Not only are many priority projects large-sized, their locations (mostly in Siberia) are unfavorable, investment commitments on the projects are highly interrelated with each other, coordination and management tasks are formidable and potential export commitments will be huge. In dealing with planning for these projects, Soviet planners face a complex set of constraints. Credit is one of them. It is an important constraint, but probably not the most important.

Another potential constraint relates to interest rate spreads and disclosure. A Soviet decision to increase significantly its Euromarket borrowings would require modestly higher interest rate spreads, consistent with a higher volume of borrowing, and better economic data. The interest rate spread on the latest Soviet long-term borrowing (December 1978) was 5/8 percent over the London Interbank Rate (LIBOR) for 8 years. On an aftertax basis (assuming a 46 percent tax rate) this rate translates into a potential return on assets employed for U.S. banks of about 35 basis points, well below most banks' targets for return on assets for international lending: these targets probably range upward from 50 basis points. U.S. banks have participated in some loans priced at 5/8 percent over LIBOR, but they have looked

[11] Central Intelligence Agency, "Soviet Economic Problems and Prospects," July 1977, p. 22.
[12] Barclay, op. cit.

primarily at other income from the customer relationship, such as fees as head managers of loan syndications, foreign exchange and letter of credit business, the size of demand balances, and the involvement of American business in the country, as justification for their participation. Because U.S.-Soviet commercial relations are still far from normalized, there have been far fewer opportunities to develop such collateral business with the Soviet Bank for Foreign Trade than with central banks in Western Europe and elsewhere.

The interest of U.S. banks in better economic information is frequently misunderstood. Unlike many European and Japanese companies, American firms in trade with the Soviet Union do not operate under the umbrella of government-to-government agreements, nor do they enjoy the support of their government to the extent that foreign firms do. This is a factor which acts to increase risks to American banks. Economic information is requested, not because the banks expect to find skeletons in the closet but because information is an essential element of the banks' risk management. It is a factor that helps reduce uncertainty and builds confidence. Better information is necessary if U.S. banks' willingness to support a significant expansion of lending above the current levels is to be increased.

In summary, then, credit does not appear to pose a constraint to solving the general economic policy problems that face Soviet planners in the 1980s. The reason is because the solutions to these problems involve real adjustments in the economy, not a shortage of credit. Credit may help facilitate such adjustments as in 1975–76, by temporarily bridging unexpected balance of payments shortfalls. At that time Soviet policymakers, unlike some of their colleagues in other Eastern European countries, gave top priority to achieving a rapid adjustment to the balance of payments problems that followed the 1974–75 world recession. Soviet borrowing policy is likely to remain conservative in the future, with much attention being given both to rapid adjustment to balance of payments problems and to exports by means of compensation agreements. A western policy to limit future credits to the Soviet Union may cause their economy some discomfort; it would not likely cause serious hardship. Soviet planners face a set of difficult problems; credit is on the list but it is not at the top of the list.

There do appear to be some constraints concerning the form of credit for specific projects. These constraints, however, could effectively be relaxed by changes in Soviet policy and practice. Some of the very large projects may have to be reduced in size by modification to a sequential or stage-by-stage pattern of development. Policy regarding interest rate spreads or information disclosure could also be modified. Techniques of project finance might be applied to some very large projects. One technique is that of production payments which has been used extensively in oil and gas projects in the West. This is a secured form of financing in which lenders receive security via the assignment of rights by the borrower to the revenues from the sale of the product.

Soviet planners must weigh the tradeoff between the costs of changes in their policy and practice (as suggested above) and the potential benefit of such projects to the economy. These projects will very likely be in priority sectors. Complicating such calculations is the probability that factors other than credit will pose constraints of their own.

V. Trade as a Constraint

There are three major issues to examine in the trade area. One relates to the products available for export. The other two issues concern the demand and price outlook for goods the Soviet Union will be exporting and the geographical location of this demand i.e., Western Europe, Eastern Europe, Japan, etc..

The decision about what to export for Soviet planners is essentially whether it is feasible and desirable to develop exports of manufactured goods as a significant part of the future increment to total exports. The alternative is whether to continue investment in the production of raw materials, thus maintaining the current high dependence on such exports in total foreign exchange earnings in the face of rising development costs. In recent years, finished manufactured products have accounted for only about 5 percent of total exports.[13] Because of rapidly increasing costs to developing raw material resources, Soviet leaders have had interest for some years in the possibilities of increasing manufactured exports. It is evident, however, that decisions made during the past few years make unlikely a significant role for exports of manufactured goods for some time into the future.

Trade in technology associated with direct investment is the most important form of international technology transfer today. Due to their predominance, compensation agreements are one of the major avenues of technology transfer in the Soviet Union. Despite other attractions, compensation is an inefficient mechanism for technology transfer. In nearly all deals, the western partner fulfills his side of the agreement by supplying a turnkey plant or equipment. After he has done this, his only worry is selling the product. There is little incentive for him to update the technological processes employed by the Soviet partner. Even when continuous transfers of technology are agreed upon in a contract, the results are likely to fall far short of potential. One of the biggest drawbacks of compensation is the great difficulty in adapting it to the production of manufactured goods. All the major compensation deals signed to date are for raw materials or basic chemicals, such as urea, PVC and polyethylene.[14]

These limitations of compensation are well understood by Soviet economists. Several years ago a number of alternative arrangements were explored in discussions with western firms. One arrangement was patterned on the joint venture model, but with long term leases substituting for foreign ownership. More than the technology itself, the Soviet Union needs western management systems to get the maximum from technology purchases. The joint venture model recognized this fact. There was opposition, however, to these proposals from various quarters (the Ministry of Foreign Trade, the chemical industry). Such profit and risk-sharing ventures were seen as being incompatible with the Soviet economic system. Serious consideration of such proposals was apparently deferred. Lacking some such means for the accomodation of foreign investment, there is little prospect that manufactured goods can play a significant role in the future in providing the needed

[13] Paul Ericson, "Soviet Efforts to Increase Exports of Manufactured Products to the West," in Soviet Economy in a New Perspective, edited by John P. Hardt for the Joint Economic Committee of Congress (Washington, D.C.: Government Printing Office, 1976, p. 710.

[14] Barclay, op. cit., Appendix B.

boost in exports. Compensation agreements in raw materials, despite evident limitations, will remain the preferred model for Soviet trade in technology during the 1980s.

Prospects for new compensation deals involving raw materials are not promising at present. The exception is natural gas, where additional contracts to supply gas via pipeline from the Urengoy fields in northwest Siberia to Western Europe are expected by 1980. There are several factors limiting western firms' interests in compensation. One is the current excess capacity in industries producing products the Soviet Union would like to export, such as basic chemicals, steel, copper, and wood products. The depressed chemicals market in Western Europe has already been hard hit by Soviet and East European imports. The volume of imports is still relatively small, no more than 5 percent of total supply.[15] But the effect on prices at the margin has been very significant. Further sharp hikes in exports will occur in the next few years as the plants now under construction are finished.

The difficulties associated with compensation have, thus, been increased by the slower growth being experienced in the West. There is a risk that western political reaction to these problems may lead to restrictions being placed in such buy-back deals. Also there are risks that western governments may initiate anti-trust proceedings against compensation deals. The EEC commission, for example, recently charged that swap deals in aluminum between western producers and Eastern Europe constitute a de facto cartel.[16] A further problem for some Soviet products is growing competition in industrial countries' markets from developing and OPEC countries, particularly, in basic chemicals and fibers.

Soviet planners face a unique set of restrictions as regards the geographic location of demand for future exports. The basic thrust of economic development is toward the East, Siberia and the Far East. The bulk of Soviet export commitments are to the West, primarily the CMEA countries in Eastern Europe and to a lesser extent, Western Europe. In view of the increasing cost of transporting resources from Siberia to countries west of the Soviet border, a sensible alternative would be to redirect more trade toward the Pacific basin countries, particularly Japan. This option has gained in importance with the construction of the new Baikal-Amur railroad.

Prospects for economic cooperation with Japan, however, have worsened markedly following the signing of the Japan-China peace and friendship treaty last year. Part of the reason for the Japanese decision to tilt toward China was apparently related to frustration in negotiating the return to Japan of four disputed islands north of Hokkaido. The Soviet Union is said to have threatened retaliatory action against the signing of the Japan-China treaty. Military bases have recently been built on two of the islands.[17]

Given these developments Japanese observers were quick to note a change in Soviet attitudes at the Tokyo meeting of the Japan-Soviet Business Cooperation Committee this February. According to the Japan Economic Journal the Soviet side indicated its strong desire

[15] "Chemicals in the East Explode West." The Economist, Feb. 10, 1979, p. 84.
[16] "Probing the Club." The Economist. Sept. 23, 1978, p. 97.
[17] "Change in Soviet Stance." Japan Economic Journal, Feb. 27, 1979, p. 10.

to obtain Japan's cooperation in Siberian resource development. The reaction on the paper's editorial page was straightforward:

> The Japanese side turned a cold shoulder to new Soviet overtures for participation in big development projects, such as construction of an integrated steel mill, and development of copper at Udokan and asbestos at Molozhozhinoe. Japanese businessmen at the conference told their Soviet counterparts that they would carefully study the proposals which call for Japan's purchase of resources developed and products manufactured. This amounted to shelving the proposals.[18]

The rapid development of the China market which seems probable in the next few years will hinder Soviet efforts to attract western firms to Siberian projects. This is particularly true for Japanese companies. Large Soviet and Chinese projects will be competing to some extent for the same western partners, for credits and also for western markets. Both China and the Soviet Union have publicized major coal and copper projects and both will be seeking help in developing offshore oil fields.

The Soviet Union's trade relations with Eastern European countries pose another major restraint on the geographical pattern of Soviet trade in the 1980s. Eastern Europe's needs for Soviet oil and other raw materials will continue to rise during this period. The Soviet Union may not be able to meet the increments to Eastern European demand to the same extent as in the past, but political considerations suggest that the continuation of raw materials supplies to Eastern Europe will remain a top priority. Given their debt problems, though, Eastern Europe will not be able to contribute much capital for new Soviet raw materials projects. Hence, export commitments to Eastern Europe will be a restraint on efforts to increase exports to the West. And though the Soviet Union gains substantially from CMEA trade, the benefits are largely consumer not investment goods.

In summary, then, the constraints to Soviet policy making in the trade area are varied, but significant. The Soviet inability to develop manufactured goods for export is probably the most important limiting factor to longer-term economic policy. The reasons are primarily domestic and reflect the inadequacies of the Soviet system of management and the unwillingness and/or inability to reform the system. By contrast, the other trade constraints are primarily external and exogenous. Although the potential demand for exports of major compensation deals was not examined in detail, it is evident that serious problems have already been encountered with chemicals. The likely continuation of moderate growth rates in Japan and Western Europe suggests that more such problems will be encountered in the future. The geographical constraints to the development of Soviet exports—Japan, the China factor, and Eastern Europe, all seem largely outside of Soviet influence, barring major changes in Soviet foreign policy.

The effects of these constraints on Soviet priorities in the context of the long-term plan appear very significant. The options facing Soviet policymakers focus primarily on the domestic factors which limit the effectiveness of technology trade. Given the foreign market and geographical constraints and the huge costs to the deferral of priority projects, the desirability of experimenting with various

[18] Ibid.

forms of foreign investment and management participation gains added weight. For such options to have much of a contribution in the period to 1990, major decisions would be necessary in the next year or two. There are no signs at present that such changes are being contemplated.

VI. Conclusions

Among the foreign options available to Soviet policymakers in the coming decade, those in the trade area pose the greatest problems and challenges. The constraints of market demand and location present significant limitations to future Soviet export expansion, given the current commodity composition of trade. Soviet planners possess little scope for a flexible adaptation to these constraints, unless ways can be found to deal with the complex set of domestic factors that hinder the expansion of manufactured exports. These domestic constraints have proven to be very resistent to change in the past. Until a new generation of Soviet leaders emerges they will continue to resist change in the future. By contrast, constraints on long-term economic strategy due to credit appear much less important and more amenable to modifications in Soviet policy. The major problems relate to the very large size of some of the projects.

In terms of relative importance as a constraint on Soviet decision-making, the following ranking is suggested:

(1) Domestic factors limiting the effectiveness of technology trade.

(2) Foreign market demand and location factors limiting the access of Soviet goods.

(3) Factors relating to credit availability.

The ranking points to several conclusions for western policy. The most important restraint on the use of foreign economic options by Soviet policymakers is a domestic one and is not, therefore, under the influence of western policy. Secondly, the importance of credit availability as a constraining factor on Soviet policy is probably overestimated. Soviet credit policy appears cautious and conservative. For this reason, restrictions by western governments on lending to the Soviet Union promise little in the way of political leverage. The most important issues for western policy lie in the trade area, particularly in relation to market access and fair trade practices.

U.S. policy toward the Soviet Union since 1975 has focused on the denial of MFN, of Eximbank credits and selected Soviet technology purchases. The Soviet Union has been able without much difficulty to deny us any political benefit from the policy and lost sales by U.S. business have imposed economic costs. In turn, we have been unable to deny their access to credit and technology in other countries.

In the wake of the 1974–75 recession and the opening up of China, market access for exports is now a very important constraint facing the Soviet policymakers; it is also directly controlled by U.S. policy. We both stand to gain economically from normalized trade relations and there should also be political gains for the United States. In offering MFN and normalized trade and credit relations, however, we must be careful to keep the potential benefits to the Soviet side in proper perspective and bargain accordingly.

SOVIET ECONOMIC PERFORMANCE IN A GLOBAL CONTEXT

(By Herbert Block)

CONTENTS

Summary

This paper views Soviet economic performance and power in a global context. It uses as its yardstick the growth and volume of national products, without disregarding the many other factors that determine the international pecking order. Nevertheless, larger wherewithals are a potential source of greater welfare, might, and prestige, and the GNP is not only a mass of goods and services, it is also an index of their producers' diligence and flexibility; it bespeaks the efficiency of their institutions and policies. On the whole every nation deserves its GNP. And in power rivalry, other things being equal (quite an assumption!), the greater economic potential will win out.

Of humanity's combined GNPs totalling in 1978 8½ trillion (1978) dollars the United States produced one fourth, the USSR one eighth. The European Community outranks the USSR with close to 19 per-

cent of the planetary product but it is not a national entity. So there are only two superpowers. The USSR may match the US militarily; economically it is not in the same ball park. The PRC and India surpass both in population (23 and 15 percent of mankind as against an American 5 percent and a Soviet 6 percent), but economically they are far from being superpowers (as yet).

Comparing the two superalliances shows that the Soviet group (Warsaw Pact, Mongolia, North Korea, Vietnam, Cuba) encompasses about 10 percent of mankind and 18 percent of the planetary product, the Western group (NATO, Japan, South Korea, Australia, New Zealand, et al.) 17 percent of the world's population and 58 percent of its product. If the balance of power differs from the GNP ratio, it is not for lack of wherewithal on the part of the U.S. and its associates. In fact, the U.S. alone has close to half as many people as the Soviet group and an output (achieved with superior technology) 43 percent larger than the USSR with all its allies.

The proportions adduced for West and East are unequivocal despite the statistical uncertainties surrounding economic aggregates and population figures alike. The problems become heavy as soon as less developed nations are examined. The author, after discussing some of the pertinent literature, advances GNP ratios of 60:100 in an Indian-Chinese comparison, 20:100 for India versus the USSR, and about 34:100 for the PRC and USSR, but such proportions are approximations and not precise measurements.

Coalitions can always be renounced as well as joined, and some of the neutrals, fence sitters, and mugwumps outside the superalliances may sooner or later side with one or the other or team up with the solitary PRC. The residual, most diverse in its composition, represents 21 percent of the planetary product, 49 percent of the world's population, and no less than 80 percent of what are now 163 sovereign states. It includes the "Third World," and while the entire less developed world outside the Communist realms has a combined national product below that of the Warsaw Pact, its population pool is large and its political and ideological radioactivity is perilous and far-reaching.

Comparing national products over space and time conjures up statistical problems of Einsteinian relativity. Still, the trends are quite clear. As nations ravaged during the Second World War regained their strength, the economic preeminence of the U.S. receded, a normal process, though since the 1960's American policies have contributed to the relative decline. Between 1950 and 1978 the American share in the planetary product declined from 33 percent to 26 percent. However, the Soviet share rose very little, i.e., only from 11.9 to 12.4 percent. The PRC's share of about 4 percent remained stable. There were, of course, startling changes. Japan's share increased from 3.8 to 12.1 percent; Brazil and other developing countries enlarged their role; OPEC members displayed a sudden embarras de richesses, while Great Britain's share went from 4.8 to 3 percent. The growth experience of the USSR and the advanced West on the whole has been quite similar over the decades with GNP progress of around 5 percent on average in the 1950s and 1960s and a noticeable slowdown to less than 4 percent in the 1970s. Does this slowdown in East and West suggest

that there are forces at work that depress growth in industrial societies, whatever their mode of operation? Or is the deceleration a short-lived happening either in the USSR or in the advanced West, while hard times will continue on the other side?

There are some developments that reduce productivity growth in all modern nations, namely adverse changes in the physical and social environment in the widest sense of the word. Awareness of these problems is greater or, at least, more vociferous in the West than in the USSR and so is the outlay in the fight against deterioration. The public service sectors with their seemingly lower productivity—it is largely a statistical illusion—expand everywhere, though more in the advanced West than in the USSR. There is no evidence of a growth-depressing slowdown in technological progress on either side, a Soviet lag vis-à-vis the West notwithstanding. The law of diminishing returns is in operation throughout the world and technology can be relied upon to offset its impact, although it may temporarily fall behind (energy output is such a field, with the OPEC monopoly—which benefits the USSR—complicating conditions).

Specific reasons for a slowdown on the Soviet side are a heavy and rising military burden, which absorbs more resources otherwise available for growth-promoting capital formation than in the West, and an economic system which has become increasingly cumbersome in running a by now vast and sophisticated economy. These peculiar institutions and policies appear unchangeable at the present time; as a result the Soviet Union will have difficulties coping with resource constraints both human and material in the foreseeable future. The more flexible and innovative market economies have a better chance to overcome the current dislocations and the accompanying malaise, but this is where economics converge with unfathomable social and political elements and where analysis ends in a matter of hunch and an article of faith.

I. The International Pecking Order as Reflected in National Product Statistics

A. Problems of Politics

These remarks on the Soviet economy in a global context deal with the international pecking order. They face conundrums as to what determines the standing of a nation and how to measure it, in other words, problems of politics and of statistics.

Our little gray cells, drawing upon a welter of information, dissolve the integrated stream of history into political, spiritual, economic, military, and other components—a miraculous process, but, oh! how deficient in precision and certainty. Spectroscopy, resolving the rays of a star through diffraction gratings, determines its composition and, in the presence of red shifts, its course and direction, by far more accurately than our intuition applied to history, past or present. Political science, to be sure, endeavors to improve upon our perception by building cliometric models measuring historical components and movements (including possible red shifts) but this process, rigorous

though it appears, does not eliminate intuition; it pushes it back into the underlying evaluations and assumptions including theories on the number and weight of specific factors observable in history (let us, however, not underrate the role of intuition in the progress of natural science).

This author refrains from cliometric experiments and sticks to his field, economics and, still more narrowly, economic aggregates. He knows full well that the volume and efficiency of output alone does not guarantee the happiness of individual citizens or the power of their body politic (even less do they account for the charisma of a leader or the marksmanship of a terrorist). But larger wherewithals are a potential source of greater welfare and comfort, of greater power and prestige (the latter intertwined with the envy of outsiders, which occasional grants and permanent strength may serve to diffuse).

Now a considerable GNP per capita of population and labor force does not come about by accident, though it is sometimes under the influence of exogenuous conditions. On the whole every nation deserves its GNP. The national income is not only a mass of products and services; it is at the same time an index of their producers' diligence and steadfastness, flexibility and inventiveness, their out- or inward orientation, and the efficiency of their institutions and policies. Even faced with events not of their making, their economic performance will reflect their ability to react to challenges and opportunities. Nations experiencing environmental changes or the gain or loss of territories or resource bonanzas and stringencies have responded according to their character, some convèrting calamities into progress, others turning windfalls into adversity.

While GNP estimates express ever-fluctuating scarcity values, they are not more relative than demographic or geopolitical data. To be sure, people are people (and Western thought teaches their equal dignity), but they differ greatly in productivity and requirements. Square miles are square miles but their significance as a source of welfare and power varies with the number of inhabitants, the stage of economic development, and technology. Distances are vast or slight depending on the technology of communications; economic and strategic capability or vulnerability change, sometimes abruptly, depending on the tools for peace or war.

B. Problems of Statistics

The statistical conundrums touched upon at the outset are fit for a volume the size of the present. Alexis de Tocqueville—whom to quote is de rigueur—thought it not only "difficult to compare social expenditures" in the U.S. and France, but he added, "It would be even dangerous to attempt it. When statistics are not based on strictly accurate calculations, they mislead instead of guide. The mind easily lets itself be taken in by the false appearance of exactitude which statistics retain even in their mistakes, and confidently adopts errors clothed in the forms of mathematical truth." [1]

Almost a century and a half have elapsed since de Tocqueville wrote this passage, and even its farseeing author would be amazed at the

[1] Alexis de Tocqueville, Democracy in America. Part II. Section 5. p. 201. "Can the Public Expenditure of the United States Be Compared With That of France?" (ed. J. P. Mayer and Max Lenz, New York, 1966).

amounts of quantitative knowledge now at our disposal. Yet his verdict remains correct and enjoins us to spell out what the figures in this paper mean—or do not mean. This will be done as we proceed from point to point. We will, first, compare the economic volume of the USSR with that of the only other superpower, the United States, both in their respective alliance systems and in relation to sympathizers, antagonists, or fence-sitters outside (and even inside) their systems. We will then examine the economic dynamics over time. In this connection we will touch upon a question which concerns the USSR as much as the West, namely whether the world experiences a downward trend in economic growth. Finally we will try to trace the course of GNP growth to its sources, which—as several ingenious economists have shown in detail—differ greatly between periods and nations. Even more significant than the change in inputs and their combined productivity in their impact on growth are the (little understood) underlying social factors influencing efforts and efficiency.

II. Present Economic Ratios

A. Soviet-United States GNP Ratio

In 1978 4.3 billion humans[2] produced combined GNPs of 8½ trillion dollars of 1978 purchasing power.[3] The shares of the U.S. and USSR in the world population (5 and 6 percent, respectively) remain far below those of the PRC and India (23.2 and 15.3 percent, respectively),[4] but the US and USSR are superpowers, China and India are not (or not yet). What counts is the GNP or, better still, the capacity to produce. In this respect the US outperforms the USSR, not to mention the PRC and India. The American share in the planetary product is one fourth, the Soviet share one eighth. The European Community (close to 19 percent of the world total) actually outranks the USSR but as of now it is not a national entity. Japan's share in 1978 was 8.6 percent; expectations voiced a decade ago that the Japanese GNP would catch up with the Soviet at the end of the 1970s came to naught. But earlier Soviet boasts to catch up with the US also hit a catch.

In some cases there may be doubt whether one country is ahead of another (e.g., Greece and Finland with GNPs of about $24 billion), but the US-Soviet comparison is unequivocal, irrespective of some dif-

[2] In my Planetary Product for 1977 and 1978 (forthcoming Special Report of the Department of State) I use a mid-1978 figure of 4.327.5 million. The U.N. implies an estimate of 4,255 million (Demographic Estimates and Projections for the World, Regions and Countries as Assessed in 1978, U.N., Population Division, 25 January 1979. This paper, incidentally, makes Israel part of Europe—a relativity of space Einstein would have approved). The Environmental Fund (World Population Estimates 1978) presents a total of 4,365.3 million. The difference is largely due to ignorance about China and India (see below, section II D). The mass migrations that characterize our age create uncertainties about the demography of many countries; fortunately, there are as yet no interplanetary migrations.

[3] All dollar figures in this report refer to 1978 purchasing power. My Planetary Product aims at purchasing power equivalents. Applying the methods Professor Irving B. Kravis uses in his International Comparison Project (ICP) might increase my 1978 figure of $8.46 trillion for the world by close to $1 trillion, chiefly because of the ICP's higher purchasing power equivalents for less developed countries. For the world as a whole transnational factor payments even off so that in the total gross national product equals gross domestic product.

[4] Areawise the territory of the United States is about equal to that of the PRC or Canada and 42 percent that of the U.S.S.R. Under present conditions these powers have sufficient space for economic and strategic purposes.

ference in the calculations.[5] The Soviet economy is half the size of the American. Insofar the two superpowers are not in the same ballpark.

Nobody will contend that, with a per capita ratio of 2.4, the average American is 2.4 times as happy as his Soviet contemporary. But let us not disregard the gratification that greater comfort provides for those enjoying it and the lure American affluence exerts on another nation with lesser means and ease. If two countries engage in a power struggle of short duration—the confrontation may in the end be limited to diplomacy and propaganda—the men and materials ready for immediate action are, of course, of utmost importance. In this respect, the US and USSR are believed to have reached a so-called approximate parity. In a war of long duration, assuming proportionate destruction and an equal will to resist, the "winner" will be the country with the larger economic potential and the greater productivity, flexibility, and inventiveness. These latter qualities are actually supported by industries producing those consumer supplies that are deemed essential; all other facilities will in an emergency begin turning out the numerous goods and services that a modern war requires.

B. A Digression on Steel

The Soviet-American ratio for industrial output is not much different from the GNP ratio; it is about 60:100 in favor of the US. But, we are told, the steel ratio is 122:100 (crude steel production 1978 in millions of metric tons 151 in the USSR, 124 in the US). Nevertheless, it would be a mistake to conclude that the USSR is 22 percent stronger than the US. It is a weakness that requires the Soviet economy—with its modest car and container production—to use up 2½ times as much steel per unit of GNP as the US (it is even compelled to import increasing amounts of steel from the West). The ton mentality that dominates Soviet economic institutions, its penchant to produce much in quantity without due regard to quality, leads to a waste of steel in production and to the output of manufactures (above all machinery) heavier than desirable. This is also an

[5] In my article in this volume's 1976 predecessor (Soviet Economy in a New Perspective, p. 246) I presented for 1955 and 1970 Soviet-American GNP ratios of 36:100 and 49:100.. Abram Bergson's ratios, using data on pp. 62, 67, and 247 of his book on Productivity and The Social System—The U.S.S.R. and the West, Cambridge, Mass., and London, 1978, are implicitly 35.3 and 49.7:100. The most recent ratios of CIA for 1955 and 1970 are 37.5 and 52.1 :100. For 1978 CIA's estimate is 55 :100 (but now revised upward in the paper on U.S. and USSR—Comparisons of GNP by J. Noren, I. Edwards and M. Hughes in the second part of this volume). The ratio in the latest edition of my Planetary Product is 49.3 :100. The World Bank Atlas offered in its 1974 edition a ratio of 32.3 percent for 1972 and in its 1978 edition of 41.4 percent for 1977. Both ratios are too low. A Yugoslav author, Ivo Vinski, implies in his book Kretanje Društvenog Proizvoda Svijeta od 1910.do 1975.G. (Zagreb 1978) a 1975 GDP ratio for the U.S.S.R. versus the United States of 46:100 (my own ratio for that year is 51.4:100). Last but not least, the Soviet themselves: In Narodnove Khozyaistvo SSSR v. 1977 g. Moscow 1978, p. 53, the Central Statistical Office of the U.S.S.R., applying the Marxist concept of national income, compares for 1977 a U.S. total of $1,010 billion with a Soviet national income valued at $548 billion at the official rate of exchange and at $673 billion "at comparable prices". It suffices to consider this latter version of a purchasing power equivalent. The ratio is 66.6:100. The American figure appears reasonable; it represents the net material product within a GNP of $1,887.2 billion (this particular comparison uses 1977 dollars). I moved the Soviet calculation from Marxist to Western concept with the help of John S. Pitzer's excellent Research Paper U.S.S.R.: Toward a Reconciliation of Marxist and Western Measures of National Income, CIA, ER 78–10505, October 1978, Table 2. When I added to $673 billion the 26.3 percent which according to Pitzer accounted for the 1970 difference between Soviet national income utilized and GNP, I arrived at $846 billion; when I added 31.8 percent, i.e., the whole difference between the Soviet figure and CIA's 1970 GNP ruble estimate, the Soviet 1977 GNP (Western concept) became $883 billion. There appears to be no reason to increase the supplement for services omitted in the Soviet national income between 1970 and 1977. The result is a Soviet-U.S. GNP ratio of 44.8 or 46.8:100 for 1977. I advance this calculation not in the belief that it offers the final solution to the problem but to show that Soviet statistics imply a rather low GNP ratio.

obstacle to exports of Soviet equipment. With military concerns in mind, it must be added that (without losing sight of ship and tank building) wars are no longer—and were probably never—won with steel; they are won with equipment embodying new technology.

To finish the steel comparison and expand the record to embrace East and West, we list in table 1 the 1978 crude steel output of the superpowers and their associates.

TABLE 1.—*Crude steel output of the superalliances, 1978*

[In millions of metric tons]

U.S.S.R.	152.0	Netherlands	5.6
		Denmark	.8
Poland	19.5		
Czechoslovakia	15.4	Total, European Economic Community	132.4
Romania	11.6		
German Democratic Republic	6.9		
Hungary	3.9	Turkey	2.3
Bulgaria	2.6	Greece	1.0
		Norway	.7
Non-Soviet Warsaw Pact	59.9	Portugal	.6
Total, Warsaw Pact	211.9	Other NATO	4.6
Democratic People's Republic of Korea	3.0	European NATO	137.0
Grand total	214.9	Total, NATO	276.0
United States	124.0	Others:	
Canada	15.0	Japan	102.0
		Republic of Korea	5.0
Federal Republic of Germany	41.3	Republic of China (Taiwan)	3.5
Italy	24.2	Australia	7.6
France	22.9	Brazil	12.2
United Kingdom	20.2	Mexico	6.7
Belgium-Luxembourg	17.4	Sweden	4.4

Juxtaposing Warsaw Pact and NATO countries, the steel ratio—whatever its meaning—shifts to 77:100 in favor of the Atlantic Alliance; adding North Korea on the Soviet side, Japan, South Korea, and Australia to the West, the ratio becomes 55:100. Out of a 1978 world steel production of 713 million m. tons, the Soviet camp accounts for 30 percent, the Western countries just enumerated for 55 percent. A capacity comparison would even widen the gap. Since we pointed to the perennial Soviet weakness of "steel eating" (a word Khrushchev coined), we have also to decry the Western steel overproduction of recent years. The structural crisis is due not only to Japan's ultramodern steel industry competing with frequently obsolete European and American plants—they are now being renovated—but, though to a smaller degree, also to the expansion of steel output—often for irrational reasons—in developing countries. The drive is not limited to the West. If between 1965 and 1978 Brazil's output of crude steel increased from 3.0 to 12.2 million tons, Romania's grew from 3.4 to 11.6 million. Beijing had vowed to overtake the (once so redoubtable) British steel industry and did so in 1975. Starting from close to nothing, the PRC's steel output (not counting, of course, the 3.5 million on Taiwan) reached an estimated 31.7 million m. tons in 1978 and is now ranking fifth in the world. China has begun to approach West Germany with its 41.3 million t. But let us not overlook that there is a quality difference between PRC (and also Soviet) steel and the steel of advanced Western nations.

C. GNP Ratios for the Superalliances

Passing on to the more meaningful GNP statistics, we encounter the data for the superalliances assembled in table 2.[6]

TABLE 2.—THE SUPERALLIANCES: 1978 GNP IN TOTAL AND PER CAPITA

[Value data in 1978 dollars]

	GNP (billions)	Midyear population (millions)	GNP per capita (dollars)
Eastern camp:			
U.S.S.R.	1,046.6	261.4	4,004
Poland	108.3	35 0	3,094
German Democratic Republic	81.0	16.8	4,834
Cechoslovakia	70.7	15.1	4,673
Romania	67.4	21.9	3,083
Hungary	32.1	10.7	3,000
Bulgaria	24.8	8.8	2,799
Non-Soviet Warsaw Pact	384.3	108.3	3,549
Total Warsaw Pact	1,431.0	369.7	3,871
Mongolia	1.5	1.6	937
Democratic People's Republic of Korea	16.2	18.2	890
Vietnam	11.0	51.6	213
Cuba	12.5	9.8	1,275
Subtotal	41.2	81.2	507
Grand total	1,472.2	450.9	3,265
Western camp:			
United States (50 States)	2,106.9	218.6	9,640
Canada	196.6	23.6	8,323
Federal Republic of Germany	513.1	61.3	8,372
France	411.3	53.3	7,719
United Kingdom	254.2	55.8	4,556
Italy	210.7	56.7	4,211
Netherlands	88.1	13.9	6,324
Belgium	69.7	9.8	7,085
Denmark	38.9	5.1	7,607
Luxembourg	2.5	0.4	6,889
Total European Economic Community	1,588.5	256.3	6,200
Turkey	43.4	43.2	1,005
Norway	31.9	4.1	7,867
Greece	24.2	9.4	2,576
Portugal	16.9	9.8	1,723
Ireland	1.3	0.2	5,706
Other NATO-Europe	117.7	66.7	1,765
European NATO	1,706.2	323.0	5,282
Total NATO	4,009.7	565.2	7,094
Japan	727.9	115.0	6,329
Australia	96.7	14.2	6,800
Republic of Korea	39.0	37.0	1,054
Republic of China (Taiwan)	25.1	17.1	1,468
New Zealand	16.0	3.1	5,119
Israel	14.8	3.6	4,154
Subtotal	919.5	190.0	4,839
Grand total	4,929.2	755.2	6,527

Source: The Planetary Product in 1977 and 1978, the Department of State (forthcoming).

[6] The GNP data are taken from the forthcoming 1977–78 issue of the author's Planetary Product (referred to in footnote 2). The 1976–77 version appeared as Special Report No. 44 of the Department of State, June 1978. The GNPs of the advanced Western countries are converted into dollars not with 1978 average rates of exchange but with 1973 rates which are closer to purchasing power equivalents. See text on pp. 12–15 of the 1976–77 paper including a comparison with the results of the U.N. and World Bank-sponsored ICP mentioned in footnote 3. The GNP data of the six non-Soviet Warsaw Pact countries are taken from Economic Growth in Eastern Europe 1965–78 by Thad P. Alton and Associates, Research Project on National Income in Eastern Central Europe, New York, 1979. The Romanian estimate yielding a per capita GNP above that of Poland and Hungary appears to be on the high side. Both the economic and military strength of the superalliances is discussed in The Economic and Military Balance Between East and West by Herbert Block and Edward N. Luttwak, American Bar Association, Chicago, Ill., April 1978.

In 1978 the population of the Warsaw Pact members numbered 65 percent that of NATO; the GNP ratio was 36:100 in toto, 55:100 per capita. The greater economic strength collected in NATO is obvious. The political and military balance is another story. Part of this story is the position of the protagonist in each alliance system. In the Warsaw Pact the USSR accounted for 71 percent of the population and 73 percent of the GNP, in NATO the US for 53 percent demographically, 37 percent economically. Decisions are obviously easier to arrive at in a group consisting of one superpower and six middle-sized countries than in the NATO with one superpower and fourteen nations, great, medium, and small (not to mention the difference between Eastern authoritarian and Western democratic rule). The Soviet Union's largest partner, Poland, had a GNP 9.7 percent that of the USSR; next in line was the GDR with 7.7 percent. Romania, at 6 to 7 percent of the Soviet GNP and yet at sixes and sevens with its imperative Pact leader, plays a risky game. In NATO the West German GNP was 30.4 percent as large as the American converted into dollars at the average 1978 exchange rate or 24.4 percent at a rate closer to purchasing power equivalent; the corresponding proportions for France (with its currency less overvalued vis-à-vis the dollar than the mark) were 22.3 and 19.5 percent, for the UK 14.6 and 11.2 percent, for Italy 12.1 and 10 percent. Even the latter ratio gives Italy more economic weight in NATO than has Poland in the Warsaw Pact.

Each superpower has military commitments besides NATO and the Warsaw Pact. They range in form from multi- or bilateral treaties to policy declarations and in substance from low-risk to high-risk associations and from solid to brittle or even ephemeral.[7] In the Soviet camp are Mongolia, North Korea, Vietnam, and Cuba. The strength of commitments between the USSR and several African and Asian countries is uncertain. The US is firmly bound to Japan, South Korea, Australia, New Zealand, and Israel; the American defense treaty with the Republic of China continues into 1980 but security assistance is likely to go on. The US has given additional pledges to the Phillippines and Thailand (both members of ASEAN) and to others. The ASEAN countries (others are Indonesia, Malaysia, and Singapore) are not covered by explicit American commitments but their outlook tends to tie them to the Western side. (In 1978 ASEAN as a whole had 247 million inhabitants and a GNP—with Third World Supplements—of $165 billion, i.e. 44 percent as much population and 4 percent as much GNP as NATO).

What stands out in a comparison limited to the countries enumerated in Table 2 is that the Soviet group with all its associates encompasses about 10 percent of mankind and 18 percent of the planetary product, the Western group 17 percent of the world's population and 58 percent of its product. If the balance of power differs from the GNP ratio it is not for lack of wherewithal on the part of the US and its confederates. In fact, the US alone has close to half as many people as the Soviet side and an output (achieved with superior technology) 43 percent larger than the USSR together with its allies.

[7] John M. Collins, in his book, American and Soviet Military Trends Since The Cuban Missile Crisis, Washington, D.C. 1978, lists on pp. 161–165 the security commitments of both sides as of early 1978.

D. Sino-Soviet Proportions

Secretary Schlesinger called the People's Republic of China the 16th member of NATO. Whatever description we may use, the vision of an arrangement between the superalliance of the West and what will be a formidable superpower in a foreseeable future has produced in Moscow the cauchemar des coalitions that Count Shuvalov ascribed to Bismarck. It is therefore important to fit the PRC into the global context. Beijing itself is—in contrast to Washington and Moscow—not the hub of an alliance. Albania rejected it as it forswore the USSR years ago; the Kampuchean regime of Pot went to pot, and the PRC's friends in various parts of the Third World did not prove dependable either. Hanoi (with 52 million subjects—not counting 12 million Laotians and Cambodians under its thumb, a total GNP of very roughly $7 billion, and a strong military establishment) has become a thorn in China's flesh.

Estimates of the GNP of Mainland China suffer from the paucity and inadequacy of Beijing's statistics; per capita calculations are afflicted by inadequate population estimates.[8] Even if the raw data were by far better, a host of methodological headaches would still afflict us (adjusting the statistics of the PRC to the standards of Western market economies; comparing the purchasing power parity of an indigent country with that of the US or even the USSR; coping with changes in real price relations during a period of rapid economic development, etc.).

What we know about the Chinese national income is largely the work of American and British scholars and much of it is assembled in various volumes of the Joint Economic Committee on the economy of the PRC. The latest is Chinese Economy Post-Mao, November 9, 1978; this fat green book has eclipsed the Little Red Book. Several JEC volumes contain the important national income calculations by Arthur G. Ashbrook, Jr., and Robert M. Field. The latter will soon publish a "Recomputation of Chinese National Accounts" as a sequence to the 1978 tome. I myself, not a Sinologist, can only hope that the forthcoming revisions will help improve comparisons between the PRC and its great neighbors to the North and South.

Ashbrook and Field offer for 1978 an estimate of $437 billion in toto and, applying Aird's population figure, of $435 per capita. CIA's latest GNP calculation for the USSR—$1,146.4 billion—implies a Sino-Soviet ratio of 38:100 in toto and of 10:100 per capita. India's GNP, converted at the official rate of exchange, equaled $105.1 billion and per head of a population of 660.7 million (according to the Bureau of the Census; the World Bank Atlas has only 643 million) $159. These figures undervalue the Indian GNP greatly. The International

[8] The new 1978 figure in the medium series of John S. Aird, Bureau of the Census, FDAD, is 1,003.9 million, i.e. 23½ million higher than his previous estimate for the same year. The difference is ½ percent of all mankind. Leo A. Orleans has in the 1975 JEC Compendium (p. 77) for 1978 a projection of 887.4 million, Werner Klatt an implied figure of about 870 million (China's National Accounts—as seen by Western Analysts, Bundesinstitut für Ostwissenschaftliche und Internationale Studien, Cologne, December 1978). If demographic data are that uncertain, what may we expect of GNP estimates with their value problems? The difference between Klatt's figure and Aird's high series is 169 million people, more than two thirds the entire U.S. population.

Since this footnote was written, it has been disclosed (see The Washington Post, May 14, 1979) that PRC authorities are now using a population figure that, extended to mid-1978 and excluding Taiwan, amounts to 966 million. A census is planned for 1980; the new official figure is still only an estimate. It is 3.9 percent below Aird's calculation and 8.8 or 11.1 percent, respectively, above the extrapolations of Orleans and Klatt.

Comparison Project calculated for 1973 an exchange rate deviation index of about 3 [9] that, if it were roughly the same by 1978, would yield an Indian GNP of $315 billion in toto and of $477 per capita. The Indian-Chinese ratio would then be 72:100 and 110:100, respectively. Opinions differ as to whether India or the PRC has the larger per capita GNP (which must not be mistaken for consumption and says even less on income distribution). I am inclined to favor the PRC considering its decidedly faster growth over the postwar decades and a number of important physical output data (of which steel is one; see above). If this is correct, the indicated Indian-Chinese ratio would require emendation with three alternatives in mind. Either the demographic data underlying the per capita figures are wrong (substituting Klatt's estimate for Aird's would raise the PRC GNP per capita from $435 to $502, i.e., by 15 percent). Or the ICP purchasing power for India is on the high side (it may, for instance, overstate the real value of Indian services as compared to services in an advanced country and, in particular, the US as the base country).[10] Or, finally, the Ashbrook-Field estimate for the PRC is below the purchasing power equivalent. If the Indian-Chinese ratio for GNP per capita were reversed (not 110:100 but, say: 100:110), the Ashbrook-Field figure would rise from $435 to $525. With Aird's population figure the PRC total would increase to $527 billion, i.e., half the Soviet GNP. This is unlikely. Until better data are available, I continue to use and extrapolate for the PRC the series Ashbrook presented in the JEC volume for 1972 [11] and for India a dollar series at nominal rates increased by a 60 percent Third World Supplement, which I apply to poor countries in general. The latter percentage is, as I have admitted all along, on the low side and so is the resulting Indian-Chinese ratio of 78:100 for GNP in toto and 52:100 per capita. If, the statistician's eye in a fine frenzy rolling, I may express my hunch, I would raise my Third World Supplement in the case of India to 100 percent and increase the Chinese per capita GNP by about 10 percent above the Indian. This would provide ratios for GNP in toto of 60:100 in the Indian-Chinese comparison, of 20:100 in an Indian-Soviet comparison, of 34:100 in a Sino-Soviet comparison.

E. Countries Outside the Alliance Systems

Always remembering that alliances can be renounced as well as joined and that neutrality may also be temporary, the world in its political structure consists currently of the Soviet camp with 11 states, 10 percent of mankind, and 17 percent of the planetary product, the PRC with 23 percent demographically and 4 percent economically, the Western camp as described in table 2 with 22 states, 17 percent of humanity, and 58 percent of the product, and all the others. These others embrace as of mid-1979 130 states, 49 percent of the world's population, and 21 percent of the product. The residual group

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[9] Slightly more or less depending on the concept used; see calculations by Irving B. Kravis, Alan W. Heston, and Robert Summers in their article "Real GDP Per Capita for More Than One Hundred Countries" in The Economic Journal, June 1978, pp. 215–242, and in their book International Comparison of Real Product and Purchasing Power—United Nations International Comparison Project: Phase II, Baltimore and London, 1978.

[10] According to the ICP book quoted in footnote 9, services of all kinds in the India of 1973 constituted 36.3 percent of the GDP at international prices, 16.6 percent at national prices (p. 124).

[11] Arthur G. Ashbrook, Jr., "China: Economic Policy and Economic Results, 1949–71" p. 5, in People's Republic of China: An Economic Assessment, Joint Economic Committee, May 18, 1972.

is most diverse. It includes four countries that call themselves Communist (Kampuchea and Laos with an unclear situation, Yugoslavia and Albania), several nations with a decidedly Western outlook but without NATO and related structures (Switzerland, Sweden, Finland, Ireland, Austria, Spain, and a few smaller states), all members of OPEC and OAPEC (15 together, but Egypt's membership in OAPEC has been suspended since April 1979), and many others, large and small, with sympathies, sometimes shifting, for this or that camp or simply sitting on the fence and ready to jump in either direction. The large number of states in the residue is indicative of the proliferation of sovereignty; there are now 163 independent nations in the world (counting two Chinas for, legal niceties aside, they are two states, each with the full paraphernalia of statehood), many of them by far less important than "dependencies" such as Puerto Rico or Hong Kong. They lack frequently the political and economic experience of well-tempered nations with accepted traditions or they are caught between modern and traditional modes of behavior or are unviable for one reason or another. Some of them, with small or tiny populations and slight domestic products, but with material resources much in demand, a vital geopolitical location, and a surfeit of passion have become bones of contention between the great powers or, as has been the case throughout history, they are exploiting great power rivalry. While the entire less developed world outside the Communist realms has a combined GNP below that of the Warsaw Pact and while it is divided in itself, its population pool is large and its political and ideological radioactivity perilous. The explosive power extends not only to international affairs but also to the domestic scene within the great powers (through minorities and factions) both in the East and the West.

III. Economic Performance in Three Decades

A. Long-Term Growth Fluctuations

Adding time to space we turn to Soviet performance in the context of global development in recent decades. Again the reader must keep in mind that the raw data for worldwide comparisons vary in reliability and that, depending on methods, concepts, deflators, etc. the rates of change differ. But the trends are quite clear (see table 3).

First of all, while the Western world suffered through the Great Depression, the Stalinist command economy—created exactly fifty years ago—started a rapid build-up of industries moving rural masses into more productive pursuits in the cities and pushing investment at the expense of personal consumption, utilizing the available resources to a wasteful limit, and preventing inflationary financing from unbalancing foreign economic relations by making the ruble a strictly domestic currency. According to Abram Bergson's calculations the Soviet net national product increased between 1928 and 1940 (the latter year including a larger territory) by an average annual 4.2 percent at 1937 ruble factor cost and by 9.3 percent with a composite 1937 base.[12] The Nazi regime followed a basically similar course, though with private enterprise maintained and with greater attention to consumer needs. The German net national product rose by a reported annual 9.3

[12] Abram Bergson's book quoted in footnote 5, p. 122.

TABLE 3.—PLANETARY PRODUCT WITH THIRD WORLD SUPPLEMENT IN SELECTED YEARS, 1950–78

[In billions of 1978 dollars]

	1950	1955	1960	1965	1970	1975	1976	1977	1978
WORLD	2,366.71	3,017.77	3,747.96	4,824.58	6,164.09	7,455.52	7,828.35	8,133.63	8,459.45
Developed countries	1,936.16	2,457.06	3,009.04	3,848.40	4,910.45	6,070.17	6,387.53	6,617.89	6,858.86
Less developed countries	430.55	560.71	738.92	976.18	1,253.64	1,385.35	1,440.83	1,515.74	1,600.59
Non-Communist countries	1,897.93	2,373.60	2,897.83	3,762.31	4,817.69	5,797.69	6,112.89	6,351.11	6,603.73
Communist countries	468.78	644.17	850.13	1,062.27	1,346.40	1,657.83	1,715.46	1,782.52	1,855.72
Developed non-Communist countries	1,584.58	1,973.89	2,370.91	3,058.79	3,905.76	4,736.65	4,997.30	5,178.83	5,371.92
United States	811.40	995.89	1,120.60	1,408.20	1,635.42	1,828.60	1,932.80	2,027.50	2,106.90
Developed Western Europe	597.00	735.30	919.32	1,168.26	1,532.15	1,770.63	1,852.19	1,887.82	1,944.47
Germany, Federal Republic	123.67	193.79	263.17	333.96	416.11	457.97	483.62	496.19	513.06
France	113.58	140.05	180.10	238.81	304.87	367.16	387.72	399.35	411.33
United Kingdom	126.06	144.28	163.94	191.98	215.36	236.73	242.89	243.78	254.18
Italy	57.08	76.26	99.90	128.27	171.24	192.53	203.31	206.77	210.68
Canada	51.73	67.93	82.38	108.30	136.79	174.80	184.95	189.93	196.58
Australia	28.80	34.56	44.89	56.61	73.53	89.01	92.39	94.33	96.69
New Zealand	NA	6.77	9.11	11.59	13.27	16.08	16.03	15.84	15.97
Japan	73.81	113.90	171.14	275.54	475.93	619.93	657.13	687.96	727.86
Less developed non-Communist countries	313.35	399.71	526.92	703.52	911.93	1,061.04	1,115.59	1,172.28	1,231.81
India	63.20	74.82	91.23	105.23	133.18	145.35	147.68	156.54	168.13
Brazil	19.32	26.83	37.33	55.81	80.77	135.12	147.25	154.11	163.82
Communist countries	468.78	644.17	850.13	1,062.27	1,346.40	1,657.83	1,715.46	1,782.52	1,855.72
Developed Communist countries	351.58	483.17	638.13	789.61	1,004.69	1,333.52	1,390.23	1,439.06	1,486.94
U.S.S.R.	269.68	357.60	479.31	608.91	790.17	940.40	980.84	1,014.19	1,046.64
Less developed Communist countries	117.20	161.00	212.00	272.66	341.71	324.31	325.23	343.46	368.78
People's Republic of China	70.10	117.20	138.90	169.60	217.00	283.33	283.33	300.50	323.94
Memorandum items:									
NATO total	1,367.95	1,724.99	2,025.14	2,573.95	3,119.63	3,542.28	3,735.78	3,872.11	4,013.16
NATO in Europe	512.19	666.36	835.62	1,066.25	1,345.61	1,538.88	1,618.04	1,654.68	1,709.98
Warsaw Pact	380.08	500.56	666.22	835.57	1,063.51	1,286.48	1,341.41	1,386.91	1,430.97
Six Pact members in Eastern Europe	110.40	142.96	186.91	226.66	273.34	346.08	360.57	372.72	384.66
All OPEC (OAPEC) members						356.41	394.83	418.83	435.17

Source: See footnote on table 2.

percent between 1932 (when it was at low ebb) and 1939.[13] The democratic West watched totalitarian growth with uneasy wonderment.

In the meantime Western economic policy began to learn from Keynes. A postwar depression—widely predicted since people expect always more of the same—did not take place. Instead a new chapter opened in economic history. For close to a quarter of a century (from 1950–73) the world economy grew by a unique average 5 percent per annum. (All GNP growth rates in this paper are in real terms, i.e., deflated as well as possible.) Recessions there were but—except for a few minor cases of actual GNP decline (zero growth in the USSR in 1963)—they were mere "growth recessions", i.e., years of low growth. GNP growth between 1950 and 1973 is calculated at 5.3 percent for the USSR, at near 5 percent for the non-Communist world. The persistent progress created in the West a euphoria, even hubris until a combination of currency disequilibria, commodity scarcities (real or contrived), environmental anguish, and other troubles shook the confidence, engendered an all but universal malaise, and revived theories of long-term cycles with an unpropitious wave now believed to engulf us.

The time pattern of growth varies even between closely allied market economies—which may not be without advantages; in fact, the severity of the 1974 recession was attributed not only to the "oil crunch" and similar happenings but also to the simultaneous collapse of an unusually pervasive boom in 1973. The growth experience of the Soviet economy coincides even less with that of the West. New periods of Soviet development began with the years 1955, 1959, 1964, and 1971.

B. The Soviet Challenge of the 1950's

Countries recuperate fast after wars; the USSR regained its prewar level of output by 1948. But in the early 1950s the performance appears to have slackened. We judge by the appendix tables made available by CIA/OER—a non-taxable windfall which I gratefully acknowledge. The series update with slight revisions for past years the careful computations made by the late Rush V. Greenslade and published in the preceding JEC volume on the Soviet economy.[14] The GNP figures show an average annual growth rate of 5 percent for 1954 over 1950, low not in itself but for a period when rehabilitation was still going on with significant takings from Eastern Europe. There is no doubt that the despotism of Stalin's last years had become a depressant, that international tension led to growth-retarding preparedness measures (the Korean war began in 1950; in August 1953 the USSR exploded its first nuclear bomb), and that agriculture did poorly in those years.[15]

Stalin's heirs, Malenkov and, after his fast eclipse, Khrushchev, did not change the economic institutions but made distribution less inegalitarian and saw to it that there was more to distribute. During

[13] Statistisches Bundesamt, Bevölkerung und Wirtschaft, 1872–1972, Stuttgart-Mainz, 1972. p. 265.

[14] Rush V. Greenslade, "The Real Gross National Product of the U.S.S.R., 1950–1975" in Soviet Economy in a New Perspective, Joint Economic Committee, Oct. 14, 1976, pp. 269–300.

[15] Abram Bergson in The Real National Income of Soviet Russia Since 1928 (Cambridge, Mass., 1961, p. 303) arrived at an annual GNP growth of 6.7 percent for the same years, expressed in ruble factor cost of 1937. Later base years yield, as a rule, lower growth rates.

the four years 1955–58 household consumption, recovering from the lower depths of previous years, increased according to the accompanying table A–3 by an annual 6.5 percent, consumer goods offerings by 7.8 percent. This improved supply presupposed investments, and Khrushchev did direct investments into food production and housing construction to ease the worst scarcities. New fixed investment is believed to have risen during the same four years by annually 15.6 percent. Where did the funds and labor come from? It appears that the government restrained the expansion of military activities (the Korean armistice was the beginning of several years of reduced international tension) and curtailed a top-heavy administration. The figures in table A–10 underlying the series on "administrative and other services" show a reduction of "civilian police"—an admittedly indistinct category—from 1.5 billion (1970) rubles in 1953 to 1.07 billion rubles in 1958. While these figures are shaky, military expenditures can only be guessed at. Table A–3 on GNP by end use (at factor cost) contains two defense-related lines. One is "outlays not elsewhere covered"; they increased in 1955–57 only by annually 1.5 percent but rose by no less than 21 percent in 1958. The category is a residual catchall for omissions and errors, changes in inventories (including strategic stocks) and net exports, and above all the national security outlay including the cost of the militarized police (KGB troops). The growth of this manifold residue is not an index of the defense component. Not only does it contain non-military items (some of them on occasion negative, e.g., when inventories decline), but there exist defense outlays in other items of the GNP breakdown, namely among the public services, in investments, and above all in R & D. The R & D line in table A–3 could be up to three quarters of a defense nature (nor need it be all-inclusive), and in the years 1955–58 it increased by an annual 11.9 percent.

Nevertheless there are reasons to believe that at least between 1954 and 1957 national security outlays grew moderately. The shift of hardware production from military accouterments to civilian equipment gave impulse to a GNP growth which in 1955–58 reached an annual 7.5 percent.

This, in turn, influenced the international economy. In the 4-year period 1954–57 the GNP's of Japan and Germany, belatedly recovering from war and defeat, leaped by 7.8 and 7.9 percent p.a., but the US, recession-plagued, did poorly: a mere 2.3 percent. The difference between the superpowers became even more pronounced in 1958 when Soviet GNP, favored by an excellent crop, increased by 7.7 percent, whereas the American GNP experienced one of two slight declines in the twenty years 1950–69, namely by 0.2 percent. The launch of the first Soviet satellite in 1957 accentuated the unequal performance. Khrushchev now predicted that the USSR would overtake the US by 1970 and his challenge—above all meant as a tonic for a population restive during "de-Stalinization"—produced in the West agonizing reappraisals of the future and the economic policies of the US.

During this period of "growthmanship" the PRC started the Great Leap Forward. Mainland China had made the usual rapid recovery after the takeover by Mao and his forces in 1949 (GNP growth in the three years up to 1952 is calculated at more than 19 percent per

annum) [16] and had successfully completed a First Five-Year Plan (GNP growth an annual 6.8 percent according to Ashbrook and Field, 5.9 percent according to Klatt).[17] Now Mao decided to out-Stalin Stalin. In the first Leap year (1958) the PRC GNP increased in Ashbrook's 1972 estimate by 11.8 percent, in his later calculation by a miraculous 19.5 percent.[18] Bulgaria' Zhivkov was so impressed that he wanted to out-Mao Mao. Both follies failed.

C. The 1960's: Western Prosperity—Communist Disappointments

Late in 1950s a sea change occurred. Growth improved in the West, decelerated in the East. The annual average GNP rate for the six years 1959–64 was 5.1 percent for OECD as a whole, 4.4 percent for the US, 11.5 percent for Japan, 5.3 percent in OECD Europe (including even a pretty good 3.8 percent in the UK); Brazil made 7 percent and the less developed countries of the West came close to 6 percent. Western inflation, between 2 and 3 percent, was still tolerable.

On the Communist side the rate was 4.5 percent for the USSR, 4.8 percent for its six Eastern European associates, at best zero in the PRC. This zero growth in 1964 over 1958 hides a calamitous fall up to 1961, then a recovery from the "Leap". Soviet growth receded to actually less than zero in the poor crop year 1963—a bench mark insofar as Khrushchev, breaking with Stalin's pitilessness, began to import grain; GNP came back in 1964. This performance, unbecoming for a challenger, was, weather aside, due to erratic and contradictory policies in a system with a disadvantageous cost-benefit ratio. At a time when entries into the labor force fell off in consequence of the low birth rate during the Second World War, Khrushchev felt himself constrained to reduce the workweek. At a time when heavy investment should have been continued to keep the economy in rapid development, the regime embarked on foreign policy ventures (Berlin, Cuba, China, etc.) which provoked an arms race and forced the USSR to divert resources from growth and welfare to the military. Policy failures as well as the style of his leadership undid Khrushchev in October 1964.

The series in appendix table A–3 shows that in the six years 1959–64 fixed new investment increased by only 6.2 percent, i.e., at a rate not much more than a third that of the preceding period. This reduced rate was an important factor in dampening GNP growth and likewise the availabilities for consumption (down to 3.9 percent, consumer goods to 3 percent). R & D outlays continued to grow by about the same rate as before (10.6 percent, to be exact), and the residue "outlays n. e. c." moved slightly faster at 2.9 percent p. a. I will return to this item presently

Brezhnev and his lieutenants changed Khrushchev's governmental style; their's was more dignified, stable, and tranquil—but then their task was not to guide the Soviet empire through the difficult period following the tyrant's demise. As little as Khrushchev did they change the basic features of the economic system, and they continued, with adaptations to changing circumstances, their predecessor's allocation policies: greater attention to the consumer, particularly through

[16] Ashbrook in the JEC volume Chinese Economy Post Mao, Nov. 9, 1978, p. 208.
[17] Ashbrook, loc. cit., Klatt., loc. cit., p. 41.
[18] Ashbrook, JEC 1972, p. 5, JEC 1978, p. 208.

consumer-oriented investments; grain imports on an even greater scale and, above all, throughout a sequence of years; a greater openness to foreign economic relations, including technology imports; also more concern for the less privileged classes; and at the same time a power-minded national security posture. Table A–3 indicates that in the six years 1965–70, with GNP growth somewhat improved to an annual average 5.5 percent, consumption expanded by 5.2 percent in toto (5.7 percent for consumer goods), fixed new investment by a modestly higher 6.7 percent, R & D outlays by 6.5 percent, i.e. less than before (one cannot triple these expenditures every eleven years), while the residue increased by 3.7 percent.

For 1970 table A–7 could be amended to include an explicit defense figure, namely the one that CIA, making use of new evidence, has adopted since 1975. It reads 50 billion (1970) rubles at established prices. The "outlays n. e. c." would then change from 44.2 billion to negative magnitudes, namely 5.8 billion rubles. Let us now make three assumptions: first, that the defense figure is by and large reasonable; second, that the GNP total—obtained from and checked by summing up the value added in the various sectors of origin (industry, agriculture, services)—is fairly correct, and, third, that the non-defense ingredients in "outlays n.e.c." (some positive, some negative) are on balance small. Under these assumptions the GNP for civilian purposes would have to be reduced roughly by the aforementioned 5.8 billion rubles, again at established prices, because they are in reality defense expenditures. This means that some consumer goods and services are military goods and services and some of the investment goods military plant and equipment. John S. Pitzer, in the CIA study cited above,[19] calculated that in the same year 1970 around 3.5 billion rubles (at established prices) of machinery were military hardware and 1.5 billion rubles of construction military installations. By implication investment in civilian machinery was not 26.2 billion but only 22.7 billion rubles, i.e. 15 percent lower than new investment in machinery and equipment as shown in a 1970 column of the GNP by end use at established prices.

Over the 1950s and 1960s "machinery investments" increased year in, year out by over 10 percent. (Table A–3.) Did the share of military hardware decrease or increase? How did the significantly lower investment in civilian machinery affect the capital-output ratio, i.e., capital productivity? If in 1960 defense and space expenditures absorbed roughly 10 percent of the GNP,[20] their annual increase in the 1960s must have been 9–10 percent in order to fit into the attached tables. If on the other hand national security outlays rose in line with the GNP, i.e. by about 5.1 percent p. a., defense must have devoured 15–16 percent of the 1960 GNP with the likelihood that much of the so-called machinery investment was in reality military and space hardware. If in the time before 1970 (civilian) capital productivity was not higher than the "machinery" line of fixed investment (without deductions for military hardware) implies, do we have to change the GNP growth rates, either by increasing the GNP of earlier years or by reducing it for more recent years? As long as these questions remain unclarified (they may never be answered), I prefer a dollar figure for the Soviet GNP somewhat below the series in recent CIA publications.

[19] See the study mentioned in footnote 5, above.
[20] See, for instance, Abraham S. Becker, Soviet National Income 1958–64, Berkeley and Los Angeles 1969, p. 267 and Tables K–1 and K–2.

Soviet recovery from the untoward final period of Khrushchevian stewardship took place in a world still in its prosperous decade. Notwithstanding a number of international and domestic conflicts and tensions, it was an era of peaceful modernization everywhere and of improved international division of labor. In the US the seven fat years were 1962–68 with an average annual GNP growth of 4.9 percent; in the years discussed in the preceding paragraphs (1965–70) American GNP growth—moving toward another recession—was only 3.5 percent. It was 5.1 percent in OECD Europe including Britain's 2.4 percent (the mal Anglais became acute), 4.8 percent in the entire OECD including Japan's sensational 10.5 percent, and slightly over 5.3 percent in the Third World with Brazil's equally astounding 10.1 percent. Non-Communist performance was 5.1–5.2 percent, in other words, very close to the USSR's 5.4–5.5 percent. Progress in the six other Warsaw Pact nations in Eastern Europe was less favorable, namely an estimated 3.4 percent.[21] The PRC warrants a special comment. In 1965 Mainland China had just recovered from the Great Leap Forward; in 1970 it began to recover from the Cultural Revolution; the interval was filled with political turmoil and correlated economic friction. In view of these events I cannot reconcile me to Ashbrook's and Field's average annual growth rate of no less than 8.1 percent.[22]

D. The 1970's: Slowdown in the USSR and the Advanced West

The 1970s are the decade of our discontent. The average growth rates up to now are not bad: 1971–78 on average 4 percent for the world as well as its non-Communist and Communist sectors. But the decline by roughly one percentage point spoilt expectations of progress as accustomed; above all, the average hides the ups and downs in specific years and countries and eliminates through deflation pervasive price and currency troubles. Here we are faced with significant differences in performance between the USSR and the West. Soviet growth is not only lower than in past years, it is at the same time sluggish. On the monetary side Soviet inflation is not rampant as in many—by no means all—Western economies; it is creeping, latent, it is unreported and, with a strictly domestic currency, not a matter of international concern.

In the advanced West the troubles began in the US and as early as the end of the 1960s. The American economy was recessed in 1969/70;

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[21] From 1965–70 3.1 percent according to Thad P. Alton's recently revised calculation. Loc. cit. in footnote 6 above.

[22] Because official national income data are available for the First Five-Year Plan 1953–57, Sinologists use the years 1952 and 1957 as base years for their estimates. For 1952–70 Ashbrook's and Field's new average growth rate is 5.6 percent, for 1957–70 5.1 percent. Their former series showed rates of 4.1 and 3.4 percent for the two periods; Klatt's estimates are 4.8 and 4.4 percent. The increased rates of Ashbrook and Field happen to coincide with the Soviet rates for the same periods (5.6 and 5.2 percent); their 1952–78 rate of 5.9 percent is almost 1 percentage point above the Soviet rate. It ought to be remembered that the Soviet series has in 26 years only one case of GNP decline or, to be exact, of zero growth (1963 minus 0.04 percent), while according to Ashbrook and Field the PRC GNP dipped from 1958–61 by 37 percent and regained the 1958 level only six years later; it declined by 4.3 percent in 1967 and did not grow at all in 1976. Since the agricultural production index of Ashbrook and Field for the period 1952–78 increased by an average annual 2¼ percent and their industrial index by 10.5 percent (services are added to either agriculture or industry), the PRC's agriculture has now a share of 30 percent in the GNP by origin, industry of fully 70 percent. If it were possible to improve the coverage of the slow-moving services, if Ashbrook and Field were able to steer away from physical output data, if they could gauge changes in quality (which has deteriorated in many fields) and take account of the Gerschenkron Effect, their growth rates were likely to return to those in their previous series (or would even remain below them).

overvaluation of the dollar led to a rush first into gold, then into other currencies and to a series of devaluations beginning in 1971. In 1971/72 the US joined a general boom which had continued in other regions of the West irrespective of the currency uncertainties, until it came to an abrupt end in the "oil crunch" of 1973/74 with its accompanying dislocations in pursuits with large oil consumption. The years 1976–78 brought a "return to normalcy" in the sense that output achieved again satisfactory and fairly steady growth rates; somehow Western enterprise had learned to live with a considerable degree of inflation and currency fluctuation and with unsettled commodity markets.

To quote some figures: in the US average GNP growth 1971–78 was 3.2 percent with maxima of 5.7 percent in 1972 and again in 1976 and minuses of 1.3–1.4 percent in 1974 and 1975. In the OECD area as a whole the average was 3.5 percent with a 6.3 percent increase in 1973 and a decline by 0.6 percent in 1975. Japan's average was 5.5 percent with a 9.8 percent expansion in 1973 followed by a minus of 1 percent the year thereafter. While the Third World was under the influence of the cyclical swings in the advanced West, more through trade than through grants, it managed to increase its combined GNPs by an annual average 6–7 percent and without OPEC members still by about 5½ percent. As a result quite a few less developed countries moved into the GNP brackets of the advanced nations; several OPEC members with small populations became superrich in a matter of years. But the Third World includes also a number of retrodeveloping countries, countries that perform below average or decline for a shorter or longer period either because of adverse climatic conditions, political troubles, or a combination of inexperience, instability, and weakness. They have become politically what the Balkans were before the First World War.

On the Communist side the PRC poses again the statistical problem depicted in previous paragraphs. Ashbrook and Field offer for 1971–78 an average growth rate of 6.6 percent; Klatt for 1970–76 of 5.1 percent. My uneducated guess is on the high side of 5 percent, still considerably above the Soviet performance. Whatever the correct figures, the annual fluctuations were great under the influence of climatic changes both in weather and politics (according to Ashbrook and Field between 12.8 percent in 1973 and zero in 1976). The six Warsaw Pact members of Eastern Europe actually speeded up in the 1970s with an average GNP growth of 4.1 percent. There were oscillations in time and between countries and in more recent years a decline in growth to 3.1 percent in 1978. Popular demands for a better life, balance of payments difficulties, energy shortfalls have begun to depress the previous progress, problems which in the more authoritarian, more centralized, and moreover energy exporting USSR have up to now been better controlled.

Soviet economic growth in the eight years 1971–78 was on average 3.7 percent. Weather was largely responsible for fluctuations, for even now value added in agriculture accounts for one-sixth of the GNP, and food and light industries in turn depend on agricultural raw materials. In 1972 GNP grew by only 1.7 percent and in the bumper crop year 1973 by 7.2 percent; otherwise the rates remained close to the average and this average must have greatly disappointed a growth-oriented regime.

IV. Reasons for Economic Slowdown

A. The Same Factors at Work in East and West?

In a limited number of cases the developments of three decades, as outlined in Part III, have changed the economic ratios between countries with the results depicted for 1978 in Part II. The world has been amazed by the rise of Japan and Brazil, by the comeback of West Germany; it has been puzzled by Great Britain's languishment and startled by OPEC's sudden embarras de richesses. Otherwise the proportions among the great powers have not changed greatly, once those ravaged by war had repaired the damage. Since the US had expanded its economy by an average 12.3 percent in the five years 1940–44—drawing upon resources idled during the depression—since it was victorious and sound in a world in shambles, its position was preeminent; the gradual reduction of its share in the planetary product was in the nature of things, though since the 1960's American policies have contributed to the relative decline. Comparing 1955, when peace had been raging for ten years, and the year 1978, the share in the planetary product declined for the US from 33 to 25 percent, for the UK from 4.8 to 3 percent; it increased for Japan from 3.8 to 12.1 percent, remained stable for the PRC (slightly below 4 percent), decreased marginally for NATO in Europe (from 22 to 20 percent) and the Federal Republic of Germany (from 6.4 to 6.1 percent), and improved marginally for the USSR (from 11.9 to 12.4 percent).

Comparisons over the decades (see table 3) show furthermore that on the whole the USSR and the developed West have shared their growth experience with progress of around 5 percent in the first decades and a noticeable slowdown to less than 4 percent recently. A threefold question arises. Are forces at work both in the USSR and in the advanced West that depress growth, in other words, are hard times upon all industrial societies, whatever their mode of operation? Or is the Soviet economy encountering unique obstacles to more rapid growth, whether they are due to its peculiar institutions, its social and political climate, or its resource endowment? Conversely, is the USSR—despite its mediocre performance for a few years—exempt from untoward conditions that brake progress in the "capitalist" market economies of the West, with the result that in a foreseeable future its economic base would become commensurate with its military posture and its political clout? Let us briefly review a number of factors that induce a slowdown of economic growth.

B. Expanding Public Service Sectors

The increasing role of services in modern societies produces the illusion of a GNP deceleration. This is so because statistical practice, for want of better materials, determines the value added to the GNP by government and non-profit organizations by only one of their inputs, namely the remuneration of their labor force. Neither are the services of government-owned capital services imputed nor is a presumable productivity gain allowed for. Consequently rapidly expanding public services make for some understatement of economic growth; other

services may share in this shortcoming. In the USSR, comparing man-hours of employment in the civilian labor force between 1958 and 1978, we notice that the total of all sectors increased by an average annual 1.5 percent but services in government administration, health care, education, science, and the like by close to 3.8 percent.[23a] In terms of GNP at factor cost the value added by the services named increased at the same rate as their man-hours, i.e., 3.8 percent (administrative service by 3 percent) p. a. as against a 4.6 percent GNP growth. If the services would have included a productivity gain commensurate to labor in "business" or "material production," their value would have grown faster and would have speeded up the GNP, though the difference could not be large It is hardly necessary to add that the value added in military services does not include a supplement for their increasing productivity (or, rather: destructivity).

C. Increasing Outlays for National Security

Military personnel has a share of 3–4 percent in the entire labor force. Military and defense-related expenditures absorb according to recent estimate 13–15 percent of the GNP. It appears that the share of national security outlays has grown over the years. Insofar as this is the case they have slowed down the potential growth of the GNP. In NATO the defense share declined in the five years 1974–78 from 4.8 to 4.2 percent of GDP, in the US (which bears 60 percent of NATO's defense expenditures) from 6.1 to 5 percent.[23] Japan's share is still close to 1 percent of GNP. It is well-known that Japan's extraordinary growth was aided by the small size of its military establishment; vice versa it can be said that more modest Soviet defense outlays would have freed investment funds and labor for more productive activities.

D. Declining Capital Productivity

There is, however, a catch. Even if we assume that some "investment" has all along been military hardware procurement in disguise, the USSR has always overinvested, judged at least by Western standards. Suffice it to say that according to the appendix table A–3 total investments (omitting inventory changes) and also new fixed investments increased between 1950 and 1978 in the average year by 7.7 percent; since the GNP grew by 5 percent, the share of investment rose in 28 years from 14.8 to 31 percent and for fixed investment from 11.9 to 25 percent of GNP. The Soviet economy has a GNP gap of its own in the sense that if it were able to utilize its capital funds as effectively as (over the business cycle as a whole) the Western economies, it would grow not by a long-range 5 percent as in the past three decades but by a much higher rate. Even in recent years when new fixed investment increased only by 5.2 percent (average for 1971–77), it still rose faster than GNP (3.8 percent). In the US gross in-

[23a] Murray Feshbach and Stephen Rapaway, "'Soviet Population and Manpower Trends and Policies" in Soviet Economy in a New Perspective, Joint Economic Committee report of October 14, 1976, particularly tables on pp. 138 and 153, extended to 1978 by personal information. GNP data derived from table A–10.

[23] NATO Press Service, Brussels, Dec. 4, 1978.

vestment (private and public) had in 1977 a share of 15.6 percent of GNP (some increase appears now desirable), in the European Community of 20.7 percent, in Japan with its slight defense outlay of 28.9 percent. Were capital productivity in the USSR equal to that of the West, the Soviet economy would grow at rates approaching Japan's. That the Soviet Union's peculiar "gap" has widened over the years and has thus contributed to the general slowdown can be gauged by CIA's calculation of capital productivity in Soviet industry: it declined steadily from a positive 4.2 percent in the average of 1961–65 to minus 3.6 percent in 1977.[24]

E. Problems of Labor Supply and Labor Productivity

Conditions are similar in regard to manpower. Since Soviet labor—its quantity and quality—discussed with great expertise in the preceding JEC volume on the Soviet economy (see footnote 23a) and will again be examined in the second part of the present publication, it suffices to state that the slowdown of the 1970s cannot be ascribed to a lower rate in the growth of the labor supply because only since 1978/79 have the entry of 16 year olds into the labor force and the annual net increments to the population of able-bodied ages begun to diminish (labor supply will become a problem in the years to come). Moreover, the USSR produces a GNP half that of the US with a labor force 41 percent larger. The relation between Soviet GNP and labor force and GNP and labor force in other countries is in the case of Japan 1.4 and 2.6 times (to wit, the Soviet GNP is 1.4 times as large as the Japanese, the Soviet labor force 2.6 times as large as the Japanese), in West Germany 2 and 5.4 times, even in Italy 5 and 6.5 times. In other words, these nations require by far less labor per unit GNP than the USSR. The figures quoted refer to the year 1977. In Soviet industry labor productivity in terms of man-hours has declined from 3.6 percent in the average of 1961–65 to 1.8 percent in 1977.[25]

F. The Law of Diminishing Returns in Operation

In the past 28 years mankind has increased by more than 70 percent, the Soviet population by 45 percent, the planetary product about 3.4 times, the Soviet GNP 3.9 times. Under these circumstances the demand for agricultural and industrial raw materials rose steeply and technological progress was hard put to offset the law of diminishing returns. In this context it is useful to differentiate between a real increase in marginal costs wherever—despite all technological efforts—demand can only be satisfied from lands or deposits with lower yields and, on the other hand, an artificial increase in price due to monopoly power. The first case implies a decline in productivity (in total productivity because land, capital stock, and labor in their combination extract less output with the same inputs) and it contributes to a slowdown in GNP growth (or, as in the Sahel countries, brings about an absolute GNP decline). Monopoly prices for oil, coffee, or raw materials, however, are simply a transfer of income from consumers to producers, whether within one country or in foreign trade. There

[24] National Foreign Assessment Center, Handbook of Economic Statistics 1978, CIA—ER 78–10365, October 1978, p. 47.
[25] Loc. cit., p. 47.

exists also the reverse case of governments subsidizing with tax revenues farmers with high production costs and then dumping the produce abroad. In the USSR all three possibilities have become reality. Agriculture and raw materials output increase in real costs. Through exports of raw materials the USSR was able to profit from monopoly prices, above all by charging OPEC prices for oil and commensurate prices for other energy products. Finally in its imports of grain and other foodstuffs (meat, dairy products) it was at times able to buy below the cost price at the expense of Western taxpayers (including the American).

G. The Role of Technology

Technological progress is the prime force in increasing output per unit of input. According to Denison, advance in knowledge (not counting some sources of growth n. e. c.) was responsible for about 30 percent of the increase in U.S. national income between 1948 and 1969.[26] No data are available for the USSR but progress in technology—including transfer of foreign technology—must account for less than 10 percent of its economic growth. In the absence of more detailed measurements I refer to total factor productivity as an approximate index of advance in knowledge. As calculated by F. D. Whitehouse and D. R. Kazner, the average annual growth of Soviet total factor productivity amounted to 1.2 percent 1951–60, 0.8 percent 1961–70 and minus 0.6 percent in 1971–75.[27] This decline in factor productivity accounts for much of the slowdown in the Soviet economy. In the US factor productivity increased by an annual rate of 2.9 percent between 1948 and 1966, but while the level of the rate has remained above Soviet performance the trend has also been downward: 1.4 percent p. a. 1967–76, about 2 percent 1977, zero in 1978.[28] The development—which to a small degree may be statistical rather than real—has caused puzzlement, unhappiness, and a search for remedies.

At various times in modern history "secular stagnation" was diagnosed or predicted with a technological standstill one of its main ingredients. There is no evidence whatsoever that Western technology is on a decline. Nor are there imperatives why Soviet technology should decelerate. It is true that in the Soviet system scientists and technicians—men with a brilliant tradition going back two centuries—have trouble translating their innovations into practice and that foreign technology is not as easily absorbed as desired but the lag behind Western technology—some fields with great achievements excepted—while it is observable, need not increase.[29]

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[26] Edward F. Denison, Accounting for United States Economic Growth 1929–69. The Brookings Institution, Washington. D.C., 1974. p. 127.

[27] In The Future of The Soviet Economy: 1978–85, Ed. Holland Hunter, Boulder, Colo., 1978. p. 10.

[28] John W. Kendrick, "Productivity", Road Maps of The Conference Board, January 1978, and personal communication. See also Kendrick's contributions on productivity trends in the JEC publication U.S. Economic Growth From 1976 to 1986, vol. I, October 1, 1976, pp. 1–20, and during the Hearings, November 18, 1976. The 1979 issue of the American Enterprise Institute's annual Contemporary Economic Problems will carry an article by Kendrick on productivity. See also John W. Kendrick and Elliott Grossman, Productivity Trends and Cycles, Johns Hopkins University Press 1979.

[29] John W. Kiser has studied the actual and potential transfer of Soviet (and Eastern European) technology to the United States. See his article "Soviet Technology—The Perception Gap" in Mechanical Engineering, April 1979, pp. 22–29.

H. Environmental Deterioration

Environmental damage in the widest sense of the word is an important reason for a slackening of productivity growth in the West.[30] With larger populations and a greater volume of output more harm is done to our physical and social surroundings; there is also more awareness of such impairments together with a tendency to exaggerate them. They exist in all societies and in a forced-draft economy like the Soviet they may be worse than elsewhere. Judging by the noise level of Soviet environmentalism neither the awareness nor the costs of fighting environmental damage appear close to what it is now in the advanced Western countries.

I. Rising Cost of Crime

The costs of criminal activities, of crime prevention and persecution have risen everywhere; the USSR is no exception. In an economy with all-encompassing regulations and controls infractions must be pervasive, particularly since de-Stalinization has made them less risky. Insofar as the USSR's Second Economy (see Gregory Grossman's paper in the present volume) is expanding and insofar as its pursuits are pernicious and not simply harmless—perhaps even efficient—extralegal additions to the national product satisfying some heretofore neglected demand, they tend to reduce productivity. With Soviet history in mind one cannot help wondering to what degree the despotism of the past—there are remnants left—might be understood as a most costly crime that permeated the human environment of the entire nation and its dependencies.

J. The Size of Soviet Enterprises

Economics of scale have been important source of productivity gains. The Soviet economy has either lagged behind or has gone beyond the optima. Beyond the optima are the ultra-giant enterprises, whether they be industrial plants, farms, or service organizations. "Bigger is better" in Brezhnev's words, and he echoes the sentiments of all his predecessors. On the other hand almost one third of the agricultural output is obtained from infra-tiny kitchen plots—which are so important that despite their ideological impurity they have recently been officially encouraged—and the extra or illegal producers of the Second Economy are understandably undertakings on the smallest scale.

K. The Soviet Economic System

This is where the quest for the sources of Soviet economic slowdown enters into a contemplation of the Soviet system. The manifestations of and reasons for, its inefficiency compared to Western-style market economies have been described in numerous publications; they have

[30] Edward F. Denison in Survey of Current Business, January 1978, pp. 21–44. The paper "Effects of Selected Changes in the Institutional and Human Environment Upon Output Per Unit of Input" deals also with the cost of crime and dishonesty.

been touched upon in this article and need no further elaboration. Nor should we overlook a tendency toward overregulation in the advanced West—which in turn has provoked a backlash against big government and welfare extravagance. As has been stated before, neither Stalin himself nor his heirs have changed the structure he built in 1928/29. They have only tinkered with institutions (e.g., during Kosygin's 1965 "reforms," which have long since petered out).

Nor do we deny that these institutions induced or, at any rate, permitted a ninefold increase of the national product in half a century, a fourfold increase in the past three decades. They were essential for the creation of a military establishment that Peter the Great and Alexander I would be proud of. The tasks were achieved with immense sacrifice and toil and inordinate costs. Is the economic structure increasingly inappropriate for the planning, managing, and controlling of an economy so much larger and so much more intricate than the economy of fifty years ago? The low level of total factor productivity and its decline can be regarded as an affirmative answer. Does this mean that the ruling elite will be looking for new fundaments? There is as yet no indication.

The self-criticism—which has become routine—remains unchanged in contents and style; a long-suffering reader of Soviet pronouncements can only marvel at the political inefficiency and administrative helplessness of denunciations voiced at such extent and repeated over the decades. For the complaints have always been the same, even though occasion and target vary (stress is now on bottlenecks in railroad transportation, on the beginnings of manpower shortage, on the lack of metals and energy sources). In general the plans are said to be unbalanced, taut, and frequently revised. Information is wanting. Costs are disregarded. Resources are spread over too many projects. Capital and labor are underutilized except during the "storming" immediately before planned deadlines. Spare parts are unavailable. Materials are wasted. Contracts remain unhonored. There is lack of control. Extra and illegal deals are frequent. Innovation is inefficient. Assortment and quality of output and service are poor, particularly for consumers.

The remedies are also old hat. The Party must intervene. More ideological education is needed. More selflessness. More discipline. More socialist competition. Offenders must be punished. "Hidden reserves" must be utilized. Resources must not be wasted, investment funds not dispersed. Costs must be counted, productivity improved, plans overfulfilled. One nostrum, often applied and also prescribed in the 1979 plan may be called "stimulative planning": goals are set high not in the hope of reaching them but to goad administrators, managers, and workers; later they are silently reduced so that the plan is in the end successfully fulfilled.

The by now old-fashioned prescriptions just enumerated are in line with the character of the Soviet system. Its label could be what on his deathbed Austria's Francis I bade his successor: "Do not change anything." (Crazy Ferdinand I followed the advice and was ousted thirteen years later.)

APPENDIX TABLES [1]

TABLE A-1.—U.S.S.R.: GNP INDEXES BY SECTOR OF ORIGIN (FACTOR COST)

[1970=100]

	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959
Industry	20.4	22.7	24.6	27.3	30.2	33.6	37.1	41.2	45.8	50.4
Ferrous metals	23.5	26.3	29.6	32.3	35.5	39.1	42.1	44.5	47.6	51.8
Nonferrous metals	18.3	20.7	23.3	26.0	28.5	33.4	35.5	37.4	39.5	42.7
Fuel	24.4	26.6	28.5	30.5	33.6	38.1	42.4	47.2	51.5	55.0
Electric power	12.5	14.2	16.2	18.3	20.5	23.1	26.0	28.5	32.0	36.0
Machinery	15.7	16.7	18.6	21.7	24.2	27.5	31.2	36.6	41.7	46.1
Chemicals	13.6	15.0	16.3	18.0	20.3	23.1	25.7	28.0	31.9	34.8
Forest and paper products	40.3	45.8	47.7	50.0	54.7	57.9	59.8	64.0	70.2	76.7
Construction materials	14.7	16.9	19.2	22.3	25.8	30.2	33.3	39.0	46.5	53.3
Light industry	27.6	31.9	32.1	35.2	38.9	41.7	45.8	48.6	53.1	57.6
Food industry	23.0	26.2	28.7	31.7	33.8	37.1	41.5	45.0	48.5	54.8
Construction	20.7	23.6	26.1	28.6	31.7	35.7	39.0	43.5	49.2	55.6
Agriculture	48.3	45.3	46.9	50.0	51.9	59.0	66.3	68.5	73.3	72.7
Transportation	16.8	18.9	20.8	22.7	25.0	28.3	31.2	35.6	39.4	43.5
Communications	22.4	24.5	26.7	28.4	30.8	33.0	35.6	38.3	40.6	43.2
Trade	23.6	26.3	28.9	31.7	35.0	38.7	42.6	46.7	51.1	55.0
Services [2]	52.3	55.0	57.1	57.1	57.7	58.7	59.2	60.3	62.2	64.2
Gross national product	34.1	35.5	37.5	39.5	41.6	45.3	48.7	51.7	55.7	58.7

	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
Industry	53.6	56.9	61.3	64.7	68.8	73.7	78.0	83.8	89.6	94.0
Ferrous metals	56.3	60.5	64.9	69.1	74.0	78.6	83.2	87.9	92.0	95.2
Nonferrous metals	46.8	51.0	55.1	59.4	64.0	67.8	74.6	81.5	89.1	95.0
Fuel	58.2	60.9	64.5	69.8	74.1	78.4	83.2	87.6	90.7	94.7
Electric power	39.7	44.5	50.2	55.8	62.0	68.3	73.5	79.1	86.1	92.9
Machinery	48.9	52.9	58.9	62.1	66.8	71.2	74.6	80.7	88.8	94.4
Chemicals	38.4	42.0	46.7	51.1	57.6	66.3	72.6	79.9	85.2	90.4
Forest and paper products	77.0	77.0	78.8	81.9	85.7	87.5	87.7	91.9	94.0	95.6
Construction materials	59.3	63.5	66.6	68.2	71.5	76.1	81.7	87.4	90.6	92.3
Light industry	61.2	62.6	64.2	65.8	68.8	70.9	76.8	83.4	89.7	94.5
Food industry	56.7	59.8	63.9	66.9	66.3	75.2	79.7	86.6	91.2	93.7
Construction	59.4	62.3	65.6	68.2	71.8	76.4	80.7	86.3	90.2	93.4
Agriculture	72.1	78.8	75.6	63.4	77.2	81.3	87.3	85.6	90.2	87.0
Transportation	47.2	50.5	54.4	58.9	64.2	69.8	74.9	81.8	88.4	93.4
Communications	46.5	49.2	52.2	55.3	59.2	65.4	72.3	79.7	85.5	93.0
Trade	58.1	60.2	63.6	65.5	68.6	73.3	78.9	84.6	90.1	93.7
Services [2]	65.4	67.9	71.2	74.3	78.0	81.5	85.2	88.7	92.9	96.4
Gross national product	60.7	64.4	66.7	66.6	72.7	77.1	81.7	85.5	90.5	93.0

	1970	1971	1972	1973	1974	1975	1976	1977	1978
Industry	100.0	106.9	112.0	119.0	126.5	133.5	138.5	144.1	149.5
Ferrous metals	100.0	103.8	106.9	111.0	115.4	120.3	123.5	124.9	128.5
Nonferrous metals	100.0	106.6	112.3	118.9	127.3	133.3	137.0	140.4	141.7
Fuel	100.0	104.8	109.9	115.3	121.1	127.9	132.3	137.6	142.2
Electric power	100.0	108.1	115.8	123.6	131.9	140.6	150.3	155.7	162.7
Machinery	100.0	110.0	116.8	128.4	138.3	147.4	156.1	165.3	175.3
Chemicals	100.0	108.0	115.0	125.1	137.3	150.9	158.4	167.9	173.0
Forest and paper products	100.0	102.8	104.7	107.4	109.3	113.2	113.1	113.5	113.4
Construction materials	100.0	106.0	111.3	117.6	122.9	128.4	132.5	133.7	134.5
Light industry	100.0	105.0	106.0	109.2	111.7	113.7	118.1	121.0	123.2
Food industry	100.0	104.6	108.5	108.6	117.7	122.6	117.1	122.8	125.3
Construction	100.0	105.8	110.7	116.9	122.9	129.3	133.5	136.4	139.8
Agriculture	100.0	99.1	90.3	105.3	102.2	90.1	97.9	101.0	102.5
Transportation	100.0	107.1	113.2	121.4	129.9	137.9	144.0	148.9	156.3
Communications	100.0	107.2	114.7	123.4	132.3	141.9	151.0	159.8	169.4
Trade	100.0	105.4	108.5	115.6	121.0	126.1	129.9	135.4	140.4
Services [2]	100.0	103.7	107.4	110.1	114.5	118.2	121.8	125.5	129.2
Gross national product	100.0	104.3	106.1	113.7	118.1	120.1	125.4	129.7	133.8

[1] The tables in this appendix were provided by the Office of Economic Research, Central Intelligence Agency. They represent a preliminary version of the data to appear in volume 3 of this compendium.

[2] Including military personnel costs.

TABLE A-2.—U.S.S.R.: GNP BY SECTOR OF ORIGIN (FACTOR COST), AVERAGE ANNUAL RATES OF GROWTH

[Percent]

	1951–55	1956–60	1961–65	1966–70	1971–75	1976–78
Industry	10.6	9.8	6.6	6.3	5.9	3.8
Ferrous metals	10.7	7.5	6.9	4.9	3.8	2.2
Nonferrous metals	12.8	6.9	7.7	8.1	5.9	2.1
Fuel	9.4	8.9	6.1	5.0	5.0	3.6
Electric power	13.1	11.4	11.5	7.9	7.0	5.0
Machinery	11.9	12.2	7.8	7.0	8.1	5.9
Chemicals	11.2	10.7	11.5	8.6	8.6	4.7
Forest products	7.5	5.9	2.6	2.7	2.5	.1
Construction materials	15.5	14.5	5.1	5.6	5.1	1.5
Light industry	8.6	8.0	3.0	7.1	2.6	2.7
Food industry	10.0	8.8	5.8	5.9	4.2	.8
Construction	11.6	10.7	5.2	5.5	5.3	2.6
Agriculture	4.1	4.1	2.4	4.2	−2.1	4.4
Transportation	11.0	10.7	8.1	7.5	6.6	4.3
Communications	8.1	7.1	7.1	8.9	7.2	6.1
Trade	10.4	8.5	4.7	6.4	4.8	3.7
Services [1]	2.3	2.2	4.5	4.2	3.4	3.0
Gross National Product	5.8	6.0	4.9	5.3	3.7	3.7

[1] Including military personnel costs.

TABLE A-3.—U.S.S.R.: GNP INDEXES BY END USE (FACTOR COST)

[1970=100]

	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959
Consumption	37.0	(2)	(2)	(2)	(2)	48.2	50.9	54.2	57.6	59.8
Consumer goods	35.1	(2)	(2)	(2)	(2)	47.2	50.4	54.3	58.4	59.9
Food	41.3	(2)	(2)	(2)	(2)	52.8	55.5	58.7	62.7	63.7
Soft goods	23.8	(2)	(2)	(2)	(2)	36.5	41.8	47.1	51.6	54.1
Durables	10.2	(2)	(2)	(2)	(2)	25.6	28.0	34.0	37.4	40.8
Consumer services	39.8	41.3	42.9	44.5	46.9	49.6	51.7	54.0	56.5	59.8
Fixed investment	18.5	22.1	21.5	24.8	26.9	32.5	36.8	41.7	45.9	50.7
New fixed investment	17.9	21.9	20.7	24.4	26.6	32.8	37.6	42.9	47.4	52.0
Machinery and equipment	13.4	13.8	14.2	15.0	19.0	22.9	28.1	30.8	35.6	38.7
Construction and other	20.8	23.9	26.3	28.9	32.1	36.4	39.8	44.8	50.4	56.7
Net addition to livestock	3.1	38.2	−15.6	17.0	−3.4	39.3	61.3	82.3	71.2	61.7
Capital repair	22.0	23.6	25.3	27.0	28.9	30.9	32.5	35.4	38.2	44.2
Administrative and other services	97.3	97.4	97.4	93.4	86.7	77.3	75.9	72.4	73.2	71.2
Research and development	17.5	19.1	20.9	22.1	24.0	26.2	29.2	33.3	37.6	41.3
Outlays not elsewhere classified [1]	50.7	(2)	(2)	(2)	(2)	62.7	69.4	67.0	74.2	77.7
Gross national product	34.1	35.5	37.5	39.5	41.6	45.3	48.7	51.7	55.7	58.7

	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
Consumption	63.3	65.4	68.5	70.5	73.3	77.0	81.4	85.9	90.8	95.5
Consumer goods	63.4	64.9	67.7	68.9	70.9	74.5	79.5	84.3	89.8	95.1
Food	66.7	68.2	71.4	72.9	74.9	77.5	82.0	86.4	91.3	96.4
Soft goods	58.4	60.2	62.3	62.8	63.8	69.6	75.3	81.1	87.2	93.0
Durables	45.9	47.1	49.4	49.2	54.3	60.8	68.2	74.2	82.6	89.3
Consumer services	63.1	66.1	69.6	72.9	76.9	80.7	84.4	88.2	92.4	96.1
Fixed investment	52.9	59.2	60.9	54.7	68.1	73.8	74.8	78.4	83.2	88.7
New fixed investment	53.5	60.0	61.6	52.8	67.9	73.6	73.7	76.8	81.4	87.9
Machinery and equipment	41.5	45.9	51.8	57.3	64.8	69.2	73.1	78.7	85.0	88.9
Construction and other	59.9	62.2	65.2	66.7	69.6	73.3	76.7	84.3	88.0	93.3
Net addition to livestock	35.8	106.7	69.2	−147.2	61.8	101.3	38.7	−27.2	−21.5	14.2
Capital repair	50.0	54.9	57.2	64.3	69.2	74.7	80.4	86.5	92.4	92.5
Administrative and other services	70.3	69.5	70.9	71.2	74.2	78.1	82.3	87.9	92.9	97.5
Research and development	47.5	52.3	57.8	63.3	68.6	72.4	78.5	81.5	87.0	92.4
Outlays not elsewhere classified [1]	69.4	76.1	74.4	77.6	83.1	88.4	104.8	104.3	110.3	89.2
Gross national product	60.7	64.4	66.7	66.6	72.7	77.1	81.7	85.5	90.5	93.0

	1970	1971	1972	1973	1974	1975	1976	1977	1978
Consumption	100.0	103.5	105.9	110.6	114.6	119.0	123.0	126.8	131.1
Consumer goods	100.0	103.5	105.2	110.6	114.6	119.3	123.7	127.4	131.8
Food	100.0	102.0	101.2	106.5	109.3	111.8	115.0	117.0	119.5
Soft goods	100.0	104.9	109.2	113.3	118.6	126.5	132.6	137.4	143.9
Durables	100.0	113.5	131.3	142.3	154.3	169.5	181.4	198.8	214.7
Consumer services	100.0	103.6	106.9	110.5	114.7	118.7	122.1	125.7	129.9
Fixed investment	100.0	103.9	107.5	116.8	124.8	130.4	140.3	147.7	154.6
New fixed investment	100.0	102.8	105.3	114.2	121.6	125.8	135.7	142.5	148.7
Machinery and equipment	100.0	105.3	113.9	122.5	134.8	152.0	166.8	176.2	(2)
Construction and other	100.0	105.6	110.3	116.3	122.2	128.3	132.4	135.0	(2)
Net addition to livestock	100.0	53.6	−4.1	42.8	43.2	−44.3	12.9	58.5	38.5
Capital repair	100.0	109.4	119.1	130.1	141.4	153.9	164.2	174.5	185.3
Administrative and other services	100.0	104.1	108.0	111.5	116.1	120.1	123.8	127.4	130.9
Research and development	100.0	106.1	114.3	113.3	127.3	134.7	143.3	152.5	160.4
Outlays not elsewhere classified [1]	100.0	109.5	99.7	124.9	116.5	92.0	90.0	87.8	81.6
Gross national product	100.0	104.3	106.1	113.7	118.1	120.1	125.4	129.7	133.8

[1] Includes defense, net exports, change in inventories and reserves, unidentified outlays, and statistical discrepancy.
[2] Not available.

TABLE A–4.—U.S.S.R.: GNP BY END USE (FACTOR COST), AVERAGE ANNUAL RATES OF GROWTH

[Percent]

	1951–55	1956–60	1961–65	1966–70	1971–75	1976–78
Consumption	5.4	5.6	4.0	5.5	3.5	3.3
Consumer goods	6.1	6.1	3.3	6.1	3.6	3.4
Food	5.1	4.8	3.0	5.2	2.3	2.3
Soft goods	8.9	9.9	3.5	7.5	4.8	4.4
Durables	20.1	12.4	5.8	10.5	11.1	8.2
Consumer services	4.5	4.9	5.0	4.4	3.5	3.1
Fixed investment	11.9	10.3	6.9	6.3	5.5	5.8
New fixed investment	12.9	10.3	6.6	6.3	4.7	5.7
Machinery and equipment	11.3	12.6	10.8	7.7	8.7	[2]
Construction and other	11.8	10.5	4.1	6.4	5.1	[2]
Net addition to livestock	65.8	−1.8	23.1	−.2	[3]	[3]
Capital repair	7.0	10.1	8.4	6.0	9.0	6.4
Research and development	8.4	12.6	8.8	6.7	6.1	6.0
Administrative and other services	−4.5	−1.9	2.1	5.1	3.7	2.9
Outlays not elsewhere classified [1]	4.3	2.1	5.0	2.5	−1.6	−4.4
Gross national product	5.8	6.0	4.9	5.3	3.7	3.7

[1] Includes defense, net exports, change in inventories and reserves, unidentified outlays, and statistical discrepancy.
[2] Not available.
[3] Not calculable.

TABLE A–5.—U.S.S.R.: SHARES OF GNP BY END USE (FACTOR COST)

[Percent]

	1950	1955	1960	1965	1970	1975	1978
Consumption	62.1	61.0	59.8	57.3	57.3	56.8	56.2
Consumer goods	35.5	36.0	36.1	33.4	34.6	34.3	34.1
Consumer services	26.6	25.0	23.7	23.8	22.8	22.5	22.1
Fixed investment	14.8	19.5	23.7	26.0	27.2	29.5	31.4
New fixed investment	11.9	16.5	20.1	21.7	22.8	23.8	25.3
Capital repair	2.8	3.0	3.6	4.3	4.4	5.7	6.1
Research and development	1.8	2.0	2.7	3.3	3.5	3.9	4.2
Administrative and other services	7.3	4.4	3.0	2.6	2.6	2.6	2.5
Outlays not elsewhere classified [1]	14.0	13.1	10.8	10.8	9.4	7.2	5.7
Gross national product	100.0	100.0	100.0	100.0	100.0	100.0	100.0

[1] Includes defense, net exports, change in inventories and reserves, unidentified outlays, and statistical discrepancy.

TABLE A–6.—U.S.S.R.: GNP VALUE ADDED WEIGHTS BY SECTOR OF ORIGIN (FACTOR COST)

[Billion 1970 rubles]

	1970	1978
Industry [1]	99.198	148.266
Ferrous metals	6.864	8.822
Nonferrous metals	3.712	5.260
Fuel	8.838	12.566
Electric power	6.827	11.107
Machinery	31.755	55.368
Chemicals	6.362	11.018
Forest and paper products	7.300	8.276
Construction materials	6.636	8.916
Light industry	8.985	11.065
Food industry	9.590	12.007
Construction	30.064	42.020
Agriculture	69.405	71.132
Transportation	26.455	41.357
Communications	2.568	4.350
Trade	20.673	29.034
Services	81.808	105.648
Housing	27.647	33.835
Utilities	3.369	5.141
Repair and personal care	3.676	6.588
Recreation, art, and physical culture	1.967	2.131
Education	13.630	16.260
Health	7.677	9.136
Science	8.360	13.409
Credit and insurance	.556	.861
Administrative and miscellaneous services	7.467	9.902
General agricultural programs	.753	1.104
Forest economy	.548	.571
Apparat and social organizations	2.866	3.656
Culture	1.772	2.576
Municipal services	.475	.652
Civilian police	1.053	1.343
Military personnel and statistical discrepancy	7.459	8.420
Gross national product [2]	338.191	452.566

[1] Includes 2.329 billion rubles of value added by "other industry" in 1970 and 3.472 billion rubles in 1978.
[2] Includes 8.020 billion rubles of unallocated value added in 1970 and 10.723 billion rubles in 1978.

TABLE A–7.—U.S.S.R.: GNP WEIGHTS BY END USE (FACTOR COST)

[Billion 1970 rubles]

	1970	1978
Consumption	193.850	254.085
Consumer goods	116.868	154.076
Food	82.162	98.216
Soft goods	26.324	37.868
Durables	8.382	17.992
Consumer services	76.982	100.008
Housing	27.787	34.007
Utilities	4.265	6.714
Personal transportation	5.064	8.289
Personal communications	.750	1.271
Repair and personal care	4.496	8.058
Recreation, art, and physical culture	4.709	5.103
Education	18.547	22.921
Health	11.364	13.647
Fixed investment	91.883	142.067
New fixed investment	76.959	114.409
Capital repair	14.924	27.658
Research and development	11.815	18.950
Administrative and other services	8.687	11.376
General agricultural programs	.985	1.444
Forest economy	.716	.746
Apparat and social organizations	3.804	4.853
Culture	1.201	1.746
Municipal services	.620	.851
Civilian police	1.361	1.736
Outlays not elsewhere classified [1]	31.956	26.089
Gross national product	338.191	452.566

[1] Includes defense, net exports, change in inventories and reserves, unidentified outlays, and statistical discrepancy.

TABLE A–8.—U.S.S.R.: SECTOR OF ORIGIN SERVICE INDEXES (FACTOR COST)

[1970=100]

	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959
Services	52.3	55.0	57.1	57.1	57.7	58.7	59.2	60.3	62.2	64.2
Housing	46.3	47.8	49.5	51.3	53.3	55.6	58.0	60.4	63.2	66.7
Utilities	23.8	25.0	26.5	28.2	30.0	32.0	34.4	37.5	41.2	45.0
Repair and personal care	41.1	41.7	42.4	43.1	43.9	44.8	45.8	46.9	48.0	55.2
Recreation, art, and physical culture	35.8	38.3	41.1	43.0	49.3	55.8	59.7	63.0	67.5	69.7
Education	47.5	49.1	50.7	52.0	54.4	56.6	57.4	58.5	59.9	61.2
Health	44.0	45.8	47.6	49.3	52.7	56.0	57.6	60.2	63.4	66.4
Science	17.5	19.1	20.9	22.1	24.0	26.2	29.2	33.3	37.6	41.3
Credit and insurance	68.0	68.1	68.1	68.2	68.2	68.3	68.6	67.3	67.0	67.0
Administrative and miscellaneous services	90.6	90.9	91.0	87.6	82.0	73.9	72.6	69.6	70.5	68.8
General agricultural programs	66.6	72.2	77.6	71.0	73.6	53.0	57.8	55.4	65.8	69.4
Forest economy	121.8	123.9	126.0	113.3	109.3	105.6	103.2	97.4	94.2	87.9
Apparat and social organizations	118.3	116.6	114.8	110.7	98.9	87.0	83.7	78.8	78.2	74.9
Culture	39.9	41.2	42.5	43.6	45.5	47.3	47.8	48.5	49.7	50.4
Municipal services	53.4	55.4	57.5	58.7	59.8	60.9	62.5	63.1	63.9	64.3
Civilian police	118.3	116.6	114.8	110.7	98.9	87.0	83.7	78.8	78.2	74.9
Military personnel and statistical discrepancy	114.2	129.3	137.6	127.0	119.9	116.6	105.6	100.2	95.4	91.0

	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
Services	65.4	67.9	71.2	74.3	78.0	81.5	85.2	88.7	92.9	96.4
Housing	70.6	74.1	77.4	80.5	83.3	86.0	88.8	91.6	94.5	97.3
Utilities	49.4	54.4	59.3	64.5	70.0	75.5	80.5	85.3	89.9	94.6
Repair and personal care	53.5	49.6	49.1	50.2	54.7	60.7	67.4	75.0	83.0	90.5
Recreation, art, and physical culture	72.2	76.2	78.5	79.6	84.2	87.7	88.3	93.5	97.5	98.3
Education	62.9	65.8	70.3	74.2	79.2	83.8	87.9	91.0	94.7	97.7
Health	69.4	72.2	75.0	77.2	80.3	83.8	86.9	89.4	93.4	97.1
Science	47.5	52.3	57.8	63.3	68.6	72.4	78.5	81.5	87.0	92.4
Credit and insurance	68.3	71.4	72.9	74.5	76.3	77.3	80.7	84.8	89.2	93.6
Administrative and miscellaneous services	68.1	67.6	69.2	69.9	72.9	76.8	80.9	86.7	92.0	97.0
General agricultural programs	84.3	76.2	75.1	74.1	76.8	79.1	83.7	91.6	98.4	99.9
Forest economy	86.2	86.9	89.4	91.5	93.1	91.9	94.0	94.9	97.2	98.6
Apparat and social organizations	70.5	70.1	71.2	70.7	73.5	78.6	83.3	88.8	93.1	98.1
Culture	51.2	52.9	56.3	59.3	63.3	66.9	70.1	77.2	85.2	92.8
Municipal services	65.4	66.2	68.3	71.0	74.6	77.4	81.1	87.4	91.7	96.2
Civilian police	70.5	70.1	71.2	70.7	73.5	78.6	83.3	88.8	93.1	98.1
Military personnel and statistical discrepancy	74.5	74.6	77.4	80.3	83.0	84.6	87.3	89.9	96.0	97.8

TABLE A-8.—U.S.S.R.: SECTOR OF ORIGIN SERVICE INDEXES (FACTOR COST)—Continued

[1970=100]

	1970	1971	1972	1973	1974	1975	1976	1977	1978
Services	100.0	103.7	107.4	110.1	114.5	118.2	121.8	125.5	129.2
Housing	100.0	102.7	105.5	108.4	111.2	114.1	116.8	119.5	122.4
Utilities	100.0	105.2	109.6	115.1	122.2	129.9	138.0	145.1	152.6
Repair and personal care	100.0	108.5	117.5	127.7	138.0	149.2	159.9	168.9	179.2
Recreation, art, and physical culture	100.0	102.3	103.3	105.4	107.0	108.1	106.6	107.1	108.4
Education	100.0	102.9	105.2	107.1	109.5	111.6	113.8	116.7	119.3
Health	100.0	103.4	106.2	108.5	111.3	113.4	115.6	117.2	119.0
Science	100.0	106.1	114.3	113.3	127.3	134.7	143.3	152.5	160.4
Credit and insurance	100.0	105.9	113.1	119.8	127.1	133.8	140.7	147.9	154.9
Administrative and miscellaneous services	100.0	104.4	108.4	112.1	116.9	121.0	124.8	128.9	132.6
General agricultural programs	100.0	106.6	111.4	115.8	120.6	126.8	138.1	141.2	146.6
Forest economy	100.0	100.4	102.7	102.2	103.7	104.4	103.5	104.2	104.2
Apparat and social organizations	100.0	103.3	107.0	110.4	115.0	118.7	121.3	124.3	127.6
Culture	100.0	106.9	111.5	116.7	122.9	127.9	132.9	140.5	145.4
Municipal services	100.0	105.9	111.1	115.2	120.0	124.4	127.4	132.3	137.3
Civilian police	100.0	103.3	107.0	110.4	115.0	118.7	121.3	124.3	127.6
Military personnel and statistical discrepancy	100.0	103.2	105.3	107.3	108.5	110.0	111.2	111.7	112.9

TABLE A-9.—U.S.S.R.: SECTOR OF ORIGIN SERVICES (FACTOR COST), AVERAGE ANNUAL RATES OF GROWTH

[Percent]

	1951–55	1956–60	1961–65	1966–70	1971–75	1976–78
Services	2.3	2.2	4.5	4.2	3.4	3.0
Housing	3.7	4.9	4.0	3.1	2.7	2.4
Utilities	6.1	9.1	8.9	5.8	5.4	5.5
Repair and personal care	1.7	3.6	2.6	10.5	8.3	6.3
Recreation, art, and physical culture	9.3	5.3	3.9	2.7	1.6	.1
Education	3.6	2.2	5.9	3.6	2.2	2.2
Health	5.0	4.4	3.8	3.6	2.6	1.6
Science	8.4	12.6	8.8	6.7	6.1	6.0
Credit and insurance	.1	0	2.5	5.3	6.0	5.0
Administration and miscellaneous services	−4.0	−1.6	2.4	5.4	3.9	3.1
General agricultural programs	−4.5	9.7	−1.3	4.8	4.9	4.9
Forest economy	−2.8	−4.0	1.3	1.7	.9	−.1
Apparat and social organizations	−6.0	−4.1	2.2	4.9	3.5	2.4
Culture	3.5	1.6	5.5	8.4	5.1	4.4
Municipal services	2.7	1.4	3.4	5.3	4.5	3.3
Civilian police	−6.0	−4.1	2.2	4.9	3.5	2.4
Military personnel and statistical discrepancy	.4	−8.6	2.6	3.4	1.9	.5

TABLE A-10.—U.S.S.R.: GNP INDEXES OF END USE SERVICES (FACTOR COST)

	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959
Consumer services	39.8	41.3	42.9	44.5	46.9	49.6	51.7	54.0	56.5	59.8
Housing	46.3	47.8	49.5	51.3	53.3	55.6	58.0	60.4	63.2	66.7
Utilities	25.1	26.4	27.8	29.4	31.0	32.8	34.8	37.0	39.5	42.3
Personal transportation	13.6	15.1	16.6	18.6	20.8	24.0	25.7	29.4	32.8	36.0
Personal communications	22.4	24.5	26.7	28.4	30.8	33.0	35.6	38.3	40.6	43.2
Repair and personal care	41.1	41.7	42.4	43.1	43.9	44.8	45.8	46.9	48.0	55.2
Recreation, art, and physical culture	35.8	38.3	41.1	43.0	49.3	55.8	59.7	63.0	67.5	69.7
Education	42.5	43.9	45.2	46.2	48.1	50.2	51.8	53.2	54.6	56.6
Health	39.0	40.4	42.2	44.6	48.3	52.2	54.5	57.4	60.3	64.1
Administrative and other services	97.3	97.4	97.4	93.4	86.7	77.3	75.9	72.4	73.2	71.2
General agricultural programs	66.6	72.2	77.6	71.0	73.6	53.0	57.8	55.4	65.8	69.4
Forest economy	121.8	123.9	126.0	113.3	109.3	105.6	103.2	97.4	94.2	87.9
Apparat and social organizations	118.3	116.6	114.8	110.7	98.9	87.0	83.7	78.8	78.2	74.9
Culture	39.9	41.2	42.5	43.6	45.5	47.3	47.8	48.5	49.7	50.4
Municipal services	53.4	55.4	57.5	58.7	59.8	60.9	62.5	63.1	63.9	64.3
Civilian police	118.3	116.6	114.8	110.7	98.9	87.0	83.7	78.8	78.2	74.9

TABLE A–10.—U.S.S.R.: GNP INDEXES OF END USE SERVICES (FACTOR COST)—Continued

	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
Consumer services	63.1	66.1	69.6	72.9	76.9	80.7	84.4	88.2	92.4	96.1
Housing	70.6	74.1	77.4	80.5	83.3	86.0	88.8	91.6	94.5	97.3
Utilities	45.9	50.0	54.4	59.2	66.4	69.5	75.0	80.2	86.3	93.1
Personal transportation	40.1	44.0	49.7	54.8	59.3	64.8	72.0	79.1	86.6	93.0
Personal communications	46.5	49.2	52.2	55.3	59.2	65.4	72.3	79.7	85.5	93.0
Repair and personal care	53.5	49.6	49.1	50.2	54.7	60.7	67.4	75.0	83.0	90.5
Recreation, art, and physical culture	72.2	76.2	78.5	79.6	84.2	87.7	88.3	93.5	97.5	98.3
Education	59.6	63.2	68.6	72.9	78.2	82.7	86.8	90.1	94.2	97.8
Health	68.1	70.7	72.3	74.9	78.0	81.6	84.9	87.3	91.1	94.7
Administrative and other services	70.3	69.5	70.9	71.2	74.2	78.1	82.3	87.9	92.9	97.5
General agricultural programs	84.3	76.2	75.1	74.1	76.8	79.1	83.7	91.6	98.4	99.9
Forest economy	86.2	86.9	89.4	91.5	93.1	91.9	94.0	94.9	97.2	98.6
Apparat and social organizations	70.5	70.1	71.2	70.7	73.5	78.6	83.3	88.8	93.1	98.1
Culture	51.2	52.9	56.3	59.3	63.3	66.9	70.1	77.2	85.2	92.8
Municipal services	65.4	66.2	68.3	71.0	74.6	77.4	81.1	87.4	91.7	96.2
Civilian police	70.5	70.1	71.2	70.7	73.5	78.6	83.3	88.8	93.1	98.1

	1970	1971	1972	1973	1974	1975	1976	1977	1978
Consumer services	100.0	103.6	106.9	110.5	114.7	118.7	122.1	125.7	129.9
Housing	100.0	102.7	105.5	108.4	111.2	114.1	116.8	119.5	122.4
Utilities	100.0	106.3	113.2	120.4	127.9	135.7	143.8	150.1	157.4
Personal transportation	100.0	106.9	114.8	121.5	131.2	141.2	149.5	155.8	163.7
Personal communications	100.0	107.2	114.7	123.4	132.3	141.9	151.0	159.8	169.4
Repair and personal care	100.0	108.5	117.5	127.7	138.0	149.2	159.9	168.9	179.2
Recreation, art, and physical culture	100.0	102.3	103.3	105.4	107.0	108.1	106.6	107.1	108.4
Education	100.0	103.0	104.5	106.9	110.1	113.2	115.0	118.7	123.6
Health	100.0	102.6	105.1	107.6	110.9	113.4	115.6	118.4	120.1
Administrative and other services	100.0	104.1	108.0	111.5	116.1	120.1	123.8	127.4	130.9
General agriculture programs	100.0	106.6	111.4	115.8	120.6	126.8	138.1	141.2	146.6
Forest economy	100.0	100.4	102.7	102.2	103.7	104.4	103.5	104.2	104.2
Apparat and social organizations	100.0	103.3	107.0	110.4	115.0	118.7	121.3	124.3	127.6
Culture	100.0	106.9	111.5	116.7	122.9	127.9	132.9	140.5	145.4
Municipal services	100.0	105.9	111.1	115.2	120.0	124.4	127.4	132.3	137.3
Civilian police	100.0	103.3	107.0	110.4	115.0	118.7	121.3	124.3	127.6

TABLE A–11.—U.S.S.R.: GNP SERVICES BY END USE (FACTOR COST), AVERAGE ANNUAL RATES OF GROWTH

[Percent]

	1951–55	1956–60	1961–65	1966–70	1971–75	1976–78
Consumer services	4.5	4.9	5.0	4.4	3.5	3.1
Housing	3.7	4.9	4.0	3.1	2.7	2.4
Utilities	5.5	7.0	8.7	7.5	6.3	5.1
Personal transportation	12.0	10.8	10.0	9.1	7.1	5.1
Personal communications	8.1	7.1	7.1	8.9	7.2	6.1
Repair and personal care	1.7	3.6	2.6	10.5	8.3	6.3
Recreation, art, and physical culture	9.3	5.3	3.9	2.7	1.6	.1
Education	3.4	3.5	6.8	3.9	2.5	3.0
Health	6.0	5.5	3.7	4.1	2.5	1.9
Administrative and other services	−4.5	−1.9	2.1	5.1	3.7	2.9
General agricultural programs	−4.5	9.7	−1.3	4.8	4.9	4.9
Forest economy	−2.8	−4.0	1.3	1.7	.9	−.1
Apparat and social organizations	−6.0	−4.1	2.2	4.9	3.5	2.4
Culture	3.5	1.6	5.5	8.4	5.1	4.4
Municipal services	2.7	1.4	3.4	5.3	4.5	3.3
Civilian police	−6.0	−4.1	2.2	4.9	3.5	2.4

REGIONAL DEVELOPMENTS IN THE U.S.S.R., 1958–78

(By Martin C. Spechler)

CONTENTS

TABLES

SUMMARY

Soviet Union republics are the core of the economic and cultural life of the constituent Soviet nationalities. There has been a long-term commitment to leveling their economic development.

To appraise inequalities in productive activity and in material welfare among these republics for 1958–78, we measure the weighted coefficients of variation among them and the ratio between the average non-Russian republic and the RSFSR for net material product and total incomes. It appears that NMP per worker in the "productive" sphere, which has always been higher in the northern republics, became more so during the two decades under review, although even the poorest Central Asian republic continued to progress slowly. Correction for excluded services makes only a slight difference in the direction of greater inequality.

Total nominal income per capita is distributed more equally than is NMP or GDP, suggesting an open or implied subsidy to some of the poorer republics. These transfers have been growing rather rapidly. The dispersion of consumption per head is similar to that of nominal incomes in cash and in communal services. While deflation of nominal figures by the small regional price differences overall does not seem worthwhile, given the poor quality data, adjustment to an adult-equivalent basis showed that the Soviet republics have not become more unequal in their material well-being. The trends in nominal incomes per head resulted to a great degree from the different demographic

characteristics of the different republics in the last two decades. Despite a rather low disparity of incomes among the Soviet republics, the more modern USA showed noticeably more egalitarianism among the states, especially when adjustment is made for the asymmetry of Soviet regionalization.

Gross investment has been distributed somewhat more unequally during the Brezhnev years, and this may have contributed to the growing productivity gap. But efforts to develop labor-intensive industries in labor-rich areas have succeeded partly. The labor shortage is aggravating the Soviet agricultural deficit and preventing continued extensive growth. To solve these problems, more resources may be directed in the future to the Asian republics.

Introduction [1]

Since those early years when the Bolshevik leadership reunited nearly all the former vassals of the Russian Empire under the battle standard of proletarian internationalism, Soviet national divisions have attracted continual attention, not least in Moscow. Now, too, with a transition of leadership and possibly a prolonged succession crisis at hand, an outside analyst does well to probe the deep fault-lines of this multinational state. Such probing can help us determine whether and where the smooth surface might crack, or even split, in the event of severe disunity or other signs of weakness at the top.

The present paper examines certain economic aspects of the national question in Soviet life: to what extent has interrepublican equality been achieved during the Khrushchev and Brezhnev periods? Have the historical differences been aggravated, thus inviting frustration? What appear to be the practical intentions of the Soviet leadership with regard to regional issues? Needless to add, no intelligent observer believes that unperceived material interests—without organization—manifest themselves in history. Yet the material situation of the respective national groups, their relative share in the country's resources, will find reflection in the attitudes of workers, consumers, and local officials. They will do much, therefore, to condition the dilemmas forcing choice upon this present or any future Soviet government.

This study's second purpose is to inquire whether the Soviet Union is following the general trend in most developed societies towards greater interregional equality.[2] If so, this might be suggestive of increasing (socialist) market integration and better information, as well as international altruism or the necessities of imperial power. Greater inequality, on the other hand, would indicate at this stage of development that the planning bureaucracy is reinforcing agglomeration economies or established privilege.[3]

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[1] This study is the second part of a larger enterprise to compare a number of East European countries' practice during their capitalist and communist phases. The author would like to acknowledge the assistance of the Department of Economics and the Soviet and East European Research Centre of the Hebrew University of Jerusalem; The Russian and East European Research Center at Tel-Aviv University provided me office space and library facilities. Ms. Vera Dubnov, Dr. Zev Katz, and Dr. Keith Bush of Radio Liberty Research provided certain references. Dr. Sydney C. Rome checked my calculations, and my wife. Dr. Dina R. Spechler, gave advice and counsel at numerous points.

[2] J. G. Williamson, "Regional Inequality and the Process of National Development: A Description of the Patterns," Economic Development and Cultural Change, vol. 13 (1965), pp. 3–45.

[3] As predicted by Gunnar Myrdal, Economic Theory and Underdeveloped Regions (London: Duckworth, 1957).

Why Take Republics as Units

Our primary focus in this paper is on the fifteen Union-republics, not on the fifteen distinct titular nationalities which compose each Union-republic's largest single population group (except in Kazakhstan). The reasons are both practical and substantive. Some social data on nationals regardless of residence have been published since the 1970 census—and we shall refer to them below [4]—but no information on income and wealth distributions among the Soviet nationalities have found their way out of the Central Statistical Administration. Nearly all our current information relates to the Union-republics.

Despite some anomalies—like Alma-Ata, the Slavic-dominated capital of Kazakhstan—the Union-republics retain their national importance. Between 1959 and 1970, the mean concentration of the titular nationality residing in their own republic rose. Only the Russians continued to disperse among the other republics to more than a slight degree. This relative dispersal occurred despite the enormous scope for Russian migration within the borders of their own RSFSR. Still, five of every six Russians resided in the RSFSR at the 1970 census. Conversely, all the European republics counted a higher percentage of the titular nationality among their citizens in 1970 than in 1959. In polyglot Central Asia—where the centers of population are so close to each other—the main national group is always less than two-thirds of the republic's population and often much less in urban centers. It remains true that the Central Asian nationalities have shown persistent preference to live among their own kind.[5]

Furthermore, national rights in the Soviet Union are safeguarded to any degree at all only within the national republics (or autonomous areas, for lesser nationalities). Unlike "expatriate" Russians, the Ukrainian, the Armenian, or the Uzbek "abroad" will find no schools, theaters, or newspapers in his own language. He must practically speak Russian on the road,[6] even if he is not quite forced to do so at home. The many Ukrainians living in Siberia might better be in Canada from the point of view of their Ukrainian national heritage.[7] No Soviet republican nationality has autonomous status within the territory of another such nationality, though very many small national groups (Finns, Tartars, and even Jews) do.[8] One may say, then, that Union-republic boundaries outline the core of each nationality's common life.

Even where Slavs dominate the scene as fraternal colonists, experts, and skilled manpower, they may complement local nationals in the development of the republican economies—as well as compete for jobs

[4] See sections II and V. For a full discussion of the nationality dimension, the reader is referred to Brian Silver, "Levels of Sociocultural Development Among Soviet Nationalities: A Partial Test of the Equalization Hypothesis," American Political Science Review LXVIII, 4, December 1974, pp. 1618–37; and the compendium edited by Zev Katz, Rosemarie Rogers, and Frederic Harned, Jr., Major Soviet Nationalities, New York, Free Press, 1975.

[5] Katz, Rogers, and Harned, op. cit., pp. 445–46.

[6] This is the experience of many small soverign nationalities throughout the world. Komsomol'skaya Pravda. Jan. 28, 1976.

[7] I. Dzyuba, Internationalism or Russification?, 2nd ed., London, Weidenfeld and Nicolson. 1970. Nonetheless, Hungarians, Poles, and Germans have had their own schools on the West of the U.S.S.R.

[8] A minor exception might be the Nakhichevan ASSR, which is administered by the Azerbaidjan SSR, though the autonomous republic is wholly surrounded on the Soviet side by the Armenian SSR. Kaliningrad (formerly Königsberg) Oblast is a discontinuous part of the RSFSR.

and privilege. Some Russian youth and experts in construction, extraction, and engineering merely sojourn for a time under semi-mandatory labor placement. Some others stay on in the non-Russian republics to marry local youth. Many return to Mother Russia with their trustworthiness proven by years of pioneering the Soviet frontier. Hence, a fraction of the self-identified Russians in every non-Russian republic must be seen as temporary residents, although not equally so everywhere. In sum, therefore, the economic progress of any Union-republic is a good indication of the long-term economic situation for the titular nationality.

During the debate leading up to the new U.S.S.R. Constitution, some spokesmen for the centralizing tendency in Soviet life called for dissolving or altering republican borders to accord with economic reality. Indeed, when Khrushchev's administration drew up major economic regions, republican lines were sometimes crossed. Any competent geographer can point out instances in which resource and demographic unities are bisected by today's political borderlines. Much of Kazakhstan, for instance, is properly considered a continuation of the South Urals area of Russian industrialization. But economically meaningful regionalization—let alone the expressed will of certain sub-nationalities—has not been permitted to disturb the geographic status quo. Union-republics' constitutional prerogatives, including a veto on border changes and the famous right to secede from the U.S.S.R., have been preserved. Their economic independence, though, remains residuary only.[9] The new Constitution permits diplomatic interchanges with foreign countries, but not independent trade.

Indeed, since 1965 less and less has been published in Soviet statistical handbooks about the results for the major economic regions. This gathering silence is a loss to comparative economists, since there is little information about differences within the huge Russian Republic (some 53 percent of the total U.S.S.R. population in 1978) or the Ukraine (19 percent). At the smaller end, no fewer than nine of the fifteen Soviet Union-republics have populations of less than two percent each of the U.S.S.R.'s 260 millions. This fact makes comparisons with more symmetrically and rationally divided countries particularly hazardous, as we shall see in section II below.

Not a great deal is yet known about the new fashion in regional economic organization, the Territorial Production Administration.[10] Therefore, awkward as they are, the Soviet republics endure, and we must deal primarily with them as the best basis for long-period comparisons.

Official Soviet Objectives

Previous studies in Soviet regional economics have pointed out that in Soviet nationalities theory, the desired "evening out" of development has referred to both production and consumption.[11] Communism,

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[9] Arts. 73 and 74 define the legal precedence of U.S.S.R. legislation over its entire territory. For the text of the final law and the changes from the draft, see Current Digest of the Soviet Press, vol. XXIX, no. 41, pp. 1ff.

[10] But see Gertrude Schroeder. "Soviet Regional Development Policies in Perspective." NATO—Directorate of Economic Affairs, The U.S.S.R. in the 1980s, Brussels, 1978, pp. 125–41.

[11] The best discussion of the Marxist-Leninist teaching on these matters is by V. Holubnychy, "Some Economic Aspects of Relations Among the Soviet Republics," in Erich Goldhagen, ed., Ethnic Minorities in the Soviet Union, New York, Praeger, 1968, pp. 50–120.

like any non-capitalist form of social organization, has the possibility of severing claims to income and consumption from productive contributions.[12] Lenin welcomed this flexibility in the service of internationalism and did not dwell on the possible conflicts between preferential industrial and cultural development in the Moslem and Caucasian republics and the need for rapid progress of the country as a whole. "Complex development" (many industries in any region) can detract from any economies of scale and agglomeration, although less so today than when output was much smaller. Stalin tended to sacrifice movement towards national and regional equality to the achievement of overall development at maximum speed. In more recent years, the desire to impress the Third World and concern with the Chinese threat in the East have once again impelled Moscow to favor the outlying provinces, as the Tsars' ministers did. This policy is consistent with Marxism-Leninism, as we are often reminded these days. From the viewpoint of dialectical materialism, the national question arises from unequal development and will be answered through both assimilation and the "leveling" of economic development, as Soviet society reaches a yet higher stage of well-being. Coercion becomes unnecessary, and chauvinism a sign of backwardness and impatience. Indeed, according to Khrushchev and Brezhnev after him, the Leninist aspiration of "leveling" social and economic development in the U.S.S.R. has been realized "in the main." [13]

Is this not merely a boastful distortion? The objective evidence presented in sections II–IV indicates that incomes among Soviet republics are remarkably equal on average, partly owing to explicit social welfare spending. Contrary to some reports, material well-being among the Soviet republics has risen more or less steadily and evenly during the past twenty years. Productivity, on the other hand, remains more unequally distributed over the U.S.S.R., and the more productive republics have seemingly progressed a good deal faster than the more backward ones, especially those of Central Asia (sections II–III).

We may thus conclude that explicit and hidden transfers of incomes to the Asian areas have become a more and more salient aspect of Soviet political economy in the last two decades. Curiously, this phenomenon—which might be called "welfare colonialism"—has not been widely noticed up to now.

Most previous efforts in the West have concentrated attention either on production indexes or on income and consumption. A few writers who have sought to identify transfers from republic to republic have had to rely on incomplete budget data, since national income and balance of payments studies of the Union-republics have apparently not been issued in the Soviet Union for recent years.[14] The published

[12] Sometimes under immature capitalism the regional gap is aggravated by the preferences of asset owners to invest close to home in regions already advanced. Stuart Holland, Capital versus the Regions, London, Macmillan, 1976, chapters 4 and 5. This does not appear to have been the case by and large in Imperial Russia, according to my previous study. "Regional Concentration of Industry in Tsarist Russia, 1854–1917," Soviet and East European Research Center Paper Series, Jerusalem, February 1979.

[13] Pravda, Dec. 22, 1972, for example.

[14] Two important exceptions to the statement in the text are the studies on the Ukraine: V. N. Bandera. "Interdependence between Interregional and International Payments: The Balance of Payments of Ukraine," and Z. Lew Melnyk, "Regional Contribution to Capital Formation in the U.S.S.R.: The Case of the Ukrainian Republic," both in V. N. Bandera and Z. L. Melnyk, eds., The Soviet Economy in Regional Perspective, New York, Praeger, 1973, pp. 104–53. Secondly, on the transfer issue: H.-J. Wagener, Wirtschaftswachstum in unterentwickelten Gebieten, Berlin, Duncker & Humblot, 1972, pp. 152–57.

Union and republican budgets are but one of the fiscal transfer mechanisms in the Soviet economy. Within industrial branches, the cross-subsidies in enterprise wholesale pricing, for example, are completely hidden from our view. When wages are paid in excess of the current value of marginal productivity to attract labor to unpleasant situations, this investment implies a transfer.

In addition, the pioneering studies of the past perforce based themselves on statistics for only a few years—chiefly after 1958, when publication was resumed on a more generous scale. Those few years saw major institutional shifts and harvest fluctuations which may have disturbed the immediate-term trends, as these specialists knew very well. We can now utilize the full record of two decades to support our views and thus re-examine some of the accounts published in previous years. I have also tried to improve the earlier efforts somewhat by adapting the main statistical measures used so as better to suit the purposes of the comparisons offered. Given the complexity of the nationality issue and the half-concealed nature of the data made available, however, the present effort has to be considered only a tentative contribution to an on-going enterprise of specialists from the whole world.

I. Productivity Differences

The Soviet measure most acceptable to Western economists for summarizing the dispersion of productive activity is net material product (NMP), which in principle approximates our familiar net domestic product at market prices with the exclusion of defense, general government, and certain person services. That is, NMP is always less than the Western NDP.[15]

The prices according to which NMP (as published), is aggregated include turnover tax. Were our concern productive potential, the inclusion of turnover tax in each republic's output would exaggerate the role played by republics with a disproportionately high share of light industry, oil products, and agriculture—where the rate of taxation is particularly high. Since it is not practical to deduct turnover tax or to attribute a common capital charge in order to obtain NMP at factor cost for the republics,[16] we must content ourselves with the observation that the NMP comparisons will overestimate the degree to which the southern republics contribute to U.S.S.R. productive potential. This means that the measured gap found between North and South is at least as great as that in productive potential.

Beyond the usual problems in valuing Soviet national income, there are some spatial ones which must at least be mentioned, even if they cannot be resolved. Agricultural output is troublesome because it is inconsistently priced. Much of it is sold at low official procurement prices, which are differentiated to favor the disadvantaged areas and thus serve to collect rent from others. Some produce is made available at higher ccoperative or collective farm market prices. State farms are paid differently from kolkhozes. Thus even the output which is re-

[15] Abraham S. Becker, "National Income Accounting in the U.S.S.R.," in Vladimir G. Treml and John P. Hardt, eds., Soviet Economic Statistics, Durham, North Carolina. Duke University Press, 1972, pp. 69–119.

[16] On the distinction between productive potential and the (material) welfare standard. see Abram Bergson. The Real National Income of Soviet Russia since 1928. Cambridge. Harvard University Press, 1961, chapter 3.

corded is priced differently depending on institutional restraints not closely related to the scarcities on regional matters. Moreover, we have no indication of how transport costs are allocated. Different industries have quite various profit rates, especially just before a price reform, depending on bureaucratic as well as competitive factors. Those profit rates do not fully reflect scarcities on the regional markets.

Official Soviet statistics surely ignore private manufacturing, construction, and probably a good deal of private-plot agriculture. While overall these activities may not be as great as sometimes believed,[17] there is some reason to think semi-legal and illegal production of goods is more widespread and substantial in the Caucasion republics than elsewhere and the degree of underreporting correspondingly greater.

Table 1 sets out the main findings on production differentials among the Soviet republics over the past twenty years. Two summary statistics are presented to convey different aspects of the distribution. The coefficient of variation is an appropriate measure of the spread of several series with different means. Its formula is

$$CV_w = \frac{[\sum(y_i - \bar{y})^2 f_i]^{1/2}}{\bar{y}}$$

where f_i is the appropriate weight for the series y_i, whose means is $\bar{y}$.

TABLE 1.—NET MATERIAL PRODUCT PER CAPITA IN SOVIET REPUBLICS, 1958–78 [1]

	In percent of union average						Estimated level 1978 (rubles)
	1958	1960	1964	1970	1975	1978	
RSFSR	106	108	110	111	114	114	1,904
Ukraine	100	96	97	97	93	95	1,579
Belorussia	72	81	86	92	105	110	1,827
Uzbekistan	78	75	72	61	58	56	929
Kazakhstan	94	88	83	82	73	82	[2] 1,363
Georgia	85	79	75	76	76	79	1,321
Azerbaijan	91	89	76	62	63	65	1,077
Lithuania	86	92	102	112	111	111	1,854
Moldavia	82	76	76	82	77	80	1,327
Latvia	121	128	132	132	133	136	2,268
Kirgizia	77	73	73	67	60	57	953
Tadjikistan	67	66	69	58	52	50	824
Armenia	78	78	76	77	80	81	1,352
Turkmenia	116	107	94	73	66	60	991
Estonia	117	128	140	133	132	130	2,160
All-union average level (rubles) [3]	610	684	820	1,200	1,512	1,664	----------
Coefficient of variation (weighted) [4]	.106	0.119	0.136	0.166	0.197	0.198	----------
Non-Russian/Russian ratio (percent)	86.2	82.5	80	78.1	73.6	73.4	----------

[1] Net material product is net output in manufacturing, mining, agriculture, and certain services connected to production. It excludes government and financial and personal services. Projections based on national income produced, which is nearly equivalent to NMP.

[2] Estimated from republic figures and union total.

[3] In prices of 1970. Russian Republic.

[4] Weighted by republican population in the given year. The coefficient of variation is the standard deviation divided by the mean.

Note: Owing to lack of explanation in the original sources, it cannot be excluded that the constant price series are derived from a changing basis. To the extent this is so, the above series should be interpreted as current price relatives For the purpose at hand, however, such shifts would not have been very significant for relative movements over time.

SOURCES

1970: Levels taken from Narkhoz Latvia 1971, p. 56; Narodnoe Hospodarstvo Ukrain'skoi RSR v. 1971 rotsi, p. 359; Narkhoz Uzbekistan 1970, p. 216; Narkhoz Kazakhstan 1971, p. 261; V. I. Mel'kadze, ed., Ekonomika Sovietskoi Gruzii (Tbilisi, 1972), p. 90; Narodnoe Khoziaistvo Azerbaidzhanskoi SSR k 50-letiiu SSSR, p. 196; Lietuvos TSR Ekonomika ir Kultura (Vilnius, 1972), p. 114; Kirgizstan v Tsifrakh, p. 191—cited in I. S. Koropeckyj, "The National Income of the Soviet Union Republics in 1970," in Z. M. Fallenbuchl, Economic Development in the Soviet Union and Eastern Europe, vol. 1, New York, 1975, table 11.1. 1970 population from Zev Katz, Rosemarie Rogers, and F. Harned, (eds.), Handbook of Major Soviet Nationalities (New York: Free Press, 1975), Table A.4.

Net material product derived from national income produced indexes published in Narodnoe Khozyaystvo SSSR, issues for 1960, 1964, 1968, 1977. Population weights from same source.

1977: Data collected by Ann Sheehy, "Economic Performance of the Union Republics in the First Two Years of the Tenth Five-Year Plan," Radio Liberty Research Bulletin, No. 60/78 (Mar. 20, 1978), corrected to accord with later published figures for produced national income.

1978: Collected from reports in republican newspapers, January-February, 1979. Population: Vestnik Statistiki, No. 11. 1978.

[17] According to a forthcoming study of about 1000 former Soviet families by Professor Gur Ofer and Dr. Aaron Vinokur.

The all-Union average is weighted by the respective populations when we want to evaluate the dispersion of economic activity in the country as a whole. Even when the concern is narrowly political, the weighting assigns importance to each republic according to size. Surely the gap between the Ukraine and the overall level is more salient for the central leadership than a similar size gap would be for Armenia, a republic one-tenth the numbers of the Ukraine.[18]

We see that the weighted coefficient of variation has almost doubled in the period under review. The rise in the productivity gap was especially sharp during the middle Brezhnev years.[19]

For focusing on the nationality gap, as opposed to regional inequality for the whole economy, the best summary statistic is the ratio between the NMP per capita of the Russian Republic and all the rest (some 47 percent by population). The range, between Tadjikistan and either Latvia or Estonia at the top, has much less practical import on account of the social geography.[20] Binary comparisons between republics can give rise to resentment in the wealthier republics, where it is sometimes argued that they are being 'robbed' to subsidize the much poorer. The non-Russian/Russian ratio in a sense measured the typical basis for resentment by (or against) Russians. That differential grew in parallel to the coefficient of variation and confirms our impression of rising inequality in productive activity since 1958.

Turning to particulars, we can note similar experience among some closely related republics. The three Baltic republics and Belorussia made marked progress, even relative to the U.S.S.R. record, on the basis of prosperous agriculture and sophisticated light industrial and electronics manufacturing. Both of these sectors gained in standing during the period in question, as compared with the Stalin and immediate post-Stalin years. As we shall see, they also benefitted from relatively high labor-force participation, but as these rates did not rise, this fact bears mostly on their consistently high levels of production per head.

The four Central Asian republics lost their relative standing no less dramatically, although except for oil-depleted Turkmenia, the falls were never absolute in nature between benchmark years. To a lesser extent, the same decline characterized Azerbaijan and Kazakhstan.

Can it be said that these declines are owing to the increase in the number of dependent children in these Asian republics at a time when the birth rates were falling steeply in European areas? Apparently not. True, if we consider the level of NMP per employed worker in these republics for 1970, the shortfall of the Asians is considerably less than if measured per head of population. An extreme example is Turkmenia. Table 1 shows its NMP per capita as 27 percent below

[18] Professor Schroeder's reasons for preferring an unweighted CV are unconvincing. As she recognizes, Soviet republics are not "rational" economic areas, and this presumably suppresses some of the observed variance. But the divisions within countries we would wish to compare to the U.S.S.R. likewise suffer this deficiency. Failure to assign an explicit weight hardly repairs it. "Soviet Wage and Income Policies in Regional Perspective." The Association for Comparative Economic Studies Bulletin, vol. XVI, no. 2, 1974, p. 15. Any reader interested in a republican nationality as a unit of value can, of course, simply divide the index for it in the tables by that of any other republic he cares to choose in order to obtain the appropriate relative.

[19] Koropeckyj's coefficient also rose in 1958–68, but for unknown reasons his CV's are about four percentage points above those presented here. "Equalization of Regional Development in Socialist Countries: An Empirical Study," Economic Development and Cultural Change, vol. 21, 1972, pp. 68–86.

[20] Soviet specialists Ya. Feigin and Ya. F. Vorob'ev have calculated the range was 3:1 and 2.4:1 in 1960 and 1961, respectively, somewhat higher than our findings. Cited in Holubnychy, op. cit., p. 68.

the Union mean (100 minus the index of Turkmenia for 1970), but the NMP per employed worker in this traditional republic was a mere 7 percent. Nonetheless, in every case the gap between these six Asian republics and European U.S.S.R. republics increased from 1970 to 1975. Except for Kazakhstan, the gap grew still wider from 1975 to 1978 (see table 2).

The figures on NMP per employed worker in material production show also that both the non-Russian/Russian ratio and the coefficient of variation increased by about half on 1970–75. To check whether agricultural difficulties in 1975 affect that year's figure unduly, the 1976 CV was compiled. It proved to be nearly identical. Unfortunately data at hand did not permit calculation of the comparable figures for the 1960's, and even the 1975 and 1978 figures are based on tentative assumptions subject to more than the usual margin of error. When 1978 or 1980 employment data are finally available, this table would have to be amended somewhat. Nevertheless, the adjustment for labor force participation in material production reduces the NR/R ratio for 1978 about six points, from 73 to 79 (compare tables 1 and 2).

TABLE 2.—NET MATERIAL PRODUCT PER EMPLOYED WORKER IN SOVIET REPUBLICS, 1970–78[1]

	In percentage of the all-union level			Estimated level (rubles)
	1970	1975	1978	1978
RSFSR	108	116	110	4,691
Ukraine	88	87	90	3,813
Belorussia	83	92	95	4,036
Uzbekistan	82	75	70	2,989
Kazakhstan	98	88	94	4,007
Georgia	82	80	82	3,476
Azerbaijan	93	85	83	3,530
Lithuania	96	98	99	4,202
Moldavia	71	67	68	2,875
Latvia	117	117	121	5,155
Kirgizia	80	70	65	2,780
Tadjikistan	86	76	72	3,049
Armenia	98	87	85	3,626
Turkmenia	93	91	79	3,372
Estonia	106	120	124	5,256
All-union average level (rubles)	3,243	3,883	4,247	
Coefficient of variation (weighted by number of workers)	0.109	0.160	0.138	
Non-Russian/Russian ratio (percent)	83.6	70.3	79.2	

[1] Civilian employment in manufacturing, mining, and agriculture, but not in housing, communal, personal, health, financial, educational, or other governmental services. 1975 and 1978 figures projected on the assumption that the share of such workers in the population of working age remains constant. The base 1970 figures from Koropeckyj, in Fallenbuchl, op. cit., p. 294, while the 1975 and 1978 figures were calculated on the basis of index numbers published in the union and republican statistical yearbooks and the plan fulfillment reports in republican newspapers.

Perhaps the point of this is worth some stress. The rise in the disparities shown in Table 2 prove that the lagging performance outside the European U.S.S.R. is not a statistical artifact, as has been thought. The poorer republics have experienced real difficulty keeping up with the growth in labor productivity seen elsewhere. What is the source of these difficulties? Probably not insufficient industrial investment, as we shall see in section IV. Rather, the source seems to lie in industrial efficiency. But further analysis would go beyond the information currently on hand.

The much publicized and highly capitalized shift of production eastwards may have caused the rise in our Russian figure from 3501 rubles per employed worker to 4691 in 1978, that is, a rise of 34 percent. Yet mineral-rich Kazakhstan did not even hold its own. Agri-

cultural Moldavia, Armenia, and Georgia—insofar as their production was recorded—continued at levels about one-fifth below the Union average. In general, the republics' ordinal positions were quite stable over the twenty year period, with Belorussia the only one strikingly mobile.

Only one attempt has been made to calculate relative GNP per capita (actually GDP by the income approach) for the Soviet republics. Ivan Koropeckyj's detailed estimates for 1970 would give a weighted coefficient of variation of .179 and a NR/R ratio of 81.3 percent.[21] Compared with the present findings, this means that overall the government and service sectors left out of NMP were slightly disequalizing over space. Undoubtedly this effect expresses the greater urbanization in the richer republics and their generally better amenities.

II. Incomes and Consumption

In Soviet circumstances total income is derived from the wages of state sector employees (about three-fifths of the total income for 1970), from collective farm incomes (some 7 percent), as pensions and allowances (14 percent), with a similar proportion from communal services rendered to individuals, perhaps a tenth from private subsidiary activities. Some miscellaneous incomes, including petty rentals of property, make up the remainder.

Regional differences will arise from differences in skills and employment opportunities, but various studies indicate that wage compensation for any given job is fairly equal over space. "Wage drift," [22] special incentives such as housing, chances for future promotions, and other deviations from officially approved wage rates on the part of individual employers seem to absorb much of the local disequilibria caused by attempts at a too uniform pay policy. Enterprises may, of course, pay more than the value of each person's marginal product insofar as profitability is not the chief criterion of its activity. It is not impossible in the Central Asian enterprises of Union subordination that operatives are paid more than their marginal productivity.

In assembling information on the regional dispersion of incomes, the main lacuna is private market activity, mainly of peasants. The extent of such activity—much of which is legal—can be gauged only from the budget studies occasionally published by Soviet researchers.[23] Because of the way samples are collected, the sensitivity of private plot activity—which has been restricted more than once and is taxable—and the difficulties of valuing home-grown consumption, such information is shaky. More to the point, this private activity varies from region to region depending on proximity to urban markets and the produce grown, not to mention the opportunities to make use of state property for the production and distribution of such "private" goods. Adding collective farm family incomes to the wages and salaries earned in the state sector may involve double-counting, since many collective-farm family members work in state factories or construction sites.

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[21] I. Koropeckyj in Fallenbuchl, op. cit., pp. 287–331.

[22] Payment according to a skill or job classification than really justified in lieu of a wage hike.

[23] M. I. Sidorova, Vozmeshchenie neobkhodimykh zatrat i formirovanie fondavosproizvodstva rabochei sily v kolkhozakh, Moscow, 1972; and M. I. Sidorova, Obshchestvennye fondy potrebleniya i dokhodov kolkhoznikov, Moscow, 1969.

With all these reservations, it still seemed justified to present an extension through 1978 of Alastair McAuley's careful work for total income per capita.[24] For all its methodological mystery, the Soviet "real income" indexes do include most of the important items in total income, including income in kind, and some of the apparent biases would likely be uniform across regions.[25] Table 3 shows a small widening of the interregional inequality from 1970 to 1975, on both the weighted coefficient of variation and non-Russian/Russian ratio tests. A similar trend, one may recall, showed up in the figures for net material product. Comparison of the two per capita series shows that income is more equally distributed than is productivity. In 1970 in Kirgizia, for example, net material product was some 800 rubles per head or one-third below the Union average, while incomes per head were only one-quarter below the average for that year. Incomes come from the non-material sector, and net material product goes also to direct investment, so one is not able to measure the degree of "welfare colonialism" by the arithmetic differences alone. The relative difference between the indexes for a single republic-year in the two tables is revealing. though.[26]

TABLE 3.—TOTAL INCOME PER CAPITA IN SOVIET REPUBLICS, 1960–78[1]

[Current rubles][2]

	All-union average=100					Estimated level 1978 (rubles)
	1960	1965	1970	1975	1978	
RSFSR	107.5	106.8	107.4	110.0	110.2	1,396
Ukraine	94.0	97.8	96.6	94.2	93.6	1,186
Belorussia	82.7	89.6	94.6	100.0	101.3	1,284
Uzbekistan	78.0	73.9	75.7	73.8	71.8	910
Kazakhstan	95.9	91.7	90.8	86.4	84.2	1,067
Georgia	93.9	87.9	89.4	87.4	90.7	1,149
Azerbaijan	74.5	70.1	68.4	70.9	71.1	901
Lithuania	105.7	109.0	116.4	111.7	110.7	1,403
Moldavia	70.9	85.6	87.2	92.2	93.4	1,183
Latvia	124.6	122.2	124.4	118.3	118.2	1,497
Kirgizia	73.8	79.6	75.0	74.4	72.3	916
Tadjikistan	68.7	74.5	66.1	67.0	66.5	842
Armenia	86.4	84.9	88.2	87.7	88.9	1,126
Turkmenia	81.2	82.4	80.7	86.7	84.0	1,064
Estonia	129.2	121.9	133.1	127.7	127.0	1,610
All-union level (rubles)	511	679	928	1,141	1,267	1,267
Coefficient of variation (weighted)	0.112	0.104	0.116	0.129	0.135	
Non-Russian/Russian ratio (percent)	84.2	85.9	85.0	80.5	80.5	

[1] Total personal income includes all payments in cash or in kind plus free or subsidized communal consumption (like education, health, housing, or childcare). Private subsidiary activity, mainly from private plots, is included and comes to about 8.5 percent of the total in 1970.

[2] Projections of 1970 figures according to real'nyi dokhod index in 1970 prices for 1975 and 1978. The calculation assumes that private subsidiary income (and any other item not included in the underlying Soviet series) rose at same rate as the other elements of total income in money and kind.

We might take note that per capita consumption, including certain highly subsidized items missing from total income, showed a coefficient of variation of .114 in 1965, according to Professor Elizabeth Clayton's detailed study.[27] Our figure for income in 1965 was .104, so

[24] These were kindly made available to me just before publication. Schroeder's figures are somewhat different but lack of full methodological explanation prevents me from pointing out the reasons for the small discrepancies. McAuley's set were chosen as being the more comprehensive and, in my opinion closer to the real'nyi dokhod definition used in my extension.

[25] Cf. Gertrude E. Schroeder, "An Appraisal of Soviet Wage and Income Statistics," in Treml and Hardt, Soviet Economic Statistics, op. cit., pp. 287–314.

[26] One should note that the indexes of different republics are not fully commensurate: the arithmetic intervals between them are not meaningful, owing to their different sizes.

[27] Elizabeth M. Clayton, "Regional Consumption Expenditures in the Soviet Union," The Association for Comparative Economic Studies Bulletin, vol. XVII, no. 2–3, 1975, pp. 27–43.

the supposed greater availability of housing, durables, and other items in the richer areas apparently added little to overall income inequality.

To check the accuracy of the estimates for incomes presented in Table 3, several ratios were computed for the Ofer-Vinokur sample. Their sample almost completely lacked Jews who lived in Asian republics, and for various reasons the sub-sample from each republic (or group of republics) came disproportionately from certain occupations and localities. This fact limits the comparisons which we can draw here. Total per capita income from all sources in 1972–74 for the sampled urban Jews who resided in the Ukraine was about 1,274 rubles a year, while the RSFSR city residents sampled had per capita incomes of 1,571 rubles a year. That is, the sample's budgets show a relation of 81:100 between Ukrainian conditions and those of the RSFSR (see table 4).

Let us compare that with the estimates derived from official data. Using McAuley's personal income concept, which at most omits only a few small items included in Ofer-Vinokur's "total income" concept, we calculate that the Ukraine's total population had 89.8 percent of the RSFSR per capita income levels in 1970.[28] Considering the disproportionate presence of Moscovites and Leningraders in the Ofer-Vinokur sample and the absence from it of kolkhozniks (whose income dispersion is greater), the two sources of data seem to accord well. But reweighting still needs to be done in the Ofer-Vinokur results to give a more representative sampling of general well-being in each republic.

In theory two adjustments would seem necessary to transform the per capita total income levels reported in table 3 into a better indication of material well-being. First, these are nominal amounts, and market prices could differ across the tremendous expanse of the U.S.S.R. "Deflation" of the cross-section seems theoretically mandatory.

TABLE 4.—TOTAL INCOME PER CAPITA IN OFER-VINOKUR SAMPLE OF 1,000 JEWISH FAMILIES IN VARIOUS SOVIET REPUBLICS, 1972–74

Republics of residence	Income per capita [1]	Index [2]	Percent of income from private sources	Number of family budget collected
RSFSR	1,571	100	7	190
Ukraine	1,274	81	7	380
Belorussia	1,291	82	5	48
Moldavia	1,281	82	7	285
Baltic	1,373	87	4	90
All others [3]	1,407	90	4	23
Whole sample	1,359	87	7	1,016

[1] Computed by dividing family total income by the average number of persons in a family in that republic—an approximate procedure.
[2] Percentage of the Russian Republic level.
[3] Identified and unidentified sources.

Source: Unpublished estimates prepared by Y. Bar-Haim of the project staff.

Generally speaking, though, the official prices are not too dissimilar. Zonal premia on food prices in state stores are a few percent only.

[28] McAuley, Alastair, Economic Welfare in the Soviet Union, Poverty, Living Standards and Inequality, London, George Allen & Unwin, 1979, Tables 6.1 and 6.3. Ofer and Vinokur's unpublished results were generously made available to me fresh from the computer.

Other goods (except wood products) usually carry uniform prices throughout the U.S.S.R., although rural consumers pay some 7 percent more to reflect higher handling costs.[29] Thus, the main source of regional price differentials would seem to lie in the availability and demand for collective farm market animal products, fruits, and vegetables. Richer Soviet citizens avail themselves of collective farm markets more than the less well-off, at least in the cities. Possibly because of this, two Russian economists indicate a lower unit food cost in the Ukraine and Kazakhstan for 1968.[30] But computed for all of the family shopping basket, the Ukraine, Kazakhstan, Central Asia, and the most populated parts of the RSFSR show price differentials of 2 to 4 percent only, with the Urals being 10 percent dearer.[31] Remote parts of the U.S.S.R. are considerably more expensive to live in, but extraordinarily high wages are paid to compensate the relatively few households residing in these northern districts.[32] All this leads me to the conclusion that adjustment for price differentials among the Soviet republics is not justified at present on the basis of the rough data available.

No Soviet officials price index for regions has been published. Professor Wiles has been the only Western researcher up to now to brave the "deflation" matter.[33] "Very approximately," Wiles shows the price index for Transcaucasia at 92 percent of the Ukrainian statistical base and the RSFSR at 107, with the other republics scattered between these narrow limits. If Wiles is correct in the direction of his adjustment, the lower income republics enjoy the partial offset of lower prices. The figures shown in table 3 would, therefore, constitute an upper limit of the degree of inequality across regions in the Soviet Union for years around 1968. I should say this matter warrants further investigation in the field.[34]

A second desirable adjustment to per capita total income would be to account for the lower consumption requirements, normatively and in observed fact, of children and other persons not currently in the workforce. Western economists responsible for designing income maintance programs have been working on this subject for some time.[35] Soviet researchers have also explored the age, sex, and labor force participation adjustments in connection with "rational budgeting." [36]

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[29] Professor Clayton makes no adjustment for regional price differentials "since they reflect services received by consumers, i.e., transportation and handling." Unless it be argued that the transportation and handling are a proxy measure of the psychic and otherwise unmeasured pleasures of living in inaccessible areas—which the Professor from St Louis might indeed assert—this does not seem sound. People want the consumer goods, and the transportation is an intermediate cost no less than packaging. Hothouse tomatoes grown in the far North are likewise more expensive. Clayton, "Regional Consumption Expenditures," loc. cit., p. 34. For reasons explained in the text, however, Clayton's use of undeflated nominal figures seems the best policy.

[30] Respectively 13 percent and 11 percent less than the "central provinces," according to a 1972 article of I. Kapustin and N. P. Kuznetsova in Ekonomicheskiye Nauki, No. 1. 1972, cited in Wiles, op. cit., chapter III. One should keep in mind the unusually high share of food spending in the Soviet consumer's total outlays—more than half.

[31] Holubnychy in Goldhagen, op. cit., p. 99.

[32] Murray Feshbach, "Regional and Branch Wage Differentials in the Soviet Union," The Association for Comparative Economic Studies Bulletin, vol. XVII, no. 2–3, 1975, pp. 57–59.

[33] Wiles, op. cit., pp. 64–66. Unfortunately he chose to deflate net material product per head, not GDP or total income per person. See also Holubnychy in Goldhagen, op. cit., pp. 98ff.

[34] Soon Ofer and Vinokur will be reporting on implied average prices paid by their sample in 1972–74 for everyday goods, including a number of food items.

[35] Jack Habib, The Determination of Equivalence Scales with Respect to Family Size: A Theoretical Appraisal, Jerusalem, Israel, Falk Institute, 1973; E. Kleiman, "Age Composition, Size of Household, and the Interpretation of Per Capita Income," Economic Development and Cultural Change, vol. XV, October, 1966, pp. 37–58; and Jack Habib and Yossi Tawil, "Equivalence Scales for Family Size: Findings from Israeli Data," Jerusalem, Israel, The National Insurance Institute, 1974, mimeo.

[36] Raytsin, V. Ya., Normativnye metody planirovaniya urovnya zhizni, Moscow, 1967. I am indebted to Dr. Aaron Vinokur for giving me this reference.

Adjustment for these characteristics may clearly be significant across the Soviet Union because of the very different family patterns in the European parts, where the "demographic transition" has gone to an extreme, and the Asian areas, where birth rates are just beginning to taper off.

We can estimate that in 1978 about 60 percent of the RSFSR population were in the working ages,[37] while 44 to 48 percent is the range typical for Central Asia. Of course, age is not the sole factor in determining labor force participation. There may be more nursing mothers in the Asian areas who do not contribute to the marketable income of the family; but, to offset this, fewer of the Asians in the younger age-group 16 to 22 are probably in school. For an illustrative calculation of relative consumption requirements, then, the percentage in the ablebodied ages can serve as an indicator of labor force participation of republican populations.

It would not be best procedure, in my opinion, to make this adjustment by taking total income per family, as has been suggested.[38] Such a procedure would have the effect of reducing the "marginal cost" of additional children to zero or, to put it another way, of neglecting the vastly different size of families among the Soviet republics. More developed countries are universally characterized by a relatively high number of unattached individuals and small families. Dividing total incomes by number of families would thus go too far and not in a direction towards the issue as we see it in the U.S.S.R.

A more promising and exact procedure is to adjust the number of persons for the age-specific consumption required for each type of person included in the census. Equivalence scales are certainly complicated, and the following procedure can only be considered suggestive until more intensive work has been done with data not available to the present writer. For example, normative budgeting for a child will depend on the number of his siblings, the area of residence, the educational level of the parents—and not only the child's age and sex. Equivalence scales appropriate to the Soviet Union will differ from those in the West because of subsidies on Soviet housing, children's clothing, most education, and the widespread use of family members for childcare. To derive the factor with which to turn children into "adult-equivalents," we must make use of Raytsin's age- and sex-specific data.[39] After some experimentation with various assumptions, we found that the most likely adjustment was 0.51, with 0.40 the practical lower limit. For the sake of computational convenience and to stress the approximate nature of the procedure possible, each child was taken as one-half adult equivalent.[40] Retirees were also assigned the same relative consumption fairly arbitrarily to ease the calculation. Since the proportion of pensioners in the richer republics is larger and

[37] Following Soviet parlance, the trudosposobnye or "ablebodied" ages are 16–59 for men and 16–54 for women. The labor shortage has given a strong reason to redefine this concept by raising the putative age of retirement.

[38] Clayton, "Regional Consumption Expenditures," loc. cit.

[39] Raytsin, op. cit., p. 52. For simplicity it was assumed that in all years the number of children in each age cohort was the same. Central Asian children are younger as a group than European ones because of the higher growth rates in the Asian republics. What is more, rural and traditional families should be assigned a lower "marginal cost" for extra children in that their housing arrangements are more flexible. The net effect of these simplifying assumptions, as well as the treatment of retirees, is to exaggerate our income per adult-equivalent results towards inequality. That is, the Soviet Union is probably even more equal than our estimates indicate; the gap in material well-being is to be interpreted as a maximum. The derivation of the adult-equivalent factor is set out in more detail following table 5.

[40] Cf. McAuley, op. cit., chapter 6.

their relative normative consumption ought to be higher than the one-half assigned to children,[41] our illustrative calculation understates the relative number of adult-equivalents in the RSFSR and the Baltic republics and therefore once again gives us a maximal estimated of the gap in material well-being among the Soviet republics.

TABLE 5.—TOTAL INCOMES PER ADULT-EQUIVALENT,[1] 1959–78

	Percent of all-union figure				Estimated level (rubles), 1978
	1960	1970	1975	1978	
RSFSR	107	106	108	109	1,747
Ukraine	93	96	94	93	1,503
Belorussia	84	95	100	100	1,615
Uzbekistan	82	82	80	77	1,235
Kazakhstan	98	93	88	85	1,370
Georgia	95	90	88	90	1,454
Azerbaijan	77	73	75	74	1,195
Lithuania	106	117	112	112	1,799
Moldavia	72	88	93	94	1,513
Latvia	124	123	119	118	1,890
Kirgizia	78	80	79	77	1,233
Tadjikistan	72	71	73	72	1,153
Armenia	89	92	90	91	1,460
Turkmenia	85	86	93	92	1,476
Estonia	129	131	125	124	1,993
All-union level (current rubles)	649	1,205	1,457	1,608	
Coefficient of variation (weighted by adult-equivalents)	0.100	0.091	0.103	0.112	
Non-Russian/Russian ratio (percent)	85.1	87.2	83.1	82.5	

[1] Each child 15 years of age or younger is considered as 50 percent of an adult for the purposes for consumption comparisons. See text. Retirees are likewise counted as 50 percent for this purpose. See explanatory note.

Explanatory note to table 5.—Let A signifiy the number of adult-equivalents in each republic. N is the census population in each republic. a is the fraction of able-bodied ages in the population. z is the average proportion of the consumption requirements of nonworking ages to that of adults of working age. The factor z is derived as

$$z=\frac{\sum_{i\epsilon DP} C_i u_i}{\sum_{i\epsilon LP} C_i u_i}$$

where DP is the set of all age-sex cohorts in the dependent population. LP denotes the set of all laboring age-activity-sex combinations; e.g., women of 16–54 doing light physical work. C_i is the average consumption requirements of the i-indexed group in rubles. u_i is the weight of each group in its set. That means

$$\sum_{i\epsilon DP} u_i = \sum_{i\epsilon LP} u_i = 1.$$

where the set TP is the sum of LP and DP. In Central Asia the C_i and u_j in the numerator are negatively correlated; in the north, positively. Thus, z would be lower in Asian republics than in Europe. In consequence, the A/N adjustment for the Asian republics would in reality be even lower than in Europe; the convergence of incomes per adult-equivalent would be more pronounced than appears in table 5.

$$A/N=a+z(1-a)$$

A/N will be the factor by which to adjust the income per capita in table 3 to arrive at income per adult-equivalent.

$$Y/A=Y/N.\ N/A$$
$$A=aN+z\,(1-a)N$$
$$=aN\,(1-z)+zN \text{ or, } a+z\,(1-a) \text{ for A/N.}$$

is a conservative simplication, we take A/N=0.5a+.5.

Source: The 1960 income figures are weighted by 1959 shares. Underlying income figures are from table 2. The number of men and women of working age (16–59 for men and 16–54 for women) is taken from Itogi vsesoyuznoi perepisi naseleniya 1970 g., vol. 2. Projections to 1978 are by the Foreign Demographic Analysis Division, Bureau of Economic Analysis, U.S. Department of Commerce, in Schroeder, "Soviet Regional Development Policies," loc. cit., p. 133.

Table 5 presents this illustrative calculation. We see that the gap between the Russian and all other republics together is moderated, as compared to table 3. This was to be expected with the latter's higher proportion of dependents. In particular, the Central Asian republics

[41] Exodus XIX : 12.

show up very much better off, even when efforts have been made to minimize that upwards adjustment. Their weight in the overall NR/R ratio is small, however, and this explains the relatively modest adjustment upwards observable in this summary statistic.

A major finding exhibited by the coefficient of variation is that interregional inequality, measured in terms of material welfare, has hardly grown when we gauge it in total incomes per adult-equivalent. The mean absolute difference of a person in one of the Soviet republics from the Union average[42] was 8 to 10% in all four benchmark years with no discernible trend. When the effect of demographic changes on consumption standards is taken into account, nearly all of the increasing inequality which others have found disappears.[43]

If we wish to evaluate this finding in broader perspective, we should bear in mind that there are still "poor ethnics" in the rural by-ways of Soviet Asia. Because of the nature of our data units, we cannot fully discuss this serious issue. The long-term progress of Asian natives under Soviet rule—whether we measure in material, occupational, or social (literacy, infant mortality) terms—has been impressive on any showing.[44] A sense of improvement may easily temper the feeling of frustration at lingering backwardness. But in light of events in Iran, we had best leave things at this point to specialists better trained in political sociology.

Various previous writers have shown that the observed coefficient of variations in the Soviet Union is somewhat less than that observed for the United Kingdom, Poland, the German Democratic Republic, Yugoslavia.[45] While this is instructive and the more surprising in view of the relative backwardness of the Soviet Union, these authorities have not dealt with a serious statistical problem confounding any such international comparison relating to the Soviet Union-republics. Not one of the countries suggested for comparison is so asymmetrically divided as the Soviet Union, as noted earlier. In all likelihood, grouping the varying sub-regions of the RSFSR into one observation reduces the coefficient of variation measured for the USSR. It cannot apparently be proved that this generalization is analytically true; counter-examples can be produced. But in the few cases for earlier years when data were published for industrial output, a measure with its own inadequacies, for the economic regions within the RSFSR and Ukranian SSR, the cofficient of variation for the twenty-six resulting

[42] Not identical to the coefficient of variation, which is difficult to interpret verbally. The absolute difference (not shown in the tables) is computed as

$$D=\sum_i \frac{|y_i-\bar{y}|}{\bar{y}} f_i \quad (i=1, \ldots, 15)$$

with y_i denoting each republican level and f_i, its share in the total Union adult-equivalents.

[43] McAuley, op. cit., chapter 8; Schroeder's results for 1960–70 were not too dissimilar from mine, but the procedures were. Schroeder, "Soviet Wage and Income Policies," loc. cit., p. 18.

[44] Brian Silver, loc. cit., pp. 1625ff.; Alec Nove and J. A. Newth, The Soviet Middle East, New York, Praeger, 1967.

[45] E.g., Koropeckyj, "Equalization of Regional Development," loc. cit.; Schroeder, "Soviet Wage and Income Policies," loc. cit.; Wiles, op. cit.; McAuley, op. cit.; and Donald W. Green and Herbert S. Levine, "Regional Differences in Soviet Economic Development: A Comparative View," Paper presented to the American Academy of Social Sciences, March 1972, mimeo. Several writers have also pointed out the favorable material level of the Soviet Central Asian "colonies," in comparison to Afghanistan, Pakistan, and Iran. Green and Levine found the Russian/Soviet Asia gap dwarfed by that between the United States of America and Latin America. Perhaps more apt is the comparison between European/Asiatic USSR, on the one hand, and the USA/Puerto Rico's GNP has grown rapidly to about $2500 per person by 1978 plus nearly $700 in Federal transfer payments. "New Look for Puerto Rico," The Economist (London), vol. 270, no. 7071, March 10, 1979, p. 116.

regions was greater than for the fifteen republics.[46] Thus, the favorable image may be a statistical distortion.

To solve this problem an experimental approach was devised to regroup the American states into homogeneous regions resembling in their size, relative incomes, and industrial composition the Soviet republics.[47] The fifty American states plus the District of Columbia had a per capital personal income in 1976 of $6,441. Before regrouping on Soviet principles, the American states showed a weighted CV of .113. When regrouped into 15 regions corresponding to the U.S.S.R. republics in size and economic situation, the weighted CV fell to .089. As we can recall from Table 3, the actual U.S.S.R. scored .116 in 1970 and .129 in 1975 for a somewhat broader concept. So the "Atlantic City" method reveals the Soviet Union to be considerably more inegalitarian the United States of America. Though this might be explained as the result of lower real standards of living, we have seen that in per capita terms, the Soviet Union is not becoming more egalitarian with further growth, at least up to 1979.

III. Investment Priority

In view of the contribution of James Gillula to this volume, no intensive effort was made to assess the degree of inequality of investment and the growth of capital stock for the Soviet republics. Relying on previous studies, we only shall briefly review two questions: how is investment supposed to be allocated in the Soviet Union? How is it in fact allocated?

In the Soviet economy investment is little related to the place where profits are earned.[48] Loans or equity investments by individuals or enterprises for productive facilities are forbidden. New plants are supposed to be located where they best serve the interests of the U.S.S.R. as a "unitary state," as determined by Party and government bodies at the center.

Locational decisions in the U.S.S.R. are enacted by the Five Year Plans and especially the budget items for the new Territorial Production Complexes founded around sources of minerals or energy. Most TPC's are in the East, and the Tenth Five Year Plan slates 30 percent of new investments for that area, as against 29 percent in the Ninth Plan. As is only likely in such ventures—witness the Alaska Pipeline—cost overruns and unfinished projects are the universal rule.[49]

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[46] Koropeckyj, ibid.

[47] The choice was made by two American colleagues, one with expert knowledge of the Soviet Union and one without any specialist knowledge. Both were given the criteria for selection, designed to maximize the remaining inter-group variance of the pseudo-USSR, based on the American states' per capita personal incomes for 1976. They chose somewhat different groupings, as would be expected. To give an idea of this method—which, in tribute to related Monte Carlo procedures in mathematical statistics, we might call the "Atlantic City" method—Texas became pseudo-Kazakhstan, and the states of Alabama, Arkansas, Tennessee, and West Virginia stood in for Uzbekistan. Interested readers will be supplied details but might try it themselves and send me results, employing data published in any desk almanac for 1976 (with 1970 population weights for convenience).

[48] Non-returnable transfers are scarcely inefficient in themselves, as Holubnychy has asserted (op. cit., pp. 62–3), unless they are treated as costless by the recipients. Such transfers have been characteristic of the U.S.S.R. for a long time, and some republics once recipients may turn up later as involuntary donors—or vice versa. Roy Medvedev, On Socialist Democracy, Nottingham, Spokesman, 1975, p. 357. The Ukraine, as a long-industrialized area, has been called on to give more than some think it ought to. Wagener has estimated that in terms of out-transfer of national income, Lithuania and Moldavia were even greater donors than the Ukraine, while currently Central Asia is the outstanding recipient. Wagener, op. cit., pp. 152–59.

[49] Whether apparent follies will bring the expected profits under the new world conditions is, of course, a speculation this paper is not prepared to make. The profit margin between the realizable world price and the alternative domestic costs can be tempting, though. Cf. Dina R. and Martin C. Spechler, "The Soviet Union and the Oil Weapon," in Y. Roi, ed., The Limits to Power, Soviet Policy in the Middle East, London, Croom Helm, 1979, pp. 96–123, for a recent appraisal of some of the evidence for petroleum extraction.

Debates within established institutions are permitted and quite unavoidable in the contemporary Soviet Union; within limits, open discussion can even be helpful to the regime. There have been many such debates in public about regional resource allocation. When the future is concerned, especially the future of one's home region, almost anything will go into the argument over investment siting. We do not have to comprehend dialectical materialism to predict on which side Ukrainians and other Europeans will find themselves when debating atomic and coal power versus hydroelectric transmission from Siberia or oil prospecting. That is not to say that interested parties are always wrong. But outsiders can hardly judge.

Even insiders must have a problem in judging. Rent charges, interest, and properly differentiated transportation tariffs are still not much used in calculating investment effectiveness of different sites (and technologies).[50] Therefore, such calculations in existing prices are probably as much partisan weapons as disinterested management tools for identifying the national interest. Brezhnev is smart enough to recognize this.

Let the plans be unanimously voted, and the partisan struggle can go on. Many times plans are overfulfilled some places and not fulfilled other places. In part this is the upshot of the battle to secure supplies. How, then, are the funds allocated?

Most investable funds are centralized through the Union ministries and Gosplan, though retained cash-flow is a countervailing element.[51] Even social amenities created locally in most other countries are under central ministry control in the U.S.S.R. By one account 47 percent of all moving picture theater seats and 51 percent of hotel rooms belong to the industrial branches! And this is in Leningrad! In development towns cultural facilities, services, and housing are matters for interbranch coordination—and understandably so, since the industrial ministries alone have the means to build these facilities. Nor can city or provincial soviets effectively regulate the amount of industrial building in their areas.

In the past, regional and local Party committees have been progrowth, for many reasons. This is no longer so, as evidenced in the Soviet press for 1977 and 1978. The new dimension of investment policy conflict in the U.S.S.R. is the central ministries versus localities, while the old struggles between different ministries or between different Union-republics have been somewhat muted lately. Balts may oppose further industrialization because it brings more Russians,[52] but the language of debate is environmentalism and solving the labor and housing shortages.

Several prominent articles in the Soviet press, as selected by the Current Digest of the Soviet Press, dwell on narrow-minded views taken by industrial branch ministries in siting new investments. Local environmental costs are often unconsidered,[53] local fuels neglected,[54] and external diseconomies banished beyond the plant gate. Ministries

[50] L. Kantorovich in Ekonomika i organizatsiya promyshlennogo proizvodstva, January 1971; Dienes, loc. cit.; Holubnychy, op. cit., p. 64.

[51] Planovoye khozyaystvo, no. 3, March 1978, pp. 110–15. In 1971–75 (industrial) ministries controlled about 60 percent, of housing funds, 70 percent of kindergarten construction financing, and 40–45 percent of hospital and polyclinic investments in the RSFSR.

[52] Theodore Shabad in The New York Times, March 12, 1972.

[53] An old problem: Kommunist, no. 1, January 1973, pp. 90–99.

[54] L. Dienes, loc. cit., p. 41; Holubnychy, op. cit., pp. 90–91.

prefer to locate in large cities, where construction and supply are not the headache they are in smaller ones.

Now, an experience indicates, the demands of local Party people for social stability, for autarky and costly duplication,[55] and generally for sucking the industrial cow dry are dependable as well. The present emphasis on reequipment of existing enterprises should please the locals in the established districts.[56]

A most common complaint recently from local and regional Party and planning officials has been that industrial ministries overfulfill their employment targets, thus drawing in service and agricultural workers with their promises of high wages and the housing within the ministries' provenance.[57] Sections IV and V will explain the interregional consequences of these seemingly local struggles.

Within the remaining scope of this section, we can perhaps best serve the reader by mentioning two worthwhile, but still somewhat inaccessible, studies. Professor Donna Bahry has found that the interrepublican coefficient of variation for (gross) investment outlays in constant prices per capita has fallen from 1956 to 1975.[58] Her measures, when population-weighted as is proper for our purpose, declined from .275 in 1956 to .205 in 1965 but then rose to .234 in 1975. We note that these CV's are somewhat in excess of those indicating the dispersion of net material product per head and thus could still act to widen the NMP gap if more capital is put at the disposal of the most productive workers. The investment data would have to be net of depreciation in order to tell.

In 1975 the RSFSR reported investment per head of 409 rubles versus a mean for the rest of the U.S.S.R. of 265 rubles. The NR/R ratio fell sharply during the Brezhnev period from 79 percent to 65 percent. Nevertheless, Bahry concludes that there has been a "clear—but modest—effort to reduce disparities in capital outlays." Her conclusion seems more appropriate to the Khrushchev than to the Brezhnev era, if the emphasis is on productive potential. Bahry was unable to find that representation on the Politburo helped a republic get a bigger share of the swag; despite a regular seat on this body, the Ukraine and Georgia have suffered continuous relative decline in their investment shares. Past investments help any republic, according to the multiple regression results, but whether this is a real or merely statistical phenomenon remains to be clarified.

Have the Soviets succeeded in directing investment rationally into the channels suggested by relative factor availabilities? To a degree, apparently yes. According to studies by Dr. Hans-Jürgen Wagener over some years,[59] food, machinebuilding, and textile branches have increasingly been located in labor-abundant areas. The chemical and certain other industries are not such a good test of the Heckscher-Ohlin hypothesis, owing to their substantial energy and raw materials-input component.

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[55] Pravda, February 8, 1978, on the unwillingness of Baltic republics to specialize in light industry because trade officials want local supplies.

[56] Speech of Alexei Kosygin, Pravda, March 2, 1976, pp. 2–6.

[57] Planovoye khozyaystvo, no. 8, August 1978, pp. 139–42.

[58] Donna Bahry, "Distributive Politics and Soviet Elite Mobility: A Test of Two Models," Paper presented to the meetings of the American Political Science Association, New York City, 1978, mimeo.

[59] H.J. Wagener, "Rules of Location and the Concept of Rationality," in Bandera and Melnyk, eds., op. cit., pp. 63–103; and Wagener, Wirtschaftswachstum, op. cit., p. 126.

IV. Other Policy Issues

To continue its economic growth at close to the levels achieved in the 1950's and 1960's, the Soviet Union must solve its labor shortage. Rural labor supplies in the Central non-Black Earth areas have dwindled to the point that agricultural (especially meat) production is threatened. Policymakers have begun to demand reequipment of existing plants, with new facilities to be built in moderation. Mobilizing internal reserves of pensioners and women is also on the order of the day. But there will also be a spatial dimension.

Current Soviet policy is to establish any new labor-intensive plants preferentially in small towns and in the labor-rich areas of the Caucasus and Central Asia, while capital-intensive techniques using relatively little labor are to be given preference for Siberian resource exploitation. In view of rapid labor turnover even a high frontier wages and the expense of building suitable intrastructure for families in Siberia, Brezhnev has called for Komsomol enthusiasts to build up installations there. Increasingly few planners consider Central Asia a reservoir of permanent manpower for Siberia, except for unskilled construction jobs. Just getting the Central Asians to move to their "own" cities is troublesome and expensive enough. They dislike the small apartments, the job environment, and even the liberalizing social pressures.[60]

Another response to labor shortage with implications for the nationalities issue would be any increase in incentives. Soviet people do move to improve their earnings, but if they do not find decent housing, adequate food and services, and an acceptable quality of life, they keep moving. The Slavs have shown an increased liking for temperate zones, and the reasonably high wages and supplements accompanying jobs in the South do nothing to discourage them. So if the Brezhnev practice has been to equalize wages and social spending among all parts of the U.S.S.R., some of his compatriots are choosing to earn their money where the living is easier.

Housing and urban amenities are increasingly understood to be a cardinal impediment to changing jobs in the right direction.[61] Central Asians quite understandably want spacious, high-ceilinged houses, as they had in the kishlak. Moscovites will not eagerly surrender their apartments for unknown accommodations elsewhere. One answer has been to recruit new labor from rural settlements to commute to work in small cities. Like the earliest Russian proletarians, they retain their izba in the rural settlement. Meanwhile, city wages allow them to forego the drudgery of rising before dawn to milk the cows.

The wheel turns again and again—and always to the old problems again. Inefficiency and competing bureaucratic claims have produced the labor shortage, which now begins to exacerbate the agricultural shortage. To wipe out the agricultural deficit, Soviet planners have turned to sun-blessed Transcaucasia and the Fergana Valley. Owing

[60] David Shipler of The New York Times in The International Herald Tribune, January 26, 1979, p. 5.

[61] Ekonomika isorganizatsiya promyshlennogo proizvodstva, February 1972, pp. 80–87. According to V. Perevedentsev, 45 percent of migrants to cities lacked their own homes after 4 to 7 years. Voprosy ekonomiki, May 1973, pp. 128–37. Dormitory living is depressingly common in Soviet development towns.

to previous exploitation, such places lack irrigation water. So one hears of gargantuan plans to divert the Siberian rivers to replenish the Aral and Caspian Seas and their tributary rivers so as to allow an extension of cultivation nearby. Such schemes will be more than a marginal claim on resources, and they will have obvious regional implications.

Whether to find labor or to raise food production, somehow the Asians look to have good prospects to increase their relatively low shares in Soviet investments of all kinds in the years immediately ahead.

V. Interpretation and Conclusion

If one were to judge from the content of the Soviet press, the labor shortage and the search for new fuels and minerals have occupied the attention of the Brezhnev regime in the last few years more than the nationality issue as such. Does this silence or the occasional, self-satisfied claim that the national question has been solved "in the main" mean that regional inequality is being ignored by the Soviet rulers?

To some extent the rising inequality in productivity we have pointed out may be the unintended consequence of energy policy and the ministries' preferences to push the areas with a proven record of success. The European areas have benefitted from a higher standard of technical education and more abundant means for technical progress—institutes, contact with the West, proximity to power.

On the other hand, income and welfare have not become more unequal over time and this indicates substantial and growing transfers (even if non-budgetary) of goods and services to the "colonies." In consequence, by the standards of semi-developed dictatorships and fraternal Communist countries more developed than itself, the Soviet Union is rather egalitarian, although the modern USA is more so.

In other ways, too, Brezhnev has shown himself flexible and accommodating towards forces of nationalism. True, he certainly has not tolerated corruption in the Caucasus nor radical demands for "freedom," even those of an Ivan Dzyuba, a non-secessionist. Catechising children is punishable. Yet the Brezhnev regime has not set out altogether to suppress religious practice in the Islamic, Catholic, or Armenian areas, where the churches are closely identified with the local national culture. The Tariqat reportedly is tolerated as a "type of disciplined secret society" in Muslin areas. National language publications have been somewhat broadened. Central Asian birthrates are not to be treated by sterilization campaigns, as in some erstwhile democracies. Rather, Russian husbands are nagged in the newspapers to help out with the housework so the wife will agree to a second or third child.[62] Social services have been provided more generously,[63] and the child-rich republics can make use of the hospitals, crèches, and schools going up.

This can balance the reverse effect of more generous pensions in the long-established industrial regions. Private plots and the higher nationwide minimum wage help the poorer republics more than the richer ones. Limits on city growth, better highways, and the oppor-

[62] L. Unger in The International Herald Tribune, December 16–17, 1978.
[63] Jack Bielasiak, "Policy Choices and Regional Equality at the Soviet Republic Level," Paper delivered at the meetings of the American Political Science Association, September 1–4, 1977, Washington, D.C., mimeo.

tunity to build one's own home help the non-metropolitan areas. Meanwhile, Russian philologists without a clue of the Turkic or Caucasic tongues are not so often thrust on the suspicious and uncomprehending native children as Russian teachers. Rather, Central Asians are being invited to spend a few years as student trainees in the RSFSR before going back home as technicians or—as Russian teachers. As has been widely reported, the affront to the status of the Georgian, Armenian, and Azerbaijani languages in their new constitutions was promptly erased. Out-and-out Russian chauvinists are occasionally warned to desist. After threats to secede from Georgia, the Abkhazians were reportedly promised $750 million in industrial, transportation, agricultural, and educational installations.[64] While the Asians do not respond to these gestures with love and identification, a considerable amount of cultural assimilation at the popular level is obvious, at least in the main cities.[65] Elite non-Russian youth increasingly speak Russian among themselves and to other nationalities and may even raise a glass of vodka to peace and friendship.

All these are canny expedients authored by an experienced leadership to keep nationalities conflict latent only. Unpleasant side-effect of policies not maybe intended to exploit the non-Russians must not inadvertantly cause the deep faults of the Soviet subterranean foundation to break to the surface and to tumble the castles of steel and concrete which have been impressively, if somewhat hastily, erected there. Considering the external threats of Islamic fundamentalism, the competing, calls on resources, and the growing productivity gap, a new leadership would do well to make Brezhnev's "welfare colonialism" function as smoothly as it has up to now.

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[64] The International Herald Tribune, January 26, 1978.
[65] Craig Whitney of The New York Times, ibid., January 10, 1978.

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THE BAM, PROJECT OF THE CENTURY

(By Theodore Shabad*)

CONTENTS

I. Introduction

Early in 1972, a brief news item in the Soviet press announced that work had begun on a new Siberian feeder railroad running north from the Trans-Siberian mainline.[1] The new rail line, running from Bam station 112 miles north through Tynda to the Neryungri coking-coal deposit of southern Yakutia, was to provide access to a coal field in which the Japanese steel industry had expressed interest. The announcement of this north-south rail spur was the first indication that Soviet planners were considering the revival of the great Baikal-Amur Mainline project, an east-west railroad on which work had begun in the 1930's in an attempt to open up new territory situated to the north of the Trans-Siberian. The feeder railroad on which work had begun in the early 1970's, according to the BAM project, was to have served as a transverse line crossing the east-west mainline at Tynda.

Two years later, Leonid I. Brezhnev, in a speech in Alma-Ata, confirmed that the BAM project was indeed being revived as one of the major undertakings of the 10th five-year plan (1976–80) and of the longer-term Soviet development program extending to 1990.[2] Since then the 2,000-mile Baikal-Amur Mainline has become one of the high-priority construction projects of the Soviet economy extending through both the 10th five-year plan and the 11th plan period (1981–85) with completion scheduled for 1983. Despite the harsh, uninhabited environment traversed by the railroad, a difficult terrain posing serious engineering problems, and the coordination and supply problems that often delay construction projects, the BAM after five years of work appears to be fairly close to schedule, with 40 percent of the trackage of the proposed system laid by the middle of 1979.

The rationale underlying the construction of such a vast project has changed through the Soviet period. In the 1930's, when the BAM was first contemplated, it figured as a component in an ambitious develop-

*Soviet Geography, review and translation.
[1] Trud, Jan. 6, 1972; Soviet Geography, April 1972, p. 260.
[2] Pravda, Mar. 16, 1974; Soviet Geography, September 1974, pp. 443–444.

ment program designed to provide access to remote regions of the Soviet Union. In those years regional development policy was dominated by the doctrine of equal development of all parts of the Soviet Union regardless of economic efficiency, and the provision of a uniformly developed transport net throughout Siberia was an inherent aspect of the early approach to regional development. Outlying resource sites were viewed as potential foci for regional development and were expected to become centers of in-migration, often in virtual disregard of environmental and economic realities. The development of remote areas and the early construction of the BAM in particular were aided by strict controls on labor during that period and the availability of a large reservoir of forced labor that could be maneuvered at will and was often put to work on major projects in outlying regions.

In the middle 1950's, after the westernmost and easternmost segments of the BAM had been completed, the use of forced labor as a mass institution ceased upon the death of Stalin. With the dissolution of the labor pool and in the absence of an immediate economic rationale for the railroad in the post-Stalin era, work on the project was abandoned. The status of the BAM was controversial at the time. It was shown as completed on a National Geographic map of the Soviet Union and, despite evidence to the contrary, some Soviet émigrés insisted that the railroad had been finished.[3]

The renewal of interest in the early 1970's can be attributed to at least three factors: (1) security; (2) Trans-Siberian transport capacity; (3) resource development for export.

The Soviet-Chinese rift of the 1960's, culminating in border clashes, had pointed up the apparent vulnerability of the Trans-Siberian mainline running close to the Chinese border in the Amur River and Ussuri River valleys. To the extent that the BAM alignment ran at least a hundred miles farther north than the Amur River segment of the Trans-Siberian, the BAM could be said to provide a less exposed transport route in strategic terms. It should be noted, however, that no counterpart of the BAM is planned on the Ussuri River side of the Soviet-Chinese border, where rail communications are just as close to the frontier as on the Amur River side.

The BAM, though initially planned as a single-track line, can be visualized as ultimately relieving the heavy transport load on the existing double-tracked Trans-Siberian mainline. Although the carrying capacity of the Trans-Siberian had been increased during the 1960's by conversion to more efficient diesel and electric traction,[4] there appeared to be an increasing need for an additional route. One factor was the growing volume of freight moving in containers from Japan to Western Europe over the so-called Siberian Landbridge.[5] One of the early rationales for the renewal of the BAM project was also the

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[3] The New York Times, Aug. 11, 1960 ("Soviet Completes Far East Rail Link"), Aug. 21, 1950 (Letter to the Editor), Aug. 26, 1950 (Letter to the Editor). For the historical background of the BAM project and many other details, see Victor L. Mote, "The Baikal-Amur Mainline: Catalyst for the Development of Pacific Siberia, in: Theodore Shabad and Victor L. Mote, Gateway to Siberian Resources (The BAM). A Halsted Press Book (Scripta Series in Geography). New York: John Wiley & Sons, 1977, pp. 63–115.

[4] Akademiya nauk S.S.S.R. Institut geografii. Dal'niy Vostok (The Far East). Moscow: Mysl'. 1966. pp. 241–242; A. N. Gladyshev, A. V. Kuilkov, B. F. Shapalin. Problemy razvitiya i razmeshcheniya proizvoditel'nykh sil Dal'nego Vostoka. Moscow: Mysl', 1974, p. 120.

[5] Elisa B. Miller, "The Trans-Siberian Landbridge," Soviet Geography, April 1978, pp. 223–244.

expectation of a substantial movement of West Siberian crude oil across Siberia both to new refineries in the Soviet Far East and for export to Japan and other Pacific Basin countries. According to Soviet calculations in the early 1970's, it was more economical to build a new railroad with provision for special heavy tank-car unit trains than to lay a Trans-Siberian pipeline to carry West Siberian oil eastward.[6]

Finally, the atmosphere of international détente beginning in the early 1970's and apparent Soviet willingness to interact to a greater extent with the rest of the world economy focused attention on the need for a transport route that would provide access to new resource sites in Eastern Siberia and the Soviet Far East for export to the Pacific basin. In view of the long distance separating the Soviet Far East from the national economic heartland in the European USSR, there had been relatively little interaction between the easternmost regions and the Soviet domestic economy. There had long been interest in reorienting the eastern regions of the Soviet Union toward the Pacific.[7] With the advent of détente, these plans received new impetus, and were given expression in a series of articles by I. M. Mayergoyz, a Moscow University geographer.[8]

The lack of transport access to resources proved to be an obstacle to tentative joint Soviet-Western development plans under discussion in the early 1970's, for example, the question of developing the copper deposits of Udokan. Evident Japanese interest in the coal resources of Neryungri in southern Yakutia provided a further stimulus for the revival of the BAM.

Although the precise shape of things to come was difficult to predict a decade ago, the foregoing factors evidently combined to make this 2,000-mile rail project one of the priority undertakings of the Soviet Union.

II. Progress of Construction

When plans for a great new railroad in the Far East were first considered seriously in the early 1930's, actual construction got under way on the so-called Little BAM, the north-south feeder line running north from Bam station in the Trans-Siberian to Tynda. Construction on the line began in 1933, and work trains were running on it by 1938.[9] Within the next two years preliminary surveys and designs were completed for portions of the BAM, and Soviet planners ordered the start of construction on the westernmost segment of the east-west mainline, running from the Trans-Siberian Railroad at Tayshet toward Bratsk on the Angara River, and on the easternmost segment, connecting the new town of Komsomol'sk on the Amur River with the sea at Sovetskaya Gavan'. By the start of the German invasion of the Soviet Union in mid-1941, the rail-laying teams on the western segment had advanced 36 miles to Nevel'skaya station [10] and the roadbed and bridges on the eastern segment had been partly completed.

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[6] V. V. Biryukov, "The BAM: Planning Aspects," in: Shabad and Mote, Gateway . . . , op. cit., pp. 118–119.

[7] V. A. Krotov et al. "The Role of Eastern Siberia in Solving Some of the Economic Problems of the Pacific Basin." Soviet Geography, February 1968, pp. 142–144.

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[9] A. A. Pobozhiy. BAM: Skazaniye o pervykh prosekakh (BAM: The Story of the First Surveys). Khabarovsk, 1975, pp. 36–37.

[10] V. M. Rudykh. Gorod Bratsk (The City of Bratsk). Irkutsk, 1972, p. 72.

The wartime emergency interrupted work on the BAM. In fact, in 1942, rails and other structures along the right of way were dismantled on the Bam-Tynda line to provide material for the construction of a new priority rail project behind the fighting lines along the Volga River.[11]

Toward the end of World War II, as pressures in the western regions eased, Soviet rail planners turned their attention once again to the east, and work on the BAM resumed. Priority was now given to the Komsomol'sk-Sovetskaya Gavan' segment. This line was to give Komsomol'sk a direct outlet to the sea and shorten the route for freight moving from the Trans-Siberian toward Sakhalin, Kamchatka and other regions of northeast Siberia. The new railroad, which actually had its western terminal at Pivan' on the right bank of the Amur opposite Komsomol'sk (a bridge was not built until 1975),[12] was finished in July 1945.[13]

Meanwhile work was also resumed on the western segment from Tayshet to Bratsk, which was reached in 1947. Within four years it had been extended to Ust'-Kut on the upper Lena River.[14] Just as the easternmost segment of the BAM was to play a useful role in linking Komsomol'sk directly to the sea, the western segment performed a number of crucial economic functions. It opened up new logging areas east of Tayshet, helping to make Irkutsk Oblast the Soviet Union's largest timber-producing region (nearly 10 percent of the nation's commercial roundwood output). It provided an access route to the great hydroelectric project at Bratsk, which incidentally had not been anticipated in the original BAM plans and required the relaying of rails in 1955–56 so that the railroad would pass over the Bratsk dam. The western BAM segment also provided access to the iron-ore mine of Zheleznogorsk (between Bratsk and Ust'-Kut), which became the principal ore supplier (6 million tons a year) for the new West Siberian Iron and Steel Plant built at Novokuznetsk in the Kuznetsk Basin in the late 1960's. Finally, the railroad opened up a new supply route to Yakutia by carrying freight to the Lena River navigation head at Ust'-Kut for onward transportation by river to Yakutsk and other places in the remote Siberian northeast.

In the early 1970's when events moved toward a resumption of construction work on the BAM after a hiatus of 20 years, it was again the Little BAM transverse line that was the first to be built. Stimulated by the prospect of a coal deal with Japan, work began in the winter of 1971–72, and Tynda, the future junction point with the east-west mainline, was reached in May 1975.[15] While Tynda began to serve as a starting point for work on the mainline to the east and to the west, the rail-laying crews on the Little BAM pressed northward toward the coal of Neryungri. The principal obstacle along the way was a three-quarter-mile-long tunnel between the stations of Nagornyy and Zolotinka. The pressure to reach Neryungri was so great that a temporary bypass was constructed, and the first work train reached Berkakit, the rail terminal for Neryungri, in October 1977.[16] Although

[11] Pobozhiy, op. cit., p. 100.
[12] Soviet Geography, January 1976, p. 61.
[13] BAM : Problemy i perspektivy. Moscow : Molodaya Gvardiya, 1976, p. 32.
[14] Rudykh, op. cit., p. 82.
[15] Soviet Geography, October 1975, p. 547.
[16] Soviet Geography, January 1978, p. 68.

the breakthrough in the tunnel was achieved in September of that year, it took 12 more months to finish the tunnel walls and lay the roadbed and rails through the tunnel. Meanwhile a 15-mile spur was extended from Berkakit to the actual Neryungri strip mine, at mineside Ugol'naya station, and in October 1978 the first loaded coal train left Neryungri, passing through the newly completed tunnel, to deliver fuel to a local power station at Tynda.[17] The first major element of the BAM project, the north-south transverse line, had thus been completed.

Meanwhile construction has been proceeding on the east-west mainline in three principal sectors: (1) the western sector, where work on the BAM represents essentially an extension on the Tayshet—Ust' Kut segment completed in the early 1950's; (2) the central sector, where rail-laying trains have been advancing westward and eastward from Tynda; and (3) the eastern sector, between Urgal and Komsomol'sk.

In the western sector, the jumping-off point was the Lena River at Ust'-Kut, where a 1,370-foot bridge was opened in September 1975 after 17 months of construction.[18] Proceeding generally southeast toward the Baikal Mountains, the railroad reached the Kirenga River (a major tributary of the Lena) at Magistral'nyy (at 105 miles) in mid-1977, and the western slopes of the mountains in 1978. The Baikal tunnel, 171 miles from Ust'-Kut, is the second longest along the BAM and one of the principal obstacles along the entire route. As in the Little BAM, a temporary bypass was built between the tunnel entrances across the mountain range to enable work trains to proceed while work on the 4.2-mile tunnel goes on for completion scheduled in 1982. The temporary 10-mile bypass, between Del'bichinda, at the western tunnel mouth, and Davan at the eastern end, was completed in October 1978 and the first work train descended into the Lake Baikal basin. In the course of 1979, work was expected to continue past the northern tip of Lake Baikal and up into the Upper Angara valley toward the North Muya Mountains, where the longest tunnel along the entire BAM route, 9.5 miles long, is to be built. When completed, it will be the fifth longest rail tunnel in the world, exceeded only by the Simplon Tunnel in the Alps, the Apennine Tunnel near Genoa, Italy, and two underwater tunnels under construction between the Japanese islands. The North Muya Tunnel will be the last construction project along the BAM, and its completion, scheduled for 1983, would determine the start of traffic along the entire route.

In the central sector, while most of the construction effort was concentrated on the Little BAM running northward from Tynda into southern Yakutia, relatively less progress was made on the segments west and east of Tynda. However, even there, construction appeared to be close to schedule. To the west of Tynda, rail-laying crews had advanced as far as Larba (Mile 80) by the end of 1978.[19] The segment running west from Tynda through Nyukzha, Chara and Muya toward the northern tip of Lake Baikal is being left until the very end of the BAM project in the early 1980's since this portion can be completed only with the work on the nearly 10-mile-long Muya

[17] Soviet Geography, December 1978, p. 742.
[18] Soviet Geography, January 1976, p. 61.
[19] Gudok, Dec. 17, 1978. By mid-1979, Unakha had been reached.

Tunnel. To the east of Tynda, rails were laid over a distance of more than 90 miles to Dipkun by the end of 1978.[20] This segment, running from Tygda eastward toward Urgal, will require the construction of two long bridges, across the Zeya River at Zeysk and across the Selemdzha River at Fevral'sk, and will also have to await completion in the early 1980's.

In the eastern sector, between Urgal and Komsomol'sk rail-laying crews completed work in June 1979, thus establishing through traffic between the two railheads, which are already linked to the Trans-Siberian mainline in the south by feeder railroads. The completion of the Urgal-Komsomol'sk segment of the BAM thus created a self-contained loop consisting of the two feeder lines (Izvestkovaya-Urgal and Volochayevka-Komsomol'sk) and the intervening segments of the Trans-Siberian (Izvestkovaya-Volochayevka) and of the BAM. Urgal has a coal mine that has been supplying Komsomol'sk since World War II. The coal has been hauled over a roundabout distance of about 600 miles south to the Trans-Siberian, east to the Volochayevka junction, and the north along the feeder railroad to Komsomol'sk. The direct Urgal-Komsomol'sk segment of the BAM will reduce the length of haul by one-half, to 300 miles.

The work on the Komsomol'sk-Urgal segment of the BAM had been aided to some extent by the fact that a 120-mile section running from Komsomol'sk northwest to Duki had been built in the original BAM project of the 1940's and had been in use as a logging railroad since that time. It provided ready access to the Duki-Berezovka area, where rail-laying had to be started from scratch in the renewed BAM project, and required mainly reconstruction and modernization to serve as an integral part of the new project. Most of the new construction had to be done between Berezovka and Urgal along the Amgun' River valley. In this section, where Soviet Army personnel was reported to be engaged in construction, work proceeded from both ends, with some rail-laying crews operating southward from Berezovka, advancing upstream along the Amgun' River valley toward Gerbi, and other construction teams moving out of Urgal to the east and northeast toward a meeting with the other force, effected at the end of June 1979 in the Gerbi area. The construction force advancing from Urgal also found a relic of the old BAM days that could be rehabilitated for use in the new project. This was the Dusse-Alin' Tunnel, at the headwaters of the Amgun', some 40 miles out of Urgal. This 1.2 mile tunnel, the longest outside of the mountainous western sector of the BAM, had actually been excavated in the late 1940's. Over the years, in the Siberian winters, it had become clogged with ice, and most of the work in rehabilitation in 1976–77 involved the removal of more than one million cubic feet of ice by a combination of blasting and jets of hot air.[21] By July 1977, the tunnel had been reopened and refurbished and work could proceed.

Although reports on trackage laid are fragmentary, it would appear that construction is more or less on schedule on the BAM despite the evident engineering problems and the difficulties of supply and coordination. The current five-year plan (1976–80) had called for the

[20] Gudok, Dec. 29, 1978.
[21] Gudok, June 18, 1976; Sotsialisticheskaya Industriya, July 3, 1977: Pravda, July 3, 1977.

completion of about 1,100 miles out of the total BAM trackage of more than 2,000 miles by the end of 1980.[22] By mid-1979, more than 850 miles had been laid, or about 40 percent of the total rail length. More significantly, 7.5 billion cubic feet of earthwork had been done on the roadbed, or almost one-half of the total.[23] Earth-moving work, incidentally, appeared to be double the original estimates.[24] The total work force on the BAM in 1968 was put at 64,000,[25] of which one-fourth, or 16,000, were on the western mountain sector in the Buryat ASSR.[26]

III. Population and Settlement

Although the BAM alignment runs generally only a few hundred miles to the north of the Trans-Siberian and is still well contained within the southeast quadrant of the Siberian landmass, it passes through virtually uninhabited territory with a harsh physical environment that is not favorable for human habitation. Although early reports about the prospects of the BAM spoke enthusiastically about the development of a new zone of settlement, more sober appraisals by Soviet planners do not envisage any population influx beyond the immediate needs of employment on the railroad and in resource sites. The factors that generally inhibit settlement in most of Siberia to the north of the Trans-Siberian mainline apply fully to the BAM, and Soviet planners assert that the cost of maintenance of people in Siberia, including the BAM, is simply too high to justify encouraging settlement for its own sake. For one thing, the entire BAM zone lies in the area of Siberia where the regional wage differential, based on hardship, is 70 percent of the standard wage, compared with a differential of 20 to 30 percent in the southern settlement zone along the Trans-Siberian mainline. Because of these wage increments, Soviet planners do not contemplate locating labor-intensive processing industries in the BAM zone. According to present calculations, processing and services will be located mainly along the Trans-Siberian mainline to the south, and settlement along the BAM will be restricted to the needs of railroad operations and resource development, mainly mining and logging activities.[27] Early estimates for the future population in the BAM zone ranged as high as one million,[28] but the outlook over the near term is for substantially less than that projected figure.

At the start of construction in the middle 1970's, the total population along the future BAM was a little over 300,000 (out of a total Siberian population of 25 million), of which about 240,000 were concentrated in the city of Komsomol'sk, the eastern terminus, and 38,000 in the town of Ust'-Kut, at the western end. This meant that as few as 35,000 people were spread over the 2,000-mile zone between the two extremities. The zone included a total of five urban settlements, of which the largest was Chegdomyn, the mining center of the Urgal coal basin. Rural population was negligible in the absence of agriculture, consisting mainly of indigenous hunters and reindeer herders.

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[22] Planovoye Khozyaystvo, 1977, No. 10, p. 12.
[23] Stroitel'naya Gazeta, Aug. 6, 1978.
[24] Shabad and Mote, Gateway . . . , op. cit., p. 119 (220 million m³), p. 135 (222 million m³), or about 7.5 billion cubic feet. The one billion cubic feet cited on p. 79 is a conversion error.
[25] Stroitel'naya Gazeta, Aug. 6, 1978.
[26] Gudok, Dec. 29, 1978.
[27] Voprosy Geografii, No. 105 (The Baikal-Amur Mainline), 1977, p. 117.
[28] Shabad and Mote, Gateway . . . , op .cit., p. 91.

The preliminary outlines of future settlement have become evident in the course of construction since 1974 as new urban places have been founded along the BAM alignment. In the first five years of construction, a dozen new settlements were announced, most of them concentrated in the western sector.[29] These new settlements and their founding dates are as follows:

Irkutsk Oblast—
- Zvezdnyy (August 1974).
- Magistral'nyy (March 1975).
- Ul'kan (January 1976).
- Kunerma (April 1978).

Buryat ASSR—
- Tonnel'nyy (May 1978).
- Goudzhekit (May 1978).
- Severobaykal'sk (September 1975).
- Nizhneangarsk (1938).
- Novyy Uoyan (August 1976).
- Severomuysk (April 1977).

Chita Oblast (non).

Amul Oblast—Tynda (workers' settlement, 1941; city, November 1975).

Khabarovsk Kray—Urgal (October 1974).

The settlements in Irkutsk Oblast reflect the gradual progress of BAM construction from the Lena River at Ust'-Kut toward the Baikal Mountains. Of these places, probably only Magistral'nyy has any prospects of growth, being situated on the crossing of the BAM across the Kirenga River and in the vicinity of major logging and wood-processing developments projected as part of the BAM program.

In Buryat ASSR, the principal settlement with growth prospects is Severobaykal'sk, which is situated on the northern shore of Lake Baikal at the point where it is reached by the BAM. Severobaykal'sk, because of a more favorable site, is expected to supersede nearby Nizhneangarsk as the principal port and transport hub at the northern end of the lake. The other settlements have arisen in conjunction with the BAM construction, particularly the great two tunnel projects; Tonnel'nyy, as the name implies, is at the eastern entrance to the future Baikal Tunnel, and Novyy Uoyan is on the western approaches to the future North Muya Tunnel, with Severomuysk near the western end of the tunnel mouth (Severomuysk is a Russian form for North Muya).

Although no urban settlements have arisen so far in Chita Oblast, in the absence of construction work for the time being, there are prospects for such settlements, particularly at Chara, the base for nearby Udokan copper development, and at the Udokan copper site itself.

Similarly, in Amur Oblast, in light of the limited amount of construction so far on the east-west mainline, the only urban center that has arisen is Tynda, which by virtue of its situation at the crossing of the east-west line and the north-south Little BAM may be regarded as the virtual capital of the entire BAM development program. It first

[29] The founding of urban places in the U.S.S.R. is announced periodically in Vedomosti Verkhovnogo Soveta SSSR, a weekly publication of laws and decrees; cumulative listings appear in the serial publication SSSR. Administrativno-territorial'noye deleniye soyuznykh respublik, last published in 1977 (with standing as of Jan. 1, 1977).

arose as an urban settlement in 1941 at the time of the first construction of the feeder line from the Trans-Siberian, and retained nominal urban status despite the dismantling of the rails. As a result of the renewal of the BAM project, Tynda rose in 1975 to the next highest urban category, that of city. Before the resumption of the project in 1974, it had a population of about 6,000; since then the population has grown to about 40,000.

To the east of Tynda, where construction progress has been limited so far, significant urban settlements are expected to arise at two points where the BAM crosses important rivers; these prospective rail-river transport hubs are Zeysk, on the Zeya River and at the upper end of the large reservoir formed by the Zeya hydro station, and Fevral'sk, at the Selemdzha River crossing.

In Khabarovsk Kray, the principal urban development thus far has taken place in the Urgal coal basin. This area had two old urban settlements dating from the 1940's, when the coal basin was reached by a rail line from the Trans-Siberian and mining got under way: Srednіy Urgal, founded in 1942, and Chegdomyn, dating from 1949. Work on the BAM in this area has given rise to the new settlement of Urgal, which also has promises of substantial growth.

Present indications thus are for at least half a dozen major urban centers that will perform regional service functions as well as additional smaller places associated with particular mining and wood-products projects. Even the largest urban centers in the BAM zone are not expected to exceed the 50,000–100,000 population class. Larger base cities will continue to function either at the two extremities of the BAM zone (Bratsk and Komsomol'sk) or to the south along the Trans-Siberian Railroad, with its relatively more hospitable environment.

Although early enthusiastic designs for regional development along the BAM envisaged several of so-called territorial production complexes along the east-west mainline, more sober-minded subsequent analyses envisage another approach, involving the formation of north-south oriented complementary complexes, in which a segment of the Trans-Siberian zone in the south would function as a support base for the less developed corresponding BAM segment in the north.[30]

Separate mention should be made of the proposed South Yakutian territorial production complex envisaged for the Neryungri area at the northern end of the Little BAM. Here, too, the construction of the railroad has given rise to new urban settlements, including Zolotinka and Berkakit, both founded in February 1977, and supplementing the older Nagornyy, dating from 1941. Neryungri itself became an urban settlement in 1972, and was raised to city status in 1975. The environmental conditions that would appear to inhibit large-scale settlement and urban development along the east-west mainline apply all the more to the more northerly Neryungri district. For the time being, development plans at Neryungri call for the development of the strip mine, a coal washery and a power station. Looking further down the road,

[30] For a detailed account of the early designs of territorial production complexes along the BAM, see Shabad and Mote, Gateway . . . , op. cit., p. 82 (map), pp. 87–87, 153–161. For an alternative regional design concept of complementary regions combining segments of the Trans-Siberian and of the BAM, see: P. Ya. Baklanov et al. "Economic Regionalization of the Eastern Zone of Influence of the BAM (Concept and Method)," Soviet Geography, June 1979.

promoters have also been pressing for a new iron and steel complex in this area, based on the local coking coal and on nearby iron ore yet to be developed. But others argue against such a northern location for the steel plant, favoring a more southerly and more accessible site on the Trans-Siberian.

IV. Prospective Economic Functions

When the BAM program was announced in 1974, the basic rationale being offered in the Soviet literature was the need for a transport route for West Siberian crude oil to the Pacific. The BAM was visualized as part of the combined pipeline and railroad sysem, including a pipeline from the West Siberian oil fields to Tayshet, then transfer to heavy tank-car unit trains on the BAM as far as Urgal, then return to the pipeline mode on the final leg of the crude-oil transport route to Far Eastern refineries and seaside export terminals.[31] Although the second change in transport mode from rail to pipeline was never explained, it was stated that such a transport arrangement was more economical than an all-pipeline route across Siberia both because of the high cost of pipeline construction in this region, approaching that of a single-track railroad, and because of the advantages posed by a railroad as a more universal form of transport.

According to these early projections, West Siberian oil movements to the Far East were to account for as much as 70 to 75 percent of the ton-miles of freight traffic on the future BAM, with wood products accounting for 10 to 18 percent. Although the BAM was generally portrayed as a means of opening up new mineral sites along the way, data on the potential traffic generated by these future development projects were lacking and were not included in the early projections. As late as 1978, a Soviet article dealing with the design of rolling stock for the BAM envisaged heavy oil-tanker trains weighing 8,000 tons in the first 15 years of operation (starting in the mid-1980's) and even heavier trains of up to 9,000–9,500 tons thereafter.[32]

These traffic projections for the BAM have not considered the possibility that Soviet production of crude oil may be peaking sometime in the 1980's and that increasingly smaller amounts would become available for export. Although this point may not be reached as early as predicted by the Central Intelligence Agency (1981–82), the rate at which West Siberian production increments are being eroded by output declines elsewhere in the Soviet Union appears to suggest that a peak in oil production may be reached around the time the BAM goes into full operation (1983 or thereafter).

Aside from the flow of wood products and the possible expansion of trans-Siberian container traffic between Japan and Western Europe, what are the prospects for freight traffic being generated on the BAM by regional mining developments?

By far the firmest, of course, is the flow of coal that will be generated by the Neryungri strip mine in southern Yakutia. Its first-stage capacity, scheduled to be in operation by 1983, in time for completion of the BAM, will be 13 million tons, including about 3 to 4 million

[31] Shabad and Mote, Gateway . . . , op. cit., pp. 118–119, 132–133.
[32] I. I. Kantor et al. "Choice of Locomotive Capacity for the BAM," Zheleznodorozhnyy Transport, 1978, No. 3, pp. 72–75.

tons of steam coals, which lies in the upper portion of the deposit below the overburden, and 9 to 10 million tons of coking coal, which constitutes the deeper beds.[33] The first steam coal moved out of Neryungri for local power-station use in October 1978, and the 1979 plan called for the completion of the first 2.5 million ton section of the strip mine.[34] In anticipation of the growing coal-export traffic generated by the Neryungri mine, the first 6.2-million-ton section of a coal-loading pier went into operation at the new Soviet Pacific port of Nakhodka-Vostochnyy in late 1978.[35] Its ultimate loading capacity is planned at 13.6 million tons. Pending the arrival of Neryungri export coal in the 1980's, the Nakhodka coal terminal is handling coal from the Kuznetsk Basin for export to Japan, now running at around 3 million tons a year.

Aside from Neryungri coal traffic, Soviet planners appear to envisage the development of the iron and steel complex, with a location yet to be determined; the copper deposits of Udokan, in northern Chita Oblast, and the asbestos deposits of Molodezhnyy, in northern Buryat ASSR.

Regardless of the location of the steel plant, which would be working in part for export, the BAM would be involved in raw material flows to the prospective plant site. Aside from coking coal from Neryungri, this would include iron ore from an as yet undetermined location. An iron-ore deposit known as Tayezhnyy has long been known in the Neryungri area and is said to be capable of supporting an annual production level of as much as 17 million tons of crude ore (sufficient for the operatiion of a steel plant). There has also been interest in a new ore source now being explored in the Chara-Tokko district, some 200 miles west of Neryungri.[36] Aside from the controversial prospect of locating the proposed steel complex in the Neryungri area, sites have been proposed to the south, near Svobodnyy on the Trans-Siberian, and at Komsomol'sk, at the eastern end of the BAM, where a small steel plant has been operating for several decades.

The Udokan copper project, probably one of the most publicized mineral prospects in the BAM zone, will evidently require a foreign participant on a compensation basis, in which the Soviet Union arranges payback for foreign investment in the form of product. A number of negotiations were held with foreign participants in the early 1970's, but they were inconclusive, partly because of the problem of transport access to the Udokan site. The prospect of reaching this large source of copper ore is presumed to have been among the motivating forces that led to resumption of the BAM construction. Recently the Soviet Union once again approached the Japanese regarding participation in the Udokan project, which at any rate would not get under way until well into the 1980's since it is situated in the western sector of the BAM east-west line, the last to be placed into service.[37]

Part of the joint participation package presented to the Japanese in early 1979 was the Molodezhnyy asbestos project, also situated in

[33] Koks, 1977, No. 8; Ekonomicheskaya Gazeta, 1978, No. 29.
[34] Pravda, Oct. 27, 1978; Ekonomicheskaya Gazeta, 1979, No. 5.
[35] Vodnyy Transport, Dec. 23, 1978; Sovetskaya Rossiya, Jan. 9, 1979.
[36] Shabad and Mote, Gateway . . . , op. cit., p. 81; Soviet Geography, January 1977, pp. 33–38, and October 1977, p. 609.
[37] The New York Times, Feb. 17, 1979.

the western BAM zone. Though explored in the early 1960's and found to abound in the valuable long-stable fibers suitable for spinning, the asbestos deposit has remained undeveloped because of lack of access.[38] This, too, will materialize only in the mid-1980's when the BAM reaches the area. The additional construction of a 20-mile rail spur will be required from Taksimo on the BAM to the asbestos site.[39]

A number of additional mineral prospects have been mentioned in the Soviet literature, particularly metallic deposits of all kinds in the mountainous western sector near Lake Baikal, where the geology favors the presence of metalliferous formations. However, no concrete projects have been announced, and are not likely to be determined before the formulation of the next five-year plan, running from 1981 to 1985. Except for some materials that are short in the Soviet domestic economy, many of these mineral prospects would require foreign participation for export purposes.

V. Conclusion

Since the announcement of its resumption in 1974, the 2,000-mile Baikal-Amur Mainline has become one of the highest-priority construction projects in the Soviet economy. Unlike many similar undertakings, especially of such magnitude, work on the BAM appears to be reasonably close to schedule despite the harsh, uninhabited northern environment, engineering problems and the usual problems of coordination and supply inherent in Soviet projects. By the middle of 1979, about 850 miles of track, or close to 40 percent of the proposed system, had been laid. Completion of the project on time, by 1983, will depend mainly on the construction of the two major tunnels at the western end of the line (nine and four miles long).

Although the decision to proceed with construction of the BAM undoubtedly has some strategic implications (the line is 110 miles farther north from the Amur River border with China than the Trans-Siberian), there are clearly strong economic motivations behind the project. Aside from providing an additional east-west route through eastern Siberia, thus relieving the traffic load on the Trans-Siberian, the BAM will provide access to an entirely new northern tier of resource sites that were previously devoid of transport outlets. These resources are expected to be used both to build up the economy of the eastern half of Siberia and to generate a new export potential through Soviet Pacific ports, especially the new and expanding harbor facilities at Nakhodka-Vostochnyy.

A basic rationale for the construction of the BAM in the original planning calculations was the provision of a combined pipeline and railroad route for the transportation of West Siberian crude oil across Siberia to Far Eastern refineries and export terminals. As late as March 1978, rolling-stock designs for the BAM still envisaged heavy oil-tanker unit trains moving over the line until the end of the century at least. These early freight traffic forecasts appear to be put in question by the expectation that Soviet oil production will peak in the 1980's and export prospects will be curtailed.

The payoff of the multibillion-dollar BAM project will depend on the Soviet Union's ability to identify and develop potential export-

[38] Shabad, Basic Industrial Resources of the U.S.S.R., 1969, p. 263, 249 (map).
[39] Izvestiya, June 8, 1978.

oriented resources along the way. Because of the huge overland distance separating the BAM zone from the economic heartland in the western USSR, the rail project is not expected to have more than a marginal impact on the domestic economy. Although geological prospecting and exploration parties are out in the field to survey the riches of the BAM zone, the only certain resource project thus far is the development of South Yakutian coking coal, mainly for export to Japan. It remains to be seen whether additional projects will be included in the 1981–85 five-year plan.

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THE CHANGING ROLE OF RAW MATERIAL EXPORTS AND SOVIET FOREIGN TRADE*

(By Marshall I. Goldman)

Although the Soviet Union has long been regarded as the world's second largest industrial power, in fact, from the perspective of foreign trade, the Soviet Union is more of a raw material than an industrial power. As indicated in table 1, in 1977 83 percent of all the Soviet Union's hard currency earnings were derived from the export of raw materials. It is true that the Soviet Union is the world's largest exporter of various types of machinery and machine tools, but these go predominantly to either the other members of CMEA (Council of Mutual Economic Assistance) or to the LDC's. Soviet machinery has almost no market in the OECD countries. As indicated in table 2, whereas the Soviet Union sells a country like Germany $40 million worth of machinery a year, they buy in return $1,449 million, over 30 times more. The same vast disparities exist in Soviet trade with Japan and the United States. The situation is slightly better in Italy and France and England, but the machinery trade deficit even there is enormous.

In contrast, the Soviet role as a raw material producer and exporter in both soft and hard currency countries is an important one. After Saudi Arabia, the Soviet Union is the world's second largest exporter of petroleum. Similarly, after the Netherlands, the Soviet Union is the world's largest exporter of natural gas.[1] As we shall see, it is also a major factor in the timber, iron ore, manganese, coal, asbestos, and apatite, chromium, and precious metals markets as well.

*A longer version of this paper was originally commissioned by the Association of American Geographers for their Project on Soviet Natural Resources in the World Economy and will be published at a later date.

[1] Petroleum Economist, September 1978, pp. 362–363.

TABLE 1.—EXPORTS OF MAJOR SOVIET COMMODITIES TO THE HARD CURRENCY COUNTRIES IN 1977

[In millions of dollars]

	Austria	Belgium	Denmark	France	Great Britain	Greece	Italy	Japan	Netherlands	Spain	Sweden	United States	West Germany	Other	Total	Finland
Coal	39	11	22	42		1	55	143	9	8	23		5		358	84
Oil and oil products	201	199	218	531	461	282	1,012	85	365	164	261	160	1,066	354	5,359	973
Natural gas	144			92			132						198		566	59
Liquified gas				11											11	
Chrome ore				7			1	6			1	8	7		30	
Nonmetallic mineral alumina	4	32		13		1	4	21	1	2	11	7	36	10	142	10
Ferrous metal	21		3		31	1	40	30		11	6		19	10	172	9
Chemicals	5	1	1	22	10	1	8	13	15		2	5	54	13	150	8
Potash	4	11			5		4	14			2	1		4	45	5
Timber and timber products	10	35	9	76	171	9	73	449	39	9	20	2	101		1,003	83
Cotton	18	9		136	38		26	188	7	7			51	6	486	16
Furs			1	3	57	1	3	6	2	1	4	7	13	9	107	
Sunflower oil	2	1		11	2				6				24		46	
Miscellaneous			1	4	8		3	7				7	3		33	9
Products total	448	299	255	948	783	296	1,361	962	444	202	330	197	1,577	406	8,508	1,257
Machinery	9	30	8	47	46	19	25	10	16	7	14	12	44	36	323	75
Export total (82 percent)	482	480	272	1,115	1,303	323	1,484	1,161	542	222	377	369	1,827	454	10,411	1,428
Automobiles:																
1977	3,886	10,043	4,099	12,946	14,921	2,536	2,538		8,814		3,047		12,056	5,932	80,818	9,061
1976	3,184	14,635	5,833	12,584	9,498	2,688	2,106		6,154		2,708		15,828	5,730	80,948	11,817
1975	1,771	9,384	4,020	5,532	6,308	4,380	70		6,277		1,773		9,667	3,026	52,208	12,647

Source: Veshnaya Torgovia (foreign trade SSSR) [VT, SSSR], 1977 (1978).

TABLE 2.—SOVIET MACHINERY TRADE WITH SELECTED COUNTRIES

[In millions of dollars]

	England		France		Germany		Italy		Japan		United States	
	X	M	X	M	X	M	X	M	X	M	X	M
1958		18		13		41		7		3		1
1959		44		39		39	1	11		11		7
1960		58	1	63	1	96	1	30		19		28
1961		77	1	69	1	91	1	43	1	29		16
1962		62	1	88		59	1	33	2	77		20
1963	1	64	1	33	1	73	1	80	2	86		1
1964	1	47	2	42	2	134	1	52	3	133		4
1965	1	70	2	28	2	71	1	39	2	73		6
1966	2	102	3	55	2	98	1	38	1	106		7
1967	3	93	5	101	5	60	4	83	2	66		8
1968	7	134	5	193	9	103	6	110	2	65		9
1969	2	125	5	183	5	172	4	200	4	75		38
1970	5	110	7	174	28	136	5	196	3	122		24
1971	5	95	7	173	15	182	3	151	6	140		29
1972	10	108	10	160	20	367	6	146	6	241	1	58
1973	17	121	18	189	17	513	12	197	5	214	1	226
1974	29	76	20	362	19	736	18	210	6	251	2	253
1975	29	198	25	561	34	1332	19	412	4	583	5	600
1976	28	229	44	674	59	1470	15	425	6	659	4	820
1977	34	135	39	776	40	1449	21	669	8	938	3	481

Source: From annual issues of VT SSSR. (Rate of exchange prior to 1972 is $1.11=1 ruble. In 1972 it is $1.213 to 1 ruble; in 1973 and 1974, $1.34=1 ruble; in 1975, $1.32=1 ruble; 1976, $1.34=1 ruble; 1977=$1.37=1 ruble.)

Moreover, if the Soviet Union chooses to, it could be a major factor in several of these raw material markets for years to come. While its reserves of petroleum are a state secret and therefore much disputed, it is readily agreed that the Soviet Union has enormous deposits of a variety of other resources and in several cases it leads the world.[2] For example, according to one Soviet geographer, it has 59 percent of the world's coal reserves, 41 percent of its iron ore, 37 percent of its natural gas, 80 percent of its manganese, and 54 percent of its potassium.[3] It also has substantial deposits of apatite and asbestos. It is true that a large percentage of these reserves are in remote and climatically hostile areas. But it is also true that the Soviets are used to working under such adverse conditions.

Given such resources, it is clear that Soviet interests are very much linked to those of the raw material exporting countries. Indeed, the Soviet interest in high energy prices is probably greater than those of most of the members of OPEC. It is not just that the Soviets increase their prices (now even to Eastern Europe) along with anyone else when OPEC does, but that the Soviet Union is not constrained to withhold production and exports as Iran, and especially Saudi Arabia have done in order to assure the continued effectiveness of OPEC. It is not surprising, therefore, that when raw material prices soared in 1973 and 1974, the Soviet Union benefited enormously. As shown in table 3, the Soviets recorded one of the best trade balances in years.

[2] Petroleum Economist, September 1978, p. 362.
[3] G. I. Martsinkevich, Ispol'zovanie prirodnykh resursov i okhrana prirody (Minsk: BGU, 1977) p. 64.

TABLE 3.—SOVIET TRADE BALANCES WITH HARD CURRENCY COUNTRIES

[In hundred million dollars]

	1971	1972	1973	1974	1975	1976	1977
Capitalist data:							
Imports from U.S.S.R.	2,553	2,915	4,561	6,839	7,166	8,803	10,548
Exports to U.S.S.R.	2,251	3,328	4,894	6,258	11,086	12,106	12,112
Balance for U.S.S.R.	+302	−413	−333	+581	−3,920	−3,303	−1,564
Soviet data:							
Exports to West	2,319	2,491	4,327	6,739	6,346	8,420	10,187
Imports from West	2,429	3,565	5,254	6,910	11,419	12,574	11,845
Balance	−110	−1,074	−927	−171	−5,073	−4,154	−1,658

Note: Exchange rate: 1971, 1 ruble equals $1.11; 1972, 1 ruble equals $1.21; 1973, 1 ruble equals $1.34; 1974, 1 ruble equals $1.34; 1975, 1 ruble equals $1.32; 1976, 1 ruble equals $1.34; and 1977, 1 ruble equals $1.37.

The Soviets, like so many others at that time, were sure that a new era had arrived. It took the Soviets as well as many others some time to realize that the changes were not all permanent. The lesson was learned in 1975, when the high prices of 1973 and 1974 precipitated the recession of 1975. In an abrupt reversal of 1974, the Soviet Union found many of its raw material markets had collapsed. According to Soviet statistics, Soviet exports to the OECD countries in 1975 actually fell from the previous year (see table 3).

This paper will try to trace the export patterns of some of the more important Soviet raw materials. An effort will be made to discern trends and responses by the USSR to changes in political and economic developments. What role does CMEA play in Soviet trade priorities? What are the future prospects for the export of specific commodities and what will be the overall trade level?

I

Given its reputation as the bread basket of Europe, it was only proper that grain (first wheat and then barley) was the largest single export. It constituted one third of all earnings, next in importance was timber which accounted for 11 percent. Linen, leather, and fats were other important earners.

More surprising to some is the fact that prior to the revolution, Russia was also the world's leading exporter of petroleum. In 1913, export earnings from petroleum were 3 percent of the total. Petroleum exports had been considerably higher in earlier years. However, in 1913, oil production fell to only 9.2 million tons compared to a high of 11.6 million tons in 1901.[4] Russia was the world's largest producer of petroleum until 1902 when it was surpassed by the United States.[5] Coincidentally in the early 19th century, Russia was also the world's largest producer of ferrous metal.[6] However, Russia failed to keep up with the rest of the world in the production of both petroleum and

[4] Tsentral'noe statisticheskoe upravlenie Narodnoe khoziaistvo SSSR 1958 gody (Moscow: Gosstatizdat, 1959), p. 208. (Hereafter Nar khoz and the appropriate year).

[5] U.S. Bureau of the Census, Historical Statistics of the United States, Colonial Times to 1970, Bicentennial Edition, Part II (Washington, D.C., 1975), p. 594.

[6] Marshall I. Goldman, "The Relocation and Growth of the Pre-Revolutionary Russian Ferrous Metal Industry", Explorations in Entrepreneurial History, vol. 9, No. 1, October 1954, p. 19.

steel. Now, interestingly enough, it again produces more petroleum and steel than anyone else.

The year 1913 was the last substantial export year until the late 1920's. World War I, the Revolution and the Civil War that followed wrecked enormous damage on the economy. Foreign trade virtually ceased after 1919. It was not until the 1960's that the ruble value of Soviet exports exceeded the level recorded in 1913. The pre-World War II peak under the Communists was reached in 1930, and even then trade volume was only about ⅔ of the 1913 ruble value. The makeup of exports in 1930 had changed a bit from 1913. In the more recent year, grain exports accounted for 20 percent of total earnings, timber earned 17 percent, and petroleum 15 percent. The main difference was that grain's importance had diminished. Indeed, in 1929, virtually no grain was exported, although exports resumed in 1930. Several decades later, Khrushchev criticized Stalin because he had exported grain during this period of collectivization. The lack of grain brought great suffering and death to millions of peasants from starvation.

Before moving to the post-World War II era, it is necessary to say a special word about petroleum. Although wheat and timber generally brought in more revenue, petroleum exports continued to be an important source of income throughout the 1930's. Only in 1939 did petroleum exports virtually cease. Moreover, exports of crude and petroleum products frequently amounted to over 25 percent of the total production of the country's crude oil, a figure which is nearly identical with similar comparisons in the 1970's.

After World War II the Soviet trade pattern changed rapidly. Soviet officials diverted almost all trade to the nearby Communist governments of Eastern Europe, and in 1949 to China. Throughout this period the Soviets continued to export small amounts of petroleum to such traditional customers as England, Italy, and Sweden. But the bulk of Soviet exports was rerouted from the West to the East and trade volume rose rapidly almost every year.[7]

While much that was familiar about the prewar trade pattern, such as the export of timber and petroleum, carried over into the post-World War II era, there were some differences. One of the most notable was the increase in the role played by machinery exports. At their peak, machinery exports in 1938 amounted to only 5 percent of total earnings.[8] In contrast, in 1950, they accounted for 12 percent, and by 1960, for 21 percent of all earnings.[9] As noted earlier, however, little of this machinery went to hard currency countries.

The burden of earning hard currency for the Soviet Union continues to fall had since before the Revolution on raw materials. One notable change from the earlier period was that today grain is more likely to be an import than an export commodity. As indicated in Table I, the main hard currency income earner now is petroleum. In 1977, petroleum exports alone accounted for over 50 percent of the hard currency earnings and 28 percent of all export earnings. Of course,

[7] Ministerstvo Vneshnei Torgovli, Vneshniaia Torgovlia SSSR v 1976 g. Moscow Statistika. 1977 and for earlier years.
[8] Ibid., p. 17.
[9] Ibid., p. 73.

petroleum's importance jumped rapidly in 1973 after the four-fold price increase. Timber is the second most important hard currency product, and natural gas and cotton follow in that order.

The makeup of the raw material export package and the composition of the importers has varied from year to year, but certain patterns do persist. Like the United States, the Soviet Union not only supplies many of its domestic needs, but has a large export capacity as well. This is in sharp contrast to most of the other OECD countries which rely heavily, if not entirely, on raw material imports, particularly energy raw materials. This export capacity extends even to oil and natural gas which the United States has to import. In the extreme case of petroleum, the Soviet Union exports about 27 percent (allowing for imports) of its petroleum production. It has sustained this high percentage since about 1965. This percentage is also comparable to the percentage attained in 1932. Of course, due to the enormous increase in production, today the physical volume exported is about 150 million tons compared to about 6 million tons in 1932.

Iron ore is also a major export commodity. While now 17 percent of total production is exported, in years past exports were as high as 19 percent of production. Manganese exports take almost as much out of production. Glass and cotton exports amount to over 10 percent of total production. Most other exports, such as coal, pig iron, rolled steel, and timber account for less than 10 percent of total production. Although net natural gas exports in 1977 were only 6 percent of production, the percentage is due to increase significantly with the opening of the Orenburg or Soiuz pipeline.

Despite the fact that Soviet domestic consumption of these raw materials continues to grow at a steady rate, in recent years the Soviets have nonetheless been able to increase output enough to allow for a steady increase in the share of exports of many of these items. Most of this increase in percentage of goods exported has occurred since 1955. It has been particularly noticeable in petroleum and petroleum products where net exports as a percentage of production have moved from 5 percent in 1955 to 27 or 28 percent in 1977. Gas exports to production have increased from a net import basis in 1972 to 6 percent net exports in 1977. (The Soviets did export more than they imported from about 1955 to 1969 however.) The comparable figure for timber is 2 percent of production exported in 1960 and 6 percent in 1977; for cotton 2 percent in 1960, and 10 percent in 1977. Manganese exports are an exception to this trend. Exports of coal, iron, or pig iron, rolled steel as a percentage of production increased, but then decreased compared to 1960, although the percentage generally remains even higher for most of these items in 1976–77 than it was in 1960. Overall this is quite an accomplishment for the Soviet Union. In other industrialized countries raw material exports of all goods as a percentage of production are generally decreasing.

There is less of a clear pattern in the breakdown of exports between hard currency or OECD countries and members of CMEA. The share of gas, iron ore, and cotton exports going to the OECD countries has increased sharply in recent years. In the extreme case of timber and natural gas, over one half goes to Western Europe. Presumably this

will be reduced once the Orenburg gas begins to flow to Eastern Europe in 1979. The percentage of paper and manganese destined for the OECD bloc has decreased. The comparable percentage of coal, petroleum, and petroleum products has fluctuated, although again in recent years the share of exports going to the OECD countries has increased sharply. Much of this increase, however, has come at the expense of Third World countries rather than the CMEA bloc. Perhaps the most striking feature of the Soviet export pattern is that in the case of the big hard currency exports, such as oil, timber, gas, cotton, and coal, the hard currency countries receive anywhere from 27 percent to close to 60 percent of these various Soviet exports.

II

An important question for the future development of the Soviet Union is whether or not the Soviets will be able to sustain this continued growth in their raw material production. While we in the United States worry whether or not production itself will diminish, for the Soviets the question goes beyond that to whether or not the rate of growth of increase in production will cease. Foreign observers, such as the CIA, have suggested that at least in some critical areas of production, such as petroleum, Soviet production will soon level off and may even diminish.[10] As we shall see, if this should happen, it would not only have serious ramifications for Soviet domestic production, but for Soviet export earnings and thus for the import of technology.

Most of the existing deposits have been developed by the Russians and then by the Soviets themselves. Frequently, at the initial stage of the development of a new product, foreign technology has been used. But soon after the Russians and their Soviet successors have usually managed to carry through on their own.[11] This is not to deny that the Soviets are often wasteful and sometimes downright inefficient in how they have pursued their work, but the point is that generally they have managed to expand their production base on their own. A prime example of this is the development of the Tiumen oil fields in West Siberia. The first petroleum in this area was discovered only in 1959.[12] The region was desolate and cut off from most forms of transportation and industrial life. Thus it was 1964 before the first exploitation of the field took place. Then only 200,000 tons of oil were extracted. Yet by 1977, and despite the mosquitos, swamps, permafrost, cold, and impossible supply conditions, production exceeded 200 million tons. Moreover, virtually the entire effort was carried out with existing Soviet labor and technology. The Soviets have been equally impressive in exploiting their extremely challenging natural gas fields which are located in even more desolate and inaccessible regions. Moreover, unlike petroleum, which can be transported in a variety of ways, natural gas can be moved only by pipeline. This means the Soviets must not only build

[10] The Central Intelligence Agency, Prospects for Soviet Oil Production, ER-77-10270, Washington, April 1977.

[11] Robert W. Tolf, The Russian Rockefellers (Stanford: Hoover Institution Press, 1976). Also see the article on the development of the pre-revolutionary steel industry by Marshall I. Goldman, op. cit.

[12] Review of Sino-Soviet Oil, May 1977, p. 21.

roads to their production sites, but pipelines and that unlike a road which need not be in perfect repair at all times, the pipeline must be built so that it can withstand extreme changes in weather, and there can be no such thing as a crack in the pipe. Inevitably, this has been difficult to achieve, and the Soviets have been slow in fulfilling all of their pipeline construction plans. But sooner or later they seem to complete their projects, and they have managed to ship gas from some of the most hostile areas of the world.

But no matter how self-sufficient the Soviet Union may be, Soviet officials sometimes confront very difficult challenges. There is no doubt that the Soviets have run into the law of diminishing returns. At Magnitagorsk, for example, the local source of iron ore has been seriously depleted.[13] Now iron ore must be shipped vast distances. Naturally this increases the cost.

The most notorious depletion of resources has occurred in the petroleum industry. In a carefully documented analysis the CIA has shown how what were once the main sources of supply have begun to dry up.[14] Increasingly that has led to greater infusions of water in order to increase the pressure in the wells and that in turn has led to a consequent increase in the water extracted from the well along with the petroleum. This necessitates the utilization of semi-submersible pumps, many of which must be imported. Such solutions, however, provide only temporary relief.

When the extraction rates start to fall again and labor costs start to rise, the normal Soviet tendency in all areas of mineral extraction is to move to new fields. The consequence of this continued migration to the North and East, particularly in the energy field, can be better appreciated when it is realized that by 1980 the Soviets anticipate that the European portion of the Soviet Union will supply only 3 percent of the country's coal, gas, and oil, the Ural 7.4 percent while the Eastern part of the Soviet Union will supply 55.6 percent.[15] However, since 75 percent of the Soviet population and 83 percent of its industrial production is located west of the Urals, the disparity is clear. Even more ominous is the fact that only 10 percent of the Soviet Union's mineral fuel reserves are in the European part of the country.[16] Inevitably the gap between population and resource availability will grow.

Another problem the Soviets have to face is inefficiency and waste in the use of raw materials. This happens at both the extraction and the manufacturing stages. As we shall see, however, if rationalization is to take place, there will have to be some important changes in the Soviet planning and incentive system.

While raw material waste has always been a feature of the Soviet system, the degree of concern increased sharply only in the mid 1970's when the Soviet Union along with the rest of the world, began to worry about impending shortages of raw materials. Until then there seemed to be abundant quantities of raw materials but not such abundant quantities of labor and capital. In fact partly because of ideology

[13] Pravda, Apr. 3, 1978, p. 2.
[14] CIA, op. cit.
[15] A. M. Nekrasov, M. C. Pervukhin, Energetika SSSR v 1976–1980 godakh (Moscow: Energiia, 1977), p. 149.
[16] A. A. Nekrasov, M. C. Pervukhin, op. cit., p. 144.

but partly because they seemed to be so abundant, since September 2nd, 1930, and until recently, the Soviets treated minerals in the ground as free goods. In most mining operations, there was not even a rent charge. By contrast Soviet managers have had to pay for the labor they use as well as the capital goods. The result was readily predictable. In the words of Academician Khachaturov, the enterprise "prefers to make more economical use of its capital even if it means neglecting natural resources." [17]

As opposed to the American or capitalist mine operator who has to pay for the raw materials he mines either in the form of rent, royalties or the purchase of land, the Soviet mine operator is provided with raw materials free of charge. Thus he bears no or very low fixed costs. As a result, the Soviet mine owner will not attempt to exploit the mineral deposits as extensively as will his capitalist counterparts. The Soviet manager is more likely to dig or drill and run. The capitalist miner or driller is more likely to stay and take out a much larger percentage of the deposit.

The reason this happens can be explained in the following way. Like all miners, the Soviet miners take out the richest ore first. As the richest ore diminishes, the mine's costs per ton of output begin to rise. Since he has no fixed costs, the Soviet miner focuses only on his marginal and variable costs. As his costs continue to rise, the Soviet miner begins to look for another, easier and cheaper mine to exploit. Like bourgeois miners in the capitalist world, the Soviet miner does not have to worry about the costs already put into the original mine. Both in the Soviet Union and the United States, all past capital costs are no longer a concern. "Bygones are bygones." Economists and miners do not cry over "spent capital" or spent land acquisition. However, unlike his American counterpart, the Soviet miner also has no need to worry about his future land acquisition or raw material acquisition costs either.[18] Given the peculiarities of the Soviet pricing system, the new mining site is a free good to the Soviet mine operator. In addition, until July 1, 1967, the geological exploration cost was also something the Soviet mine operator did not have to fret over. Even now, not all miners have to bear these costs so that above 25 to 30 percent of all geological exploration costs still go uncovered.[19] Therefore, when the Soviet mine operator finds that his marginal costs of operation at the old site exceed the average costs of labor and capital plus the average cost of moving to the new site, he will move. By contrast, the capitalist miner has more to worry about and therefore, he is more likely to stay in place longer and attempt to extract more. In addition to all the costs the Soviet miner has to worry about, the American miner also has to worry about his new average land costs per unit of output as well as the full geological costs before he contemplates moving. Thus, the costs of operating at the new site will appear to be higher to the American mine operator than they are to the Soviet mine operator. Therefore, the American is less likely to move to a new site and more likely to dig deeper and mine more intensively. In contrast to the

[17] T. Khachaturov, "Prirodyne resursy i planirovanie narodnogo khoziaistva," Voprosy ekonomiki, August 1973, p. 17.
[18] Marshall I. Goldman, The Spoils of Progress, Cambridge, MIT Press, 1972, p. 49.
[19] N. K. Feitel'man, "Ob ekonomicheskom otsenke mineral'nykh resursov," Voprosy ekonomiki, November 1968, p. 110.

American miner who sweeps his mine clean, the Soviet miner is more likely to ignore the edges and the harder-to-reach corners of his deposit. He is also more likely to leave pillars of coal and other raw materials standing to hold up the ceiling rather than bring in other seemingly more expensive forms of support. The natural pillars left in the U.S.S.R. often contain more than 20 percent of the mine's ore or coal.[20] Potassium salt pillars often amount to as much as 50 percent of the potential output.[21] Recognizing these tendencies, economists like Federenko and Khachaturov have been arguing for the introduction of a rent or raw material charge. As Khachaturov sees it "if the enterprise has to pay for natural resources, it will treat them as carefully and economically as productive capital." [22]

To the extent that the pricing mechanism fails to reflect the full economic costs at an early stage of production, it is all but inevitable that such distortions will be carried throughout the rest of the economic system. Thus, raw materials tend to be underpriced in the Soviet Union. This in turn induces consumers of raw materials to use more than they otherwise would. This helps to explain why the Soviet Union expends more fuel per kilowatt of electric power and per ton of open hearth steel smelted and more metal per unit of engine power than the United States does. In the Soviet machine tool industry for example, over 25 percent of all the rolled steel used is discarded as scrap.[23] Given the planning system with its emphasis on output at virtually any cost and the tendency to understate or ignore the true costs involved, it was inevitable that there would be waste and inefficiency in Soviet mining practices.

This waste is translated into Soviet extraction ratios that are very much lower than those that prevail in the non-Communist world. Soviet economists and geologists constantly complain that Soviet mining and drilling practices are needlessly wasteful. In contrast to the American experience where recovery rates in coal mines, particularly strip mines, are often 90 to 100 percent, in the Soviet Union, the figure is frequently only 70 percent.[24] The recovery rate of mica is as low as 10 percent while the recovery of potassium salts and petroleum reportedly is 40 to 50 percent of that which can be extracted. Other economists complain that about 40 percent of the country's gas associated with petroleum production is flared wastefully.[25] Normally the extraction rate of ferrous and non-ferrous metals in the Soviet Union is about 80 percent, but at the Krivoi Rog mines, it is only 54 percent.[26] This is confirmed by the Soviet economist and member of the Academy of Sciences, T. Khachaturov who reports that often 40

[20] Trud, Aug. 12, 1967, p. 2.
[21] Literaturnaia gazeta, No. 7, Feb. 12, 1975, p. 10.
[22] Khachaturov, op. cit., pp. 20–21.
[23] Ibid., p. 26; Sotsialisticheskaia industriia, Mar. 3, 1978, p. 2.
[24] K. E. Gabyshev, "Ekonomicheskaia otsenka prirodnykh resursov i rentnye platezhi," Vestnik Moskovskogo universiteta, seriia ekonomika, No. 5, 1969, p. 17.
[25] G. Mirlin, "Effektivnost' ispol'zovaniia mineral'nykh resursov," Planovoe khoziaistvo, No. 6, 1973, p. 32; Review of Sino-Soviet Oil, May 1976, p. 23.
[26] Gabyshev, op. cit., p. 18; Sotsialisticheskaia industriia, Jan. 8, 1971, p. 2.

to 50 percent of the solid minerals which can be mined are left in the ground.[27]

The planning system is also ill-suited for locating new deposits. Remember that planning targets are usually spelled out in terms of some physical measure. For those in agencies like the Ministry of Geology whose work involves drilling, the most reasonable index would seem to be the number of meters drilled. The more meters drilled, the better the performance, or at least one would think. Unfortunately Soviet geologists soon discovered that the deeper they dug, the longer it took them and the less likely it was that they would fulfill their plan. As a result the geologists quickly developed the practice of drilling shallow holes. As an article in Pravda put it, "Deep drilling means reducing the speed of the work and reducing the group's bonuses." [28] It was all but inevitable therefore, that "In some places the land is becoming increasingly pitted with shallow exploratory holes drilled in incessant pursuit of a larger number of total meters drilled." Further, "There are geological expeditions in the Kazakh republic that have not discovered a valuable deposit for many years but are nonetheless counted among the successful expeditions because they fulfill their assignments in terms of meters." As a result of such practices, it is only to be expected that some ministries will complain about not increasing their reserves fast enough.

Moreover even if a deposit should be found, the drillers from the Ministry of Geology bear no responsibility for determining the size of the deposit. Consequently the actual producing ministries must maintain their own drilling units. In some instances there may be as many as three separate drilling agencies duplicating one another's work.[29] Undoubtedly it would be much more efficient if it were possible to base the drilling team's pay on the amount of raw materials actually recovered.

III

How much will the shortcomings in the Soviet planning system act to hamper the fulfillment of Soviet output and export targets? There is no doubt that there has been a fall in the rate of growth of production of most Soviet raw materials in the last few years. The growth rate for petroleum has fallen from an annual increase of 7 percent or more in the early 1970's to about 4 percent in 1978. Even more striking, absolute coal production, not just the rate of growth, in mid 1978 was actually lower than it was in 1977 and iron ore extraction barely increased in 1977 over 1976. Natural gas is one of the few products whose rate of growth has increased in recent years. Whereas output increased by only 4 percent in 1972, in 1978 it increased by 8 percent. But even where the growth rate is falling it should be remembered that it is the rate of growth that is falling, not, except for coal, the actual amount produced. In principle this is a good sign since if there are to be exports, Soviet officials must, first of all, ensure that output increases. If output falls the Soviets may still be able to export if they decide to

[27] Khachaturov, op. cit., p. 17; Martsinkevich, op. cit., p. 65.
[28] Pravda, Jan 27, 1978, p. 2.
[29] Turkmenskaia iskra, Dec. 6, 1977, p. 2; Literaturnaia gazeta, Jan. 18, 1978, p. 10.

divert supplies from domestic to export markets; but at best this risks slowing down the Soviet rate of economic growth. Clearly the Soviets would prefer to increase output. Let us consider, therefore, what the output potential of the various raw materials might be.

From the perspective of export earnings, the most important commodity is petroleum. Since petroleum accounted for over one-half of the $10.4 billion in hard currency earnings in 1977, if anything happened to reduce the availability of petroleum for export, the Soviets would have an enormous balance of payments problem. As it is, in recent years they have had a $1.5 billion to $4 billion deficit.

While Soviet petroleum has always been of some importance as an export earner, its really significant impact dates from the four-fold price increase of 1973. Thus while petroleum accounted for only 22 percent of hard currency earnings and 13 percent of all Soviet export revenues in 1972, by 1974 the figure had soared to almost 40 percent in hard currency earnings and 21 percent of total earnings. In 1977, when Soviet petroleum prices to East Europe were almost at world price levels, petroleum was a source of 52 percent of Soviet hard currency earnings and 28 percent of its overall earnings. In many ways, the USSR is a one-crop economy.

If the CIA is correct, Soviet petroleum production will start to level off in the very early 1980's as will exports.[30] In their more pessimistic estimate, production should fall as early as 1979. Equally important, based on their April 1977 calculations, the CIA projected that this drop in production would necessitate not only a corresponding cessation of exports, but a need for imports so that by 1985 the Soviet bloc would be importing 3.5 to 4.5 million barrels a day (mbd).

The transformation from being a net exporter of petroleum to becoming a net importer would cause a massive crisis for the Soviet foreign trade operation. Assuming no change in petroleum prices, the cost of importing 3.5 to 4.5 mbd would amount to $18 to $24 billion a year. If to that is added the regular Soviet imports for 1977 of $12 billion, that would mean the Soviet Union would have an overall import bill of between $30 and $36 billion a year. At the same time since over one-half of their $10.5 billion earnings have come from petroleum exports which by 1985 will no longer be available, that means that in the absence of substantial new exports the Soviets will be able to count on only $5 billion of exports. This will result in an annual trade deficit of about $25–$31 billion. There are not many countries that can sustain that kind of deficit.

Of course much of that deficit will have to be carried by the Soviet Union's East European allies who produce little petroleum of their own. Moreover in addition to the Soviet Union's visible trade exports, the Soviets also have hard currency earnings from the sale of gold, diamonds, and military equipment. The Soviets also hope that by 1985 they will be able to expand some of their other exports, especially machinery and natural gas. This should reduce the size of the deficit but to be realistic, it is unlikely that export earnings will be increased much since even if hard currency natural gas exports double, gas will

[30] CIA, Prospects for Soviet Oil Production, op. cit., p. 1.

still bring in only about $1 billion. Moreover the East Europeans already have a large trade deficit each year. Finally if the Soviet bloc is forced to buy that much petroleum, the price will go up significantly so that the import bill will be even higher.

Recognizing these criticisms, the CIA belatedly reduced its estimates of the bloc's 1985 imports.[31] In their more recent forecast, they predict that the bloc will only have to import 2.7 mbd, none of which will be required by the Soviet Union itself. But even this seems to be too extreme a situation. The Soviets must have petroleum to export because it is so vital for Soviet export earnings. Moreover the Soviets seem determined to insure there will be petroleum available to export. What are they doing to bring that about?

The first step is to improve some of the wasteful domestic consumption habits. The decision to double the price of gasoline in early 1978 is a step in that direction. However the total motor vehicle stock in the Soviet Union is small to begin with so that the curtailed use of vehicles will not be all that important. In addition the decision to buy gasoline is generally more dependent on access to ration coupons than on price. Moreover as table 4 indicates, there is apparently little slack in the Soviet energy balance to free up oil and gasoline. Unlike the United States, where in 1976 oil constituted 47 percent of total energy consumption, oil provided only about 39 percent of Soviet energy. In contrast coal played a much larger role in the Soviet Union. Yet there remains much the Soviets can do, especially in industry, electricity generation and household heating.[32] For example, building insulation is poor and drafts are omnipresent. More important the Soviets have until recently squandered what seemed to be their abundant petroleum on electricity generation and central heating. Recognizing this, the Soviets have belatedly embarked on a campaign to reverse the trend towards using more petroleum for such purposes. As shown in table 5, by 1980 the Soviets anticipate a reduction in the percentage of petroleum used for boilers and furnaces and its replacement with a significant increase in the absolute and relative share of natural gas used. In the European part of the Soviet Union where all fuel deposits are now in short supply, the Soviets have embarked on an expensive program to increase their atomic energy capacity. Although their plans are behind schedule, they seek to increase the amount of energy generated by atomic reactors in the European part of the USSR from the 3.1 percent of 1975 to 10 percent in 1980.[33] The Soviets are also making an effort to increase the use of coal which presumably would show up if Table 5 had a year-by-year breakdown rather than 5 year intervals.[34] The Soviets have also improved the overall efficiency of their use of energy. This is indicated by the fact that the ratio of energy consumed to GNP produced has started to decline.[35]

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[31] CIA, Soviet Economic Problems and Prospects, ER77–10436U, Washington, July 1977, p. 22.
[32] Izvestiia, Sept. 10, 1978, p. 2. Petroleum Economist, September 1978.
[33] A. N. Nekrasov & M. G. Pervukhin, op. cit., p. 114.
[34] Ibid., p. 153.
[35] Central Intelligence Agency, The Soviet Economy in 1976–77, An Outlook for 1978, ER78–10512, Washington, August 1978, p. 6.

TABLE 4.—CONSUMPTION OF ENERGY IN THE UNITED STATES AND THE U.S.S.R. BY MAJOR ENERGY SOURCE

[In percent]

	United States			U.S.S.R.		
	Coal	Oil	Gas	Coal	Oil	Gas
1940	52	31	11	75	23	2
1945	51	30	13			
1946				78	19	3
1950	38	40	18	77	20	3
1955	29	44	23	75	23	3
1960	23	45	28	62	29	9
1965	22	44	30	50	32	18
1970	19	44	33	41	36	23
1971	18	45	33	39	36	25
1972	17	46	32	38	38	24
1973	18	47	30	37	39	24
1974	18	46	30	36	39	24
1975	18	46	28	35	40	25
1976	19	47	27	34	39	27

Sources: United States: U.S. Bureau of the Census, "Statistical Abstract for the United States: 1977" (8th ed.) Washington, D.C., 1977, p. 594.
Soviet Union: A. M. Nekrasov, M. G. Pervukhin, "Energetika SSSR v 1976–1980 godakh." Moscow, "Energia," 1977, p. 146; Tsentral'noe statistichesko upravlenie, "Narodnoe khoziaistvo SSSR v 1959" (hereafter Nar khoz) Moscow, "Statistika," 1959, p. 176; "Nar khoz" 1970, p. 183; "Nar khoz" 1977, p. 204; Ministerstvo Vneshnei Torgovli, "Vneshniaia Torgovlia SSSR v 1976 g." Moscow, Statistika, 1977 and for earlier years.

TABLE 5.—COMPOSITION OF FUEL USED IN BOILERS AND FURNACES

[In percent]

	1970	1975	1980 (plan)
Coal	37.9	32.9	29.5
Coke	7.6	6.6	5.9
Oil	15.5	18.3	14.7
Natural	25.4	29.6	34.8
Peat	1.7	1.2	1.2
Shale	.7	.7	.6
Wood	2.0	1.4	.9
Liquified gas	.8	.9	1.1
Coke oven gas	1.9	1.7	1.5
Blast furnace	2.5	2.2	1.9

Source: Nekrasov and Pervukhin, p. 149.

The Soviets are not only trying to rationalize their consumption patterns, but production procedures as well. Without a radical shake-up of the existing planning system it is unlikely that many of the basic problems will be solved. Yet there is still room for considerable improvement within the existing framework. At the present time rates of recovery in Soviet oil fields as we saw, are embarrassingly low. But with proper incentives, the Soviets could increase the rate of extraction considerably. This expectation serves as the basis for the report by Petro Studies Company of Sweden that the Soviets by 1985 will be exporting, not importing, about 3.7 mbd.[36] In many instances it is merely a matter of increasing a number of wells in existing fields so as to increase the density of the cluster. While this report goes to the other extreme from the CIA, there is nonetheless no doubt that the Soviets do have room to increase their production on existing fields and thereby their exports. As the Swedes see it, the Soviets are in the process of changing their incentive system so that the main criterion

[36] Petro Studies Report GOP–782. Soviet Preparations for Major Boost of Oil Exports, Malmo, Sweden, 1978, pp. 13–17.

of oil development becomes the maximization of differential rent instead of the present system of the minimization of development costs.[37]

If they are to be effective, the Soviets will not only have to devise a system that will generate a desire to increase the number of development and exploratory wells, but they will also have to find a way to improve the quality of their drilling pipe and their drill bits. Soviet manufacturers normally seek to increase quantity of production, not quality. Thus it is not surprising that Soviet drilling pipe often has major threading defects. After all the main success indicator for the manufacturer is not the durability of the pipe or even the length, but the tonnage.[38] For a variety of such reasons it is normal to find that as little as 15 percent of a driller's time is actually spent on drilling. The remainder is spent on taking out and reinserting the drill pipe to attach new drill bits and replace the pipe.

The Soviets are trying to solve these problems with both their own and foreign resources. For example, to improve their offshore exploration efforts, they have combined all drilling efforts into the Ministry of Gas Ministries. This should reduce some of the bureaucratic blame shifting since now the gas industry will presumably focus on the discovery and ultimate extraction of fuel deposits instead of countenancing an indicator that stresses only "meters drilled." At the same time the Soviets have decided to buy an American drill bit plant in the hope of improving the quality of their own drill bits. They are also considering the use of foreign technology in order to produce better pipe and secondary recovery equipment. All of this should go a long way toward sustaining, if not increasing, production in old wells and increasing output in new wells.

IV

One of the remarkable features about the trade figures presented earlier in this paper was that in recent years the Soviets have not only increased the absolute volume of several of the commodities they have exported, but the relative share of total production exported. Presumably given diminishing returns, this process should come to a natural halt itself and indeed in earlier years it did look as if the percentage being exported was diminishing. What explains the recent increase?

While it is hard to judge precisely what determines Soviet actions, there seems to be good reason to believe that the volume of Soviet raw material exports is dependent at least in part on the Soviet need to balance its trade deficit. Iron ore and manganese exports are significant exceptions to this trend, and therefore it may be misleading to place too much emphasis on this phenomenon. Yet despite these exceptions, since 1972 Soviet trading patterns have undergone some sharp upheavals and there is reason to believe that Soviet officials have used Soviet raw material exports to the hard currency markets as a balancing mechanism even if it has meant sacrificing some of the needs of the domestic economy.

The most striking example of this type of balancing is reflected in the fluctuation of petroleum exports. The total volume of exports as well as the total volume to the OECD countries rose continuously until 1974. Then because prices increased four-fold to the OECD

[37] Op. cit., p. 3.
[38] Pravda, Feb. 28, 1978, p. 2.

countries, hard currency petroleum earnings, which had doubled from 1972 to 1973, doubled again in 1974. This left the USSR with one of its most favorable trade balances in years. Clearly there was no need to export as much as they had in 1973. Thus hard currency exports fell from 36 million tons in 1973 to 31 million tons in 1974. In 1975, however, the Soviets failed to take the proper precautionary measures in the recession and their imports nearly doubled. The imbalance was caused in part by the serious crop failure which necessitated large scale grain imports. In addition Soviet imports had been predicated on the assumption that export earnings would continue to grow as they had in 1974. However, in a world recession, raw material demand and prices are usually affected before anything else and as a result so were Soviet hard currency receipts. For example, timber sales which totaled about $1 billion in 1974 fell to $700 million in 1975. Similarly sales of cotton fell from $360 million to $274 million. The demand for energy products remained relatively strong however, even though prices dropped a bit. As a result the Soviets were able to offset their shortfall in the other markets with an increase in the absolute volume of energy products sold in the hard currency markets. Hard currency coal revenues rose from $230 million in 1974 to $371 million in 1975. Natural gas exports to the hard currency world rose from 5 billion cubic meters to 7 billion cubic meters, and more importantly, revenue more than doubled from $87 million to about $200 million in 1975. However, increased petroleum sales provided the biggest supplement. Hard currency exports rose from 31 to 38 million tons and earnings rose from $2.6 billion to $3 billion. They would have risen even more if petroleum prices had not weakened. Overall the increase in earnings from energy was very important. Without this increase, the Soviet exports would have been about $700 million less than they were.

While the Soviets tried to tighten their belts in 1976 and reduce their imports, they still found it necessary to import large quantities of grain and thus it was necessary to increase exports again. The timber and cotton markets firmed a bit, and so the Soviets collected $200 million more than the previous year. Hard currency coal exports actually diminished, but this was more than compensated for by a dramatic increase in petroleum and natural gas exports. Hard currency gas exports increased by 4 million cubic meters, or by about 60 percent and revenues rose about 70 percent. Petroleum exports jumped by 11 million tons or 30 percent and revenues rose by $1.5 billion or 50 percent. Because the accumulated debt was still large, this extra effort to export raw materials continued into 1977. This time export earnings of all the major commodities increased with hard currency petroleum revenue jumping the most by $800 million. Yet the jump was not as large as previous increases, and this seems to be due largely to the fact that there were mounting pressures to retain some of these raw materials in the domestic market and also because the trade deficit was no longer so large.

Although it is impossible to obtain confirmation that Gosplan and Ministry of Foreign Trade officials have consciously pursued such a course of action, there is little doubt that there is such a pattern. It will be interesting to see, therefore, what will happen if and when the Soviets manage to solve their balance of trade problem. What, for example, will happen if their wheat harvest should improve sig-

nificantly, and if they also manage to increase their non-raw material exports? The implication is that the Soviets will reduce the shipment of their raw materials, at least some of the non-renewable products, particularly petroleum and coal, although not gas, and that this reduction will mostly affect Soviet customers who do not have long-term contracts. This should mean that the East European customers will continue to receive their allocation as will those who are engaged in joint venture projects with very long pay-back periods. Such a policy satisfies not only the general tendency to conserve non-renewable raw materials where possible, but some strong Russian nationalist sentiments.

Resentment is particularly widespread when, because of the need to export, domestic consumption is affected. The sharp increase in the export of petroleum to reduce the trade deficit is the best example of how the export market has come before domestic needs. The sharp jump in exports occurred in 1975 when shipments rose by 12 percent (18 percent to OECD countries) and in 1976 when they increased by 15 percent (29 percent to the OECD). The impact on the growth of domestic consumption was acute. Whereas until 1974 domestic consumption never increased less than 7 percent a year, in 1975 it only increased by 5.8 percent. That was less than 7 percent increase in production but still large enough to be accommodated without too much difficulty. However, in 1976, domestic consumption increased by only 2.9 percent and in 1977, by 3.6 percent to 4.7 percent. In both instances there were reports of shortages of gasoline that seemed to transcend the usual complaints of inept planning procedures.[39] Not only can such diversions cause inconvenience among those fortunate to have an automobile in the Soviet Union, but it can also have a direct impact on economic growth. Undoubtedly this shortage of petroleum has contributed at least in part to the recent decrease in Soviet economic growth rates.

Reacting to a variety of such developments, some in the Soviet Union have warned about the danger of too much interchange with the West. Some even go so far as to seek a cessation of most, if not all, trading relationships. For those familiar with Russian history, much of the present debate will seem like nothing more than a continuation of the old argument between the Slavophiles and the Westernizers. The Slavophiles of the 19th century urged that Russia turn its back on the West. Failure to do so, they argued, would open Russia's borders not only to Western goods but Western ideas and ways of doing things. That would mean slums and strikes as well as degradation and disruption and ultimately social unrest. (Since Marxism was a product of the West, the Slavophiles may not have been entirely misguided.) Instead Russia with its great population and natural wealth would be better advised to follow its own path of development, they argued. From their point of view, Russia should adhere to the traditional Russian way of doing things, looking for guidance to such indigenous institutions as the Russian peasant and the Russian church. Russia should evolve in its own way with its own timing.

The modern-day version of the debate is most eloquently reflected in exchanges between Alexander Solzhenitsyn and Andrei Sakharov. Obviously neither one can be considered an official spokesman for any-

[39] Sotsialisticheskaia industriia, Aug. 24, 1978, p. 1; Sept. 22, 1978, p. 1.

thing in the Soviet Union, but their views nonetheless find support throughout the Soviet system. Solzhenitzyn, in a letter dated September 5, 1973, reerected the banner of the Slavophiles. He urged Soviet leaders to turn their backs on the outside world and concentrate on internal Soviet development. He called for an end to the stress on rapid industralization and urged a halt to further sales to the West of Russia's natural resources, such as Siberian natural gas, oil, and timber. As he put it: "We a great industrial superpower behave like the most backward country, by inviting foreigners to dig our earth and then offer them in exchange our priceless treasure—Siberian natural gas." In fact, he wants "A Russia first" policy of "lets have our raw material patrimony for future Russian generations." The raw materials will always be valuable, but the Western technology will soon become obsolete. Why give up something timeless and valuable for something empheral. In response, Sakharov argued that such a policy would be isolationist. As Sakharov put it: "Our country cannot exist in economic and scientific isolation without world trade, including trade in the country's natural resources or divorced from the world scientific technical progress—a condition that holds not only danger, but at the same time the only real chance of saving mankind."[40]

Besides Sakharov and Solzhenitzyn there are others reflecting the same clash of opinions who represent a more official point of view. In an extreme instance, Professor K. Suvorov in his request for economic independence of the USSR seemed to go beyond urging economic autarky for the CMEA, to a return to Stalin's version of socialism in one country.[41] He even cited Stalin as the originator of such an idea. The reference to Stalin was thoughtfully omitted in an otherwise fairly complete report of the article in *Soviet News* (the news bulletin of the Soviet Embassy in London.)[42] As Suvorov saw it, Stalin wanted the Soviet Union 'to steer the course towards the country's industrialization, the development of production of the means of production, and the formation of reserves for economic maneuvering" so as to ensure the Soviet Union's economic independence from the world's capitalist economy and achieve the complete triumph of socialism. This "industrialization of the USSR would insure the economic independence of the country and the ousting of capitalist elements from all the sectors of the national economy, consolidate the Soviet Union's economic and defense potential and strengthen friendship among the peoples." This policy was opposed by those who seemed undisturbed that the country would continue to be dependent on "the world's capitalist system."

Without taking such an extreme stand, there are others who nonetheless worry that the Soviet Union may be overexploiting its natural resources and wealth and that foreigners may be benefitting at the expense of future Russians. The emphasis on future generations is a recurrent theme by both politicians and economists.[43] Even those who accept the need to exploit Soviet raw materials because they want Western technology warn that such a policy is not always as simple as it seems and that it necessitates ever increasing expenses because of the need to go off further into the North and the East.[44]

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[40] New York Times, Apr. 15, 1974, p. 1; The New York Review of Books, Jan. 13, 1974. pp. 3–4.
[41] Pravda, Dec. 18, 1975, p. 2.
[42] Soviet News, Jan. 13, 1976, p. 15.
[43] Soviet News, July 15, 1975, p. 242; Iakovetz, op. cit., p. 77.
[44] Iu. Iakovets, "Dvizhenie tsen minerali'nogo syr'ia," Voprosy ekonomiki, June 1975, p. 3.

There is even some reason to believe that the debate extends into the Politbureau itself. Of course, there is a danger in placing too much emphasis on the slightly different utterances made one day by Party Secretary Brezhnev and those made by Prime Minister Kosygin a few days later. Nonetheless, on October 1974 Brezhnev is reported to have said "The natural resources of our country allow us to look to the future without danger. To make a long story short, our country is a country with uncounted riches and inexhaustible opportunities. It is our job to use these riches and opportunities properly and economically." [45]

In contrast, three weeks later, Kosygin seemed to view the situation in a different perspective. As he put it when covering the same subject. "Our country is provided with everything necessary so that the Soviet economy can develop dynamically . . . Our resources are great. But they are not inexhaustible. They belong not only to the present but to the future generation of Soviet people. Therefore it is our task to use them intelligently, carefully and in the most rationale way possible so that each kilogram of fuel, metal, cement, cotton, fertilizer, synthetic material, so that all of these serve the Socialist economy as effectively as the most advanced raw material technology permits.[46]

Even more fascinating it was not too long before Brezhnev changed his attitude and came around to the realization that more care was required in the exploitation of raw materials. "The demand of the country for energy and raw materials grows increasingly and therefore production becomes all the more costly. Consequently, if we are to avoid extraordinary increase in capital investment, it is necessary to use raw materials more effectively." [47]

Of course it is never clear if the leaders of the Soviet Union ever pay attention to or even care what one another says. But if they do, or if they read Pravda, they can not help but notice the sharp difference in attitudes toward the use of raw materials.

Finally those who justify the continuation of raw material exports sometimes adopt a novel rationalization. A. A. Trofimuk, Deputy Director of the Siberian section of the Soviet Academy of Sciences urged an even faster exploitation of oil and gas.[48] He is concerned that it is only a matter of time before new energy substitutes are found. Therefore the Soviet Union had better use its reserves now before they become valueless.

Sooner or later the Soviets will deplete their raw material deposits. Notwithstanding the Bolshevik Revolution, this holds for the Soviet Union as well as everybody else. But given the problems the Soviet Union has had in converting its now massive but still unsophisticated industry to world-wide standards, it is unlikely that the Soviet quest for advanced technology from outside its borders will soon abate. And since it is unable to pay for this technology with highly fabricated goods, in all likelihood the Soviet Union will have to continue to rely on the exportation of relatively primitive raw materials and semi-fabricated products.

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[45] Pravda, Oct. 12, 1974, p. 2.
[46] Pravda, Nov. 3, 1974, p. 2.
[47] Sotsialisticheskaia industriia, Mar. 24, 1978, p. 1.
[48] Leslie Dienes, "The Soviet Union: An Energy Crunch Ahead?" Problems of Communism, September–December 1977, p.

THE SOVIET ENERGY POLICY

(By Leslie Dienes)

CONTENTS

Introduction

The priority of basic heavy industries continues to be the core of Soviet development strategy, reaffirmed again in the 10th Five Year Plan. The rapid expansion of the nation's mineral resource base, particularly for fuels and energy, constitutes á sine qua non of this economic policy. At the same time, a looming manpower shortage and sluggish productivity gains throughout the economy seem to have convinced Soviet leaders of the urgency of faster technological advance fostered through expanding trade with the West. The function of Western technology in this process is inextricably linked with the development of the country's vast but increasingly expensive fuel reserves, vital for both the domestic economy and for hard currency earnings.

As the world at large, Soviet planners relied on hydrocarbons for the great bulk of all energy increments for more than two decades. Since 1955, eighty-five percent of all growth in aggregate Soviet energy production, including that from hydro and nuclear power, was accounted for by crude oil and natural gas.[1] Such a radical shift in the fuel mix has helped to modernize the economy through more efficient heat capture, locomotive power, reduced handling charges and far greater flexibility in chemical synthesis. For many years now, hydrocarbons have also financed a large share of Western technology imports, providing from two-fifths to one-half of all hard currency ex-

[1] Narodnoe khoziaistvo SSSR (henceforth Nar. khoz. SSSR) za 60 let (Moscow, 1977), pp. 83 and 204 and Elektricheskie stantsii, No. 8, 1977, p. 3.

port in the last few years.[2] Until recently, petroleum received most of the emphasis domestically, while thoroughly dominating trade in energy products, but a better balance between the two fuels is now being reached.

This hydrocarbon-dominated energy strategy, combined with favorable geology, has made the USSR the world's largest oil producer and second largest gas producer, with Soviet gas output clearly destined to rank first by the mid-eighties. However, the overwhelming reliance on these two fuels for energy increments and the pressure to expand output rapidly have created severe problems for the future. These problems have been well publicized of late, particularly with respect to the oil industry. The discovery of new petroleum reserves has failed to keep up with the growing volume of production and the forced-draft techniques used by the Russians tend to accelerate the depletion of reservoirs, while creating serious production problems as swiftly growing volumes of water must be lifted to recover the oil and the fields are re-drilled to replace flooded wells. Analysts at the US CIA have predicted and continue to stand by their prediction that Soviet petroleum output will peak by the early 1980's, then begin a long, though not necessarily lasting, decline.[3]

Soviet planners, while admitting to serious problems, are apparently confident that they can avoid a downturn in domestic oil output, while projecting continued rapid growth for their gas industry. But they concede that economies are needed because hydrocarbons, particularly petroleum, are too valuable to be burned under boilers for the production of steam and electricity. In an effort to conserve these resources and to make more oil available for petrochemicals and export (taking advantage of high world prices), the planners have proclaimed a new energy policy that would reduce the role of oil as power station and industrial fuel and give more attention to the use of coal, especially that of cheap strip-mined lignites. Concurrently, they push to accelerate the pace of nuclear plant construction and press with the development of hydropower. They also appear to look to the Soviet Union's vast natural gas reserves to help reduce the domestic requirements for petroleum, permitting its continued export, but increasingly also to earn valuable foreign exchange from the sale of gas as well.

In the USSR, as elsewhere, energy is used not in an abstract fashion but in a concrete world of existing equipment and specific technological applications with definite thermodynamic characteristics. It is also consumed in concrete geographic space and, except for some mobile machines, in a locationally concentrated manner. Energy demand, therefore, is subject to pronounced inertia both with respect to functional-technological uses and, still more, to geographic markets. Energy production is similarly specific and particular, both in its various primary forms (raw fuels, hydro and nuclear power) and in its location. However, the different primary forms in which energy is produced are not uniformly applicable and/or efficient in the diverse

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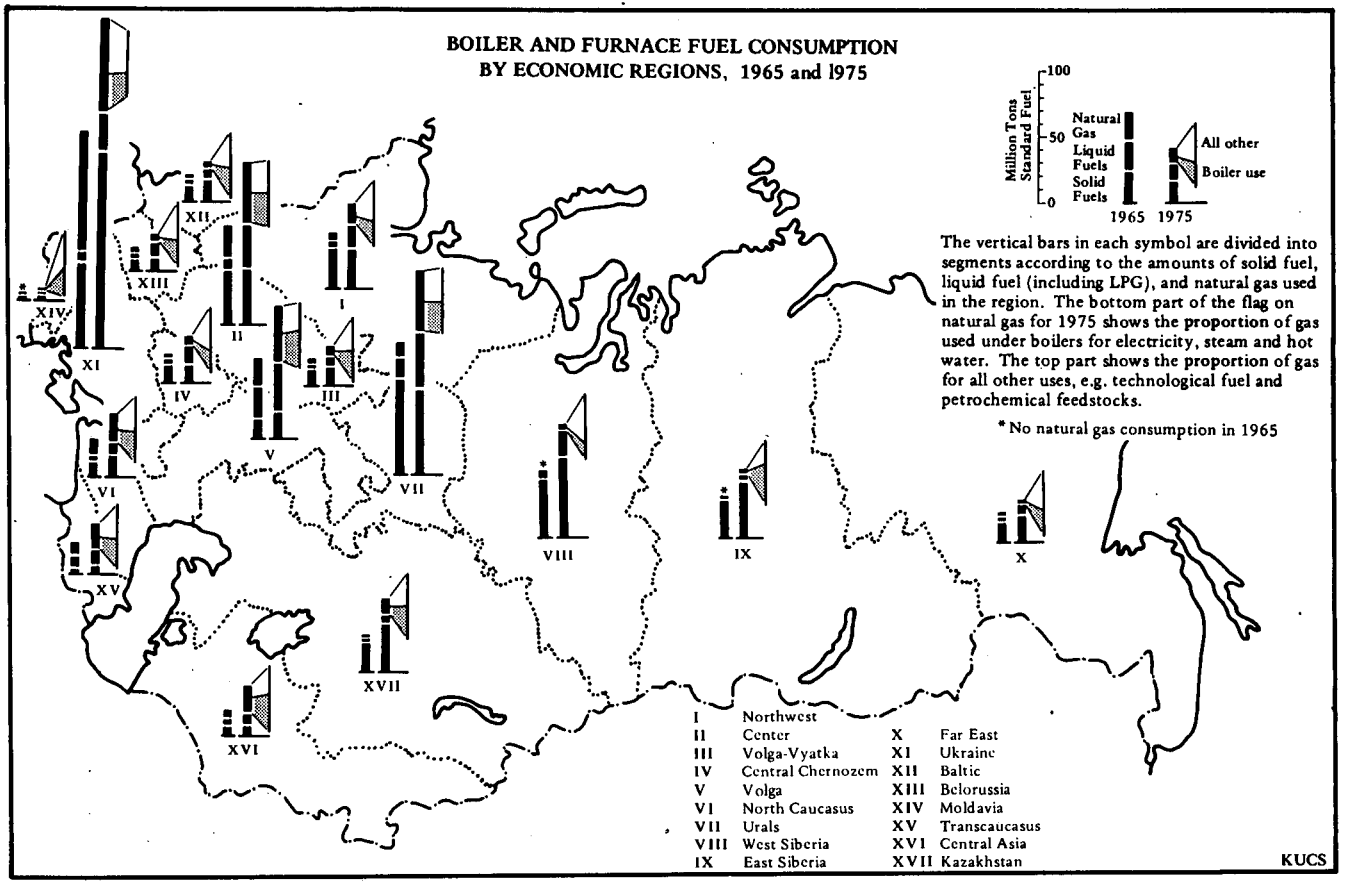
[2] Allen J. Lenz and Hedija Kravalis, "Soviet/EE Hard Currency Export Capabilities," Office of East-West Policy and Planning, Bureau of East-West Trade, U.S. Department of Commerce, October 1978.

[3] U.S., CIA, The Soviet Economy in 1976–77 and Outlook for 1978 (ER78–10512, August 1978), pp. 4–7 and 17; A Discussion Paper on Soviet Petroleum Production, June 1977; Prospects for Soviet Oil Production (ER77–10270, April 1977); and Prospects for Soviet Oil Production: A Supplementary Analysis (ER77–10425, July 1977).

technological processes, and they are seldom available near the geographic markets where they are most wanted and where they yield the greatest benefit. Energy policy decisions thus involve the meeting of geographically defined demand in the requisite forms and processes with available but strongly localized resources at acceptable monetary, social-environmental and political costs. The limits of what is acceptable and the mix of monetary and non-monetary costs in the USSR today (as in earlier periods) may indeed be particular to the Soviet system and determined by its leadership. It is clear, however, that the existing functional-technological structure of energy use and its geographic context are mostly the result of neutral technological trends and climatic-physiographic realities, though influenced by strategic and ideological decisions of the past. For today's leaders, they are exogenously determined and change only in a very gradual fashion, roughly in accordance with global patterns.


BOILER AND FURNACE FUEL CONSUMPTION
BY ECONOMIC REGIONS, 1965 and 1975
Million Tons Standard Fuel
100
50
0
Natural Gas
Liquid Fuels
Solid Fuels
All other
Boiler use
1965 1975
The vertical bars in each symbol are divided into segments according to the amounts of solid fuel, liquid fuel (including LPG), and natural gas used in the region. The bottom part of the flag on natural gas for 1975 shows the proportion of gas used under boilers for electricity, steam and hot water. The top part shows the proportion of gas for all other uses, e.g. technological fuel and petrochemical feedstocks.
* No natural gas consumption in 1965
I Northwest
II Center
III Volga-Vyatka
IV Central Chernozem
V Volga
VI North Caucasus
VII Urals
VIII West Siberia
IX East Siberia
X Far East
XI Ukraine
XII Baltic
XIII Belorussia
XIV Moldavia
XV Transcaucasus
XVI Central Asia
XVII Kazakhstan
KUCS

SOURCES FOR MAP

For 1965, the regional totals and the consumption of natural gas are taken from VINITI, Razrabotka neftianykh i gazovykh mestorozhdenii, Vol. 4 (Moscow, 1972), pp. 44–45. The 1975 regional totals estimated from aggregate Soviet consumption and the regional breakdown for 1970 as given in *Ibid.* The shares for the different fuels in individual regions are approximate. They were laboriously derived and pieced together from diverse Soviet sources. The tables and derivation for 1965, 1970 and 1975 may be obtained from the author.

The Functional-Technological Structure of Energy Consumption

In a modern economy, primary resources pass through complex stages of inter-industry processing and transaction to satisfy final demand. Little of total resource inputs today pass to consumers in an unprocessed form. Energy is no exception. In the course of development, primary energy resources in the USSR, too, are increasingly refined and transformed. The primary energy branches provide the flows of crude oil, natural gas, coal and other solid fuels, hydroelectric power and uranium ore to the two processing segments: to fuel-refining factories and to electric power and boiler plants. The former refines and upgrades raw fuels into petroleum products, coke and briquettes; the latter transforms both the raw and some of the refined fuels into electric power, steam and hot water. While some raw fuels and, of course, hydro and nuclear power still flow directly to the rest of the economy and also comprise the bulk of energy exports, about 80 percent of primary energy resources today are refined or are transformed into more usable and/or valuable forms.[4] Not only has that multiplied the economic utility of energy products, while providing environmental, hygenic and other benefits, but also has contributed to a significant improvement in the energy efficiency (i.e. energy input—utilization ratio) of end use equipment and installations.

Boiler Use: Production of Electricity, Steam, and Hot Water

The rapid growth in the share of aggregate energy used via electricity steam and hot water has been the most striking technological trend in the Soviet energy economy over the past few decades. Correspondingly, there occurred a sharp decline in the share of fuels used directly in consumer installations (Table 1). This was particularly true if one excepts energy which runs mobile machines, where direct consumption of fuel by the internal combustion engine is still dominant. Direct use of primary energy decreased from over 80 percent of the total in 1930 and more than 70 percent even in 1950 to less than one-half today. For stationary consumers, that share is down to about two-fifths, the rest being consumed via electricity, steam and hot water, with a few percent lost in transport. (Table 1 excludes non-energy uses and exports.)

Virtually all growth in energy demand by low and medium temperature processes,[4a] for example, has been satisfied by steam and hot water,

[4] P. S. Neporozhnii et al., "Fuel and Power Economy of the Soviet Union at the Current Stage . . . ," Ninth World Energy Conference. Transactions (Detroit, 1974), vol. II, p. 149.

[4a] Low temperature processes involve the use of heat below the boiling point of water (100° C). Medium temperature processes range up to and over 300° C, in which range the heat can be delivered by steam at moderate pressure. The upper limit is not clearly defined, but above 300° C the pressure soon becomes unacceptably high. For example, vapor pressure reaches only 16 atmosphere at 200° C but over 150 atmosphere at 340° C.

with an efficiency of heat transfer of 90 percent.[5] Since 1950, the quantity of fuels burned directly in small inefficient installations, and at a huge expense of labor time, declined somewhat and their share dropped drastically (Table 1). Soviet specialists expect this trend to continue, with the stated policy to further increase the centralization of heat supply and to drastically reduce the need for small heating devices, such as furnaces for individual apartments, commercial buildings and small industrial plants. The USSR today is the world leader in cogeneration, the utilization of heat produced by electric station. In 1975, dual-purpose turbines represented about 37 percent of all thermal generating capacity in the country.[6] One-half of all heat supply to industry and 27 percent to the residential-municipal economy of Soviet cities was furnished by such equipment.[7] So far electricity has been

TABLE 1.—CONSUMPTION OF PRIMARY ENERGY RESOURCES BY FUNCTIONAL CATEGORIES (EXCLUDES NONENERGY USES)

[Consumption in millions of gicacalories]

	1930		1950		1960		1971		Projected (1990–95)
	Consumption	Percent of total[1]	Consumption	Percent of total[1]	Consumption	Percent of total[1]	Consumption	Percent of total[1]	percent of total[1]
Generation of electricity	67	5.6	319	11.5	745	15.7	1,655	20.1	29.
Generation of steam and hot water	112	9.3	400	14.4	845	17.9	1,840	22.4	30.0
Direct use of primary energy:	980	81.7	1,984	71.2	[2] 3,000	63.3	4,440	53.9	37.0
(a) For high temperature industrial processes (in furnaces, kilns, ovens, and related equipment)	172	14.3	618	22.2	[3] 1,080	22.8	1,815	22.1	14.5
(b) For medium- and low-temperature processes (space and water heating, cooking, etc.)	608	50.7	966	34.7	[3] 960	20.3	950	11.5	6.5
(c) For mobile machines and power tools	190	15.8	395	14.2	[4] 960	20.3	1,675	20.4	16.5
(d) For lighting	10	.9	5	.2					
Losses in transport	40	3.3	82	2.9	150	3.2	295	3.6	3.5
Total	1,199	100.0	2,785	100.0	4,740	100.0	8,230	100.0	100.0

[1] Percents may not add up because of rounding. All estimated figures rounded.
[2] Estimated by using the share given by M. A. Vilenskii, "Ekonomicheskie problemy elektrifikatsii SSSR" (Moscow: "Nauka," 1975), p. 14.
[3] Estimated from combined high temperature and medium-low temperature total. The slight rise in the share of high temperature processes between 1950 and 1960 and slight decline between 1960 and 1971 are plausible given the relatively heavier emphasis on metallurgy during the fifties.
[4] Estimated by using the share given by Vilenskii, op. cit., p. 17 for all fuel burning transport equipments and other mobile machines with internal combustion engines. The rise in that share between 1950 and 1960 and its stabilization during the sixties is, again, plausible. The rapid growth in demand by construction and agricultural machinery and heavy trucks coincided with the continued dominance of the very inefficient steam locomotive in railway haulage. During the sixties, the shift to diesel (and electric) traction helped to counteract the swift rise in fuel consumption by trucks, agricultural and construction machinery.

Source: 1930–71 from A. A. Beschinskii and Iu. M. Kogan, "Ekonomicheskie problemy elektrifikatsii" (Moscow: "Energiia," 1976), pp. 413–15. Projected breakdown from ibid., p. 23. The percentages given were recomputed to exclude projected nonenergy uses and exports but to include a 3.5-percent loss in transport.

[5] A. A. Beschinskii and Iu. M. Kogan, Ekonomicheskie problemy elektrifikatsii (Moscow: "Energiia,"), Prilozhenie 4, pp. 413–15.
[6] P. S. Neporozhnii, ed., Razvitie elektrifikatsii SSSR 1967–1977, (Moscow: "Energiia," 1977), p. 46.
[7] V. P. Korytnikov, ed., Rabota TETs v ob'edinennykh energosistemakh (Moscow: "Energiia," 1976), p. 21.

consumed chiefly in its most efficient applications for mechanical work (mostly in stationary motors but also in transport) and for lighting, but electrolytic processes are beginning to claim a significant share.[8]

The upgrading and conversion of primary energy sources and, still more, the shift to inherently more effective hydrocarbon fuels in primary supply, have greatly enhanced the energy efficiency of end-use apparatus. And this has more than compensated for the swift growth of conversion and transport losses and the rising share of thermodynamically less efficient high-temperature processes in total energy demand (Table 2). From 1950 to 1971, the utilized portion of gross energy consumption, the portion not squandered as waste heat and lost during transport and transmission, advanced from a little less than 28 percent to almost 38 percent and stands about 40 percent today.[9]

The generation of electricity, steam and hot water comprise boiler demand and represents a pivotal part, perhaps the focus, of Soviet energy policy concerns. Boiler use constitutes the most flexible part of the energy sector where substitution among energy sources is technically and economically at its most feasible.[9a] Under boilers, solid fuels suffer a far smaller economic and technological disadvantage vis-a-vis natural gas and petroleum products than in the more specialized furnace uses,[9a] while the motor and naval markets, agricultural field operations and the bulk of chemical synthesis are technologically tied to petroleum. Recent calculations by scientists of the gas industry, for example, show that 1,000 cubic meters of gas burned under power station boilers yield a mere 3.6 rubles of economy against coal so used at the prevailing prices. By contrast, the same amount of gas versus coal produces an almost 24 ruble economy in cement kilns and over 64 rubles of saving in glass making, while in the blast furnace it saves more than 9 rubles worth of coke, always in short supply. Under smaller boilers, where pipelines exist, the relative advantage is somewhat greater but still very unsatisfactory,[10] but many such boilers do not have gas available to them because of the skeletal distributor network. In addition, fuel demand by boilers is, on the whole, subject to much greater seasonal oscillation than demand by furnaces, forges, ovens and kilns or that for petrochemical synthesis. This increases the problems and cost of gas supply and further lowers the relative effectiveness of hydrocarbons in the energy system as a whole.[11]

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[8] Beschinskii and Kogan, op. cit., pp. 413–15.

[9] Ibid., pp. 200 and 413–15.

[9a] In boiler use, fuels burned in a furnace apply their heat to a steam raising device, the boiler; in the more specialized equipments of industrial furnaces, ovens and kilns, heat from the combustion of fuels is applied directly to materials being processed (e.g. in the smelting of ores, the cement and ceramic industries, etc.).

[10] E. N. Ill'ina and L. D. Utkina, "Shkala effektivnosti primeneiia prirodnogo gaza," Gazovaia promyshlennost', No. 6, 1978, p. 28.

[11] E. N. Il'ina and L. D. Utkina, "O neravnomernosti gazopotrebleniia," Ekonomika gazovoi promyshlennosti, No. 9, 1978, pp. 8–15.

TABLE 2.—GROWTH OF ENERGY CONSUMPTION BY ENERGY FORMS AND TEMPERATURE CATEGORIES

[In percent. Base year equals 100]

	1930–50	1950–71
Mobile machines and power tools	232	443
Fuels (direct combustion)	208	424
Steam	324	145
Electricity	870	1,038
High temperature processes	363	311
Fuels (direct combustion)	359	294
Electricity	1,200	1,548
Low and medium temperature processes	177	201
Fuels (direct combustion)	169	98
Steam and hot water	494	763
Electricity	----	(1)
Utilized energy	254	401
All losses	225	255
Aggregate energy consumption	232	296

[1] Growth rate was infinite since no electricity was used for such processes in 1950. However, absolute consumption in 1971 amounted to the equivalent of a mere 15,000,000 gigacalories or 1,500 tons of oil.

Source: Computed from data in A. A. Beschinskii and Iu. M. Kogan, Ekonomicheskie problemy elektrifikatsii (Moscow: "Energiia," 1976), pp. 413 to 415.

Clearly, expect in some special instances, the burning of gas and oil for the generation of electricity, steam and hot water does not maximize the utility of these quality fuels even on the domestic market. The practice appears still more unfavorable when compared with the benefits obtained from the export of hydrocarbons, which became especially important since the drastic price changes of the early seventies. During 1977–78, a ton of crude earned almost $93 on the hard currency market and 1,000 cu. meters of gas in 1977 earned over $35. For East Europe the ruble price per ton of Soviet crude last year reached almost 60 (a 21.3 percent rise since 1977) and that of 1,000 cu. meters of gas between 35 and 40 and, in addition, these exports continue to be crucial for the political stability of the Soviet Block.[12]

The policy decision to reduce the role of hydrocarbons and particularly oil under boilers, and most of all in electric stations which account for three-fourths of all boiler demand, appears unassailable. Since 1960, the consumption of petroleum and natural gas by Soviet power stations soared, the former increasing some 11 times, the latter about 6 times, while the use of coal only by over 70 percent. By the early 1970's, hydrocarbons have come to dominate the fuel supply of Soviet electric stations, a position they never attained in the United States [13] where the wasteful and suboptimal allocation of these quality fuels has also become a policy issue.

In 1976, about 385 million standard tons of oil and gas (270 million tons of oil equivalent) was burned under boilers of all sorts, with about two-thirds of this in electric power plants alone. The production

[12] Crude prices charged for Western countries should follow the average OPEC price. U.S. CIA, Handbook of Economic Statistics, 1978 (ER 78–10365, 1978), p. 33. A further increase, in line with the latest OPEC action, should be expected in 1979. The price charged to COMECON states are reported in Petroleum Economist, March 1978, p. 125. Soviet prices for natural gas vary greatly among both West and East European countries. The average for 1977 can only be estimated since Soviet trade statistics for 1977 omit any reference to volume. The figures in the text assume 17 billion cu. meters of gas exports to hard currency markets and 15–16 billion to East Europe as estimated by Marshall Goldman. Vneshniaia torgovlia v 1976 godu and ____ v 1977 godu.

[13] Calculated from data in A. S. Pavlenko and A. M. Nekrasov, eds., Energetika SSSR v 1971–1975 godakh (Moscow: "Energiia." 1972, pp. 170–71 and A. M. Nekrasov and M. G. Pervukhin, eds., Energetika SSSR v 1976–1980 godakh (Moscow: "Energiia," 1977), pp. 149 and 151 and Statistical Abstract of the United States, 1975 (Washington, D.C.: U.S. Government Printing Office), p. 553.

of power, steam and hot water today claims more than a third of all petroleum and 55 percent of all natural gas used by the domestic economy, including self-consumption, losses and storage. The volume of hydrocarbons burned under boilers far exceeds that in all other stationary uses combined and is some three-fourths larger than Soviet oil and gas exports.[14]

The reasons for such an economically unsatisfactory allocation pattern are mainly geographical and, to a degree, technological as will be shown below. As a result, the pattern is not amenable to rapid modification despite the radical changes in the export value of hydrocarbons, mounting East European needs, and serious difficulties in the Soviet oil industry. Soviet leaders seem to recognize that fact. Only very modest changes are planned for the rest of the decade and, except for some vague projections in the early seventies which are of very doubtful validity today, no forecast beyond 1980 have been released concerning fuel requirements and availability either by broad functional categories (Table 1) or economic sectors. The present Five Year Plan calls for a stabilization in the relative proportions of both oil and gas in the generation of electric power, with a corresponding marginal increase in the share of coal (Table 3). These constant proportions, however, imply large absolute increments—more than 20 million natural tons of oil (about 30 million tons standard) and some 24 billion cu. meters of gas (close to 29 million tons standard).[15] Even with diminishing shares in the contribution of these quality fuels to power generation after 1980, their absolute growth in power station use cannot be arrested before mid-decade. Altogether, 31 new oil and gas-fired plants were to be started in the current Five Year Plan, most to be completed only in the 1980's, though some of these may, of course, be scrapped if oil supplies fail to expand as planned.[16]

TABLE 3.—SOVIET AND UNITED STATES FUEL STRUCTURES IN THERMAL ELECTRIC STATIONS

[In percent of total]

Fuels	Soviet fuel structure					United States fuel structure		
	1960	1965	1970	1975	1980 (forecast)	1960	1970	1975
Natural gas	12.3	25.6	26.0	25.7	25.1	26.0	30.0	20.8
Liquid fuels	7.5	12.8	22.5	28.8	28.0	7.6	14.7	20.0
Coal	70.9	54.6	46.1	41.3	42.5	66.4	55.4	59.3
Peat	7.0	4.5	3.1	2.0	2.6	0	0	0
Shale	1.0	1.5	1.7	1.7	1.4	0	0	0
Others	1.3	1.0	.6	.5	.4	(1)	(1)	(1)
Totals	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

[1] Negligible.

Note: United States percentages given for all stations, including nuclear and hydro. Percentages recomputed to include conventional thermal stations only. Totals may not add up to 100 percent because of rounding.

Sources: For Soviet Union, Energetika SSSR v. 1976–1980 godakh (Moscow: "Energiia," 1977), p. 151. For United States, Statistical Abstract of the United States, 1976, p. 553.

[14] Appendix Table and Vneshnaia torgovlia SSSR v 1976 godu, p. 26. In 1977, exports to the Communist world by volume seem to have increased by only 5 percent and to the non-Communist world by less than 10 percent, though complete data are unavailable. Petroleum Economist, September 1978, pp. 369–70.

[15] Computed from Nekrasov and Pervukhin, eds., op. cit., pp. 149 and 151. However, since the coal industry has already fallen almost 30 million tons behind schedule towards fulfilling the Plan, it is quite possible that even the share of hydrocarbons, or at least of gas, increased. Ekonomicheskaia gazeta, No. 4, 1977, p. 1 and No. 5, 1979. p. 1.

[16] T. Shabad, "News Notes," Soviet Geography: Reviews and Translation, December 1976, p. 717.

Information on the fuel need of boilers producing steam and hot water but no electricity is much more limited. They are a varied lot, comprising industrial and municipal boilers of all sizes for productive processes and heating and large district ones serving whole towns or parts of large cities. The vast majority, however, are very small, those furnishing heat to whole districts with an average capacity of 43 Gigacalories/hour comprising only 1 percent of the total.[17] In the mid 1970's, those boilers accounted for about 20 percent of all boiler fuel consumption,[18] with a full half of the supply being natural gas, the rest being divided between fuel oil and coal.[19]

Furnace Type Uses

Although high temperature industrial processes, in furnaces, ovens, kilns, etc., substantially increased their share in aggregate energy consumption, since 1950 that relative increase took place entirely on account of electricity. The direct use of fuels in industrial furnaces and related equipment grew at the same rate as total energy demand, and the proportion of such applications remained constant (Table 1). Soviet experts foresee a decrease in the share of fuels used in such apparatus in favor of electric power, as world technological trends point to a growing importance of electrolytic and electrochemical processes and the direct reduction of ores. Aside from the blast furnace, where coke is still an indispensable though proportionately diminishing fuel input, furnaces, forges, kilns, ovens depend primarily on petroleum products and gas the world over. Coal is unusable in many applications and where it can be and has been burned, such as cement and glass making, its economic disadvantage versus hydrocarbons is much greater than under boilers.

In the USSR, the consumption of non-coking coal in furnace-type equipment decreased since 1960 not only relatively but absolutely as well.[20] It is still used rather extensively in Siberia and Kazakhstan and perhaps to a degree in the Urals, but in all other regions, comprising two-thirds of the Soviet energy market, solid fuels have become almost totally eliminated from such applications.[21] Whatever Soviet perceptions may be about the adequacy of hydrocarbon re-

[17] V. Voropaeva and S. Litvak, "O toplivno-energeticheskom balance SSSR," Vestnik statistiki, No. 1, 1978, p. 6.

[18] In the latest statistical yearbook, total fuel-energy consumption for electricity steam, hot water and compressed air in 1975 is given as 613.5 million tons of standard fuel, out of which fossil fuels comprised 598 million tons. Consumption for compressed air, being less than one percent of aggregate fuel demand, cannot much exceed 10–13 million tons; all the rest must therefore be power station and other boiler use. The series given in the 1975 Nar. khoz. SSSR (p. 112) shows appreciably smaller amounts. An upward revision of aggregate boiler demand in 1976 evidently must have taken place. Since power stations in 1975 were claimed to consume 472.4 million standard tons of fuel, municipal, industrial and all other boilers must have burned some 110–115 million ons. Nar.khoz. SSSR za 60 let, p. 83; M. A. Vilenskii, Ekonomicheskie problemy elektrifikatsii SSSR (Moscow: "Nauka," 1975), pp. 18–19 and Nekrasov and Pervukhin, eds., op. cit., pp. 149 and 151.

[19] Il'ina and Utkina, op. cit., footnote 10.

[21] P. S. Neporozhnii et al., "Fuel and Power Economy of the Soviet Union," Ninth World tion of the different fuels for 1960 and 1975 by three functional categories. It is clear from the table that the category, "technological and other needs", overwhelmingly comprise demand by furnace type equipment and mobile machines. Approximate consumption by the latter can be separated according to data given for the transport and construction sectors. Voropaeva and Litvak, op. cit., pp. 8–9 and Robert W. Campbell, Soviet Fuel and Energy Balances (Santa Monica, Calif.: Rand Corporation, Research Report R–2257, 1979), esp. Table 2 and Table 5.

[21] P. S. Neporozhnii et al., "Fuel and Power Economy of the Soviet Union," Ninth World Energy Conference. Transactions 1974, vol. 2, p. 160.

sources or about oil and gas as hard currency earners, Soviet writers show no indication that a significant relative expansion of coal in such technological uses is viewed as a rational course for the future. Substitution of gas for oil, however, is quite feasible technologically and in the USSR may also be attractive economically as well, an issue which will be discussed later.

Mobile Machines, Power Tools, and Nonenergy Uses

Because of the low level of motorization, direct fuel demand by mobile machines in the USSR is relatively modest. Significantly, less than half of this consumption was accounted for by the transport sector, with agriculture and construction claiming the larger share.[22] The future development of this demand is subject to opposing influences. On the one hand, the expansion of Soviet automobile production has slowed down and the current Five Year Plan envisages only a 3.2 percent annual growth. Similarly, the cultivation and harvesting of field crops today is fairly highly mechanized and the emphasis with respect to field machinery has shifted from rapid growth of quantity, to improvement of quality, assortment and performance.[23] At the same time, the accelerated development of the resource rich but remote Siberian regions is raising consumption by transport and construction machinery while also increasing waste. It also boosts demand by stationary engines and power tools, such as pipeline compressors and pumps and diesel units for drilling in remote locations. Non-energy uses are not shown in Table 1 and information on them is very scanty. The bulk of this category comprises raw materials for the chemical industry, though bitumen, lubricants and a few other products are also included.

Even more than in furnace type applications, hydrocarbons entirely dominate direct fuel consumption in these technological categories. Except for some 10 million tons of coal, still used in the transport sector,[24] mobile demand for fuels is tied to petroleum, primarily to light products but also to middle distillates and fleet mazut (cf. Bunker C). Petroleum, with some natural gas, is also the fuel for stationary power tools not run by electricity. Similarly, the great bulk of non-energy uses is comprised of refinery products, LPG and pipeline gas and hydrocarbons will account for nearly all the increment over the coming years.

Mobile and chemical uses and a large part of furnace demand must be considered categorically non-substitutable in a modern economy while the rest of furnace-type applications nearly so. Very recent and hitherto unavailable Soviet data permit a great deal of refinement and detail about the consumption of hydrocarbons in the various technological categories in the second half of the 1970's and these are presented in the Appendix.

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[22] Precise shares cannot be calculated but this appears to be a good approximation. Data from Voropaeva and Litvak, op. cit., pp. 9–10 and Campbell, op. cit. (1979), Table 5 and Appendix.

[23] E. M. Rubenking, "The Soviet Tractor Industry: Progress and Problems," in U.S. Congress, Joint Economic Committee, Soviet Economy in a New Perspective (Washington: U.S. Government Printing Office, 1976), pp. 600–619.

[24] According to Voropaeva and Litvak, op. cit., p. 9, in 1975 1.5 percent of Soviet coal consumption (apparently on a calorific basis) was accounted for by the transport sector. This would work out to some 7 million tons standards and 10 million tons natural.

The technological areas listed in the first two subtotals should have a priority claim on the USSR's hydrocarbon resources since no alternative energy forms are in sight. Beyond some tightening of consumption norms, demand in these uses cannot be restricted, even in favor of exports, without affecting industrial growth rates. As the Appendix shows, the current Five Year Plan anticipates combined oil and gas requirements in these nonsubstitutable categories to grow from about 510 million standard tons equivalent in 1976, 45 percent of total hydrocarbon output, to about 670 million by 1980, still under half of the expected supply. By the mid-1980's, it may rise to between 800 and 850 million tons of standard fuel equivalent, depending on the rate aggregate consumption by the Soviet economy as a whole will grow. While very substantial, these requirements do not compromise continued exports of crude oil and products at present or even higher levels or stand in the way of a huge surge of gas exports. Nor do they put such strains on hydrocarbon supplies that the Soviet oil and gas industries could not easily surmont. The pressure on hydrocarbon supplies comes basically from boiler uses, where these quality fuels show the lowest opportunity costs and where their replacement by coal is technologically far more feasible and economically rational.

Geographic Problems of Allocation and Substitution

The Soviet energy problem is not merely a matter of producing enough energy to equal aggregate domestic and export requirement. It is also tied to disparities between the locus of current and foreseeable demand, on the one hand, and the location of available energy resources, on the other. The USSR must now furnish its own European provinces and, to a large extent, its East European partners, with fossil fuels, the incremental supplies of which must come entirely from Soviet Asia.[25] This geographic variable vastly complicates the allocation of energy among the different technological uses. Specifically, it will prevent any reduction in the share and still less in the quantities of hydrocarbons consumed as boiler fuels for perhaps another decade. Relief will come not from alternate fossil fuels but from the rapid growth of nuclear energy west of the Urals, whose rate of expansion and near-term suitability for steam as well as electricity, however, is subject to great uncertainties. The influence of geography will also continue on the relative proportions between oil and gas in the different Soviet regions both aggregately and in the various technological areas.

Almost four-fifths of all Soviet energy today is consumed in the European USSR (including the Urals and the Caucasus) and some 65 percent is consumed west of the Urals alone.[26] Despite restrictions on new energy-intensive activities in these provinces, demand in the European regions is expected to account for at least 70 percent of the by then much larger Soviet total even at the beginning of the 1990's. Today, however, the European USSR can satisfy only a little more

[25] See Chapters 3, 4, 5, and 9 in Leslie Dienes and Theodore Shabad, The Soviet Energy System: Resource Use and Policies (Washington, D.C.: V. H. Winston and Sons. Distributor John Wiley).

[26] See section, "The Geographic Pattern of Demand" in Chapter 2, ibid.

than half of its energy requirements from its own resources [27] and within a decade this share is anticipated to decline to two-fifths or even less.[28] Since 1975, aggregate production of fuels in the European provinces has been stationary and an absolute decline is probably unavoidable from now on.[29] Hence, the already massive flow of oil, gas and coal from the Asiatic parts of the country westward, whose annual volume increased 2.8 times from 1970 through 1975, must double during the current plan period (Table 4).

TABLE 4.—WESTWARD MOVEMENT OF FUEL FROM SOVIET ASIA

Fuel	Year		
	1970	1975	1980 (planned)
Oil (million tons)	15.0	113	242
Natural gas (billion cubic meters)	44.8	104	224
Coal (million tons)	65.8	96	120
Total (million tons of standard fuel)	130.0	361	708

Note: Although the source did not so specify, these data apparently include exports through western border points and ports of the Soviet Union.

Source: A. M. Nekrasov and M. G. Pervukhin, eds., Energetika SSSR v 1976–1980 godakh (Moscow: "Energiia," 1977, p. 148.

Not only is the gap between energy demand and local resources widening rapidly west of the Urals but the deficit has now engulfed virtually the entire European USSR. In this core area, which contains most of the Soviet population and economic output, it is no longer reasonable to speak of energy-rich and energy-deficit regions, since even the Ukraine has now become a massive net "importer" of fuel from provinces further east. The gap between demand and supply is actually widening faster in regions that used to enjoy a surplus (Ukraine, Caucasus and parts of the Volga Basin) than in those which have always had to struggle with a shortage of energy. In addition, the production cost of fuels, especially of oil and gas, in these parts of the country are also rising sharply as reserves dwindle in shallower reservoirs.[30] This is rapidly eliminating most of the very large economic rents earned by well-located western fields throughout the 1960's and early seventies, a distinctive feature which had played a crucial role in the regional pricing and spatial allocation of Soviet fuel supply in the recent past.[31] Energy costs in the European USSR, particularly

[27] Total Soviet fuel-energy consumption in 1977 is given as 1523.4 million tons of standard fuel. Nar. khoz. SSSR v. 1977 g., p. 43. (Apparently this excludes nuclear power, whose contribution, however, added only 4.2 million tons by the method primary electricity is entered in the energy balance in this official table.) The European U.S.S.R., including the Urals, therefore, consumed about 1,190 million tons in that year. Voropaeva and Litvak, op. cit., p. 4. Fuel and nuclear output and the regional breakdown of production in physical units is given Soviet Geography: Review and Translation, April 1978, pp. 273–85 and Dienes and Shabad, op. cit., Chapters 3–5 and page 153. Physical units converted to standard fuel equivalents.

[28] G. V. Ermakov et al., "Trends in the Development of the Nuclear Power Industry," Ninth World Energy Conference. Transaction. Detroit, 1974, vol. 5, p. 279.

[29] Dienes and Shabad, op. cit, Chapters 3, 4., and 9.

[30] See, inter alia, U.S., CIA, U.S.S.R.: Development of the Gas Industry (ER78–.0393, July 1978), pp. 31–34 and Neftianoe khoziaistvo, No. 5, 1977, p. 27; No. 7, 1977, pp. 5–8; No. 3, 1976, p. 25 and V. A. Starodubtseva, "Ekonomicheskaia effektivnost novoi tekhnologii v dobyche nefti." Candidate disseration. Gubkin Institute. Moscow, 1974, pp. 98–105.

[31] Robert W. Campbell, "Price, Rent and Decisionmaking: the Economic Reform in Soviet Oil and Gas Production," Jahrbuch der Wirtschaft Osteuropas, vol. 2, 1971, pp. 291–314 and Leslie Dienes, "Geographical Problems of Allocation in the Soviet Fuel Supply," Energy Policy, June 1973, pp. 3–20, especially pp. 6–16.

west of the Volga, are becoming rather uniform geographically; in addition, the difference *per calorific equivalent* between average fuel cost and marginal fuel cost has been sharply reduced in almost every province.[32]

Under these circumstances, differences in the growth rates of fuel consumption among the regions of the European USSR and, consequently, changes in their energy-intensiveness relative to each other have lost most of their significance. They have little impact on the total cost of meeting aggregate energy demand and on the feasible choices and inputs for various supply scenarios, particularly west of the River Volga. Incremental supplies of fuel and increasingly also Soviet exports must originate from remote provinces of the Asiatic USSR, whose environmental extremes, distances and lack of infrastructure limit expansion and transport plans and multiply the uncertainties both as to quantities and costs for *all* energy sources. Most clearly, location, transport costs and in some important cases the outright impossibility of haulage, severely restrict the opportunities of supplying truly large quantities of easily mined surface coal from the Asiatic to the European provinces for boiler use. As a result, Soviet energy prospects for the next decade and aggregate fuel costs to the economy as a whole will be controlled essentially by the speed and expense of Siberian development and progress in transport technology. The minor consequences on total energy costs arising from demand variations within the European USSR will be almost entirely submerged. By contrast the growth of fuel demand in the cis-Ural territories as a whole versus that in the different eastern regions will become even more decisive for Soviet energy policy. Unlike the European area, however, the Asiatic USSR, with less than 30 percent of Soviet fuel consumption, cannot be regarded as in any way homogeneous with respect to energy policy and prospect. This is explained by much greater geographic size, a wider range of its far more abundant resources and by the important fact that vast quantities of cheap but low grade coals can fuel the rapid expansion of demand in a number of regions but not some distance away.

The Georgraphic Imbalance and the Pressure on Hydrocarbons

This geographic imbalance has put and continues to put tremendous pressure on hydrocarbons and particularly on the oil industry. Siberian surface coals today mostly lie inaccessible for regions west of the Urals and will continue to remain so for at least another decade.[33] Consequently, the Russians have been forced to press production from their accessible oil and gas reservoirs at an injudicious rate and crash

[32] Precise figures cannot be given, but it is fairly certain that since the later sixties average costs per equivalent calories for boiler and furnace fuels have been rising faster than marginal costs. During the sixties, marginal fuel costs in the European U.S.S.R. were defined by the cost of expensive solid fuels in these provinces. Because of extensive mine closures and modernizations, these costs have not risen until now. Hydrocarbons transported from Asiatic regions may actually be more expensive today per calorific equivalent than coal west of the Urals. Yet the difference is unlikely to be large and the cost of Siberian gas, at least, will be subject to very large scale economies and should probably stabilize. By contrast, average fuel costs in all regions of the European U.S.S.R. have been rising rapidly during the past dozen years due to the exhaustion of proven and cheap to produce oil and gas reserves which held these costs down. In addition, during the 1970's the aging hydrocarbon fields of the western provinces have required very large investment to moderate their decline and delay their collapse.

[33] Dienes and Shabad, op. cit., Chapters 3, 4, and 9 and Leslie Dienes, "The Soviet Union: An Energy Crunch Ahead," Problems Of Communism, September–October 1977, pp. 41–60.

develop their West Siberian petroleum fields, since crude oil is relatively easily transportable. Similarly, it is this geographic discrepancy between the locus of energy consumption and incremental fuel supplies which lies behind the undesirably high share of hydrocarbons in boiler use (supra). For this reason also, any forecast in total demand by thermal electric plants and other boilers must be aggregated from regional projections which treat the European USSR and several eastern provinces separately, reflecting the dissimilar endowments and needs of these areas.

A close examination shows that in East Siberia, the Far East and most of Kazakhstan hydrocarbons will have to cover no more than 4–5 percent of total power station demand throughout the 1980's. In both West Siberia and the Urals, however, natural gas and, to a much smaller degree, oil will have to comprise 30–33 percent of all fuel consumption for the generation of electricity.[34] When these percentage requirements are combined with a little over 5 percent yearly growth rate of power demand in the Asiatic U.S.S.R. and allowance is made for the output of hydroelectric plants under construction and preparation, the conclusion emerges that the Urals and the Asian regions must retain over 40 million standard tons equivalent of their gas and oil resources for power stations each year by the early and mid 1980's.[35] Given the present relationship of fuel demand between electric stations and other boilers, the generation of electricity, steam and hot water for all purposes will surely require 55 million tons of standard fuel in the form of gas and oil products even in the east.

West of the Urals, the demand for gas and oil in boiler uses will be vastly greater. Already by 1975–1976, boiler fuel demand here exceeded 400 million standard tons with Soviet plans projecting close to 500 million tons by 1980.[36] Beyond the early 1980's, installation of new condensing stations (which nationwide account for somewhat over two-thirds of all thermal electricity production) are planned to cease throughout the cis-Volga provinces, with nuclear reactors and heat and power plants (TETsy) shouldering all growth in non-peak generating capacity. Allowing for the consequent substantial reduction in incremental fuel demand in electric stations and assuming a mere 4.5 percent annual growth in power consumption in the European regions and the Caucasus, total fuel demand for the generation of steam, electricity and hot water west of the Urals should still reach at least 570 million standard tons by the mid 1980's.[37]

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[34] In East Siberia, the Far East and most of Kazakhstan, demand for hydrocarbons will come mostly from peaking needs and isolated diesel units in remote areas. On the other hand, the accelerated and increasingly energy-intensive development of northern oil and gas fields, where coal is unavailable, is reducing the share of solid fuels in power stations of West Siberia and will continue to do so at least through part of the 1980's. The industrial complex of the Urals is rather easily accessible to both eastern oil and gas and coal from the Kuzbas and Ekibastuz. The latter, in particular, is playing an increasing role as electric station fuel in the region. However, much of this coal is needed to replace output from local deposits nearing exhaustion and will contribute only partially to growth. Nekrasov and Pervukhin, eds., op. cit., pp. 152–55 and Elektricheskie stantsii, No, 2, 1977, p. 6.

[35] No nuclear stations are operating or are planned for these regions, excepting a very small one in the remote north and a secret military plant believed to be in the Urals near Troitsk. Therefore, the difference between total power production and hydroelectric output must come from conventional thermal plants both today and in the foreseeable future. Detailed regional series for total electric power and hydroelectricity from Dienes and Shabad, op. cit., Chapters 5 and 7. Hydroelectric output potential through 1981 in the different Soviet regions is given in Nekrasov and Pervukhin, eds., op. cit., p. 129.

[36] Estimated from data in previous footnote and in Energeticheskoe stroitel'stvo, Nos. 11/12, 1976, pp. 19–20 and Vsesoiuznyi Institut Nauchnoi i Tekhnicheskoi Informatsii, Razrabotka neftianykh i gazovykh mestorozhdenii, Tom 4 (Moscow, 1972), pp. 44–45.

[37] Past and present distribution of capacity and output among the different types of electric stations, including TETsy and condensing plants and the 1980 Plan are presented in Dienes and Shabad, op. cit., Chapter 7, Table 44.

Only a fraction of this demand, ranging from 30 to 35 percent, can possibly be satisfied by solid fuels in the foreseeable future. Today, the provinces west of the Urals have available no more than 190 million standard tons of solid fuels annually for non-coking purposes, even including state furnished firewood and the shipment of coal from the Asiatic USSR. No more than 250 million standard tons can be provided under the best of circumstances five–six years from now.[38] And both today and through much of the eighties, some of these fuels will have to be assigned to the household-commercial economy and to non-boiler uses in other sectors.

Few existing boilers, of course, could switch to coal even if supplies were available, since the move would require a vast and costly effort of plant reconstruction for which Soviet industry is clearly unprepared. In addition, about one third of Soviet boiler demand in 1975, and a probably larger share in the European USSR, is accounted for by power stations practicing cogeneration (and thus located primarily in large and medium-sized cities) and by district and municipal boilers furnishing heat to urban neighborhoods not reached by cogenerating plants.[39] With industrial boilers, most of which are also found in large cities, the share rises close to one half.[40] In line with stated policy, these stations and boilers should continue to comprise perhaps 50 percent of the steadily growing steam raising capacity in the future. Environmental concern and frequently the lack of adequate storage space have led these consumers to an overwhelming dependence on gas and oil, particularly in the European provinces.[41] A Soviet authority, for example, states that hydrocarbons comprise almost 80 percent of all fuel supply to heat and power stations and industrial boilers. (For municipal boilers that dependence must be still higher).

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[38] See ibid., Chapter 4. Physical tons are converted to tons of standard fuel in making the projections.

Rail loading of eastern coal destined for regions west of the Urals is expected to rise from 31.3 million tons natural tons in 1975 to 45.7 million in 1980 (or about 27 million tons standard to 39 million). T. Shabad. "News Notes." Soviet Geography: Review and Translation, November 1977, p. 701. Much of this, however, will have to be coking coal, since the rapid expansion of an integrated iron and steel industry in the European RSFSR is proceeding largely on the basis of Kuzbas coal.

The construction of the Ekibastuz-Tambov 1500 kilovolt DC line, 1450 miles long, is supposed to start sometime in 1978. It is quite possible that even if the line is completed by 1985 the 6 million KW power capacity to supply it will not be. Kazakhstanskaia pravda, April 22, 1977. At any rate, the 40 billion KWH of power to be transmitted from Ekibastuz is equivalent to the shipment of 13 million standard tons of fuel, according to the planned heat rates of large thermal stations.

[39] Aggregate boiler demand from footnote 18. Fuel consumption by all TETsy in 1975 amounted to over 150 million tons of standard fuel. (Applying the heat rates per million Gcal at utility stations, which produce 82 percent of all heat by TETsy, yield 147.4 million tons standard. Non-utility TETsy, however, tend to be much smaller and have poorer heat rates) Elektricheskie stantsii, No. 1, 1975. p. 2 and No. 8, 1977. pp. 15 and 18 and Nar. khoz. SSSR za 60 let, p. 203. Municipal boilers of over 20 Gcal/hour produced 144 million Gcal, equivalent to 34 million tons of standard fuel at 60 percent boiler efficiency. (Voropaeva and Litvak, op. cit., p. 6.) Together with much smaller block boilers, of which no data exist, they must have consumed at least 40 million tons standard, since gas consumption alone by all municipal boilers amounted to 33 million tons standard in 1976 (Appendix).

[40] Industrial boilers are claimed to account for 37 percent of centralized low and medium temperature heat supply in 1975. Because of their predominantly small size, their efficiency must have been significantly lower than that of power station boilers. Voropaeva and Litvak, op. cit., p. 6.

[41] According to a Soviet report presented at the Tenth World Energy Conference in Istambul, the USSR's VNIPIEnergoprom claims that in densely built-up areas, the sulfur content of fuel cannot exceed 0.5 percent. In plants equipped with tall stacks and well removed from settlements, the permissible limit is 1.5 percent. Fuels with higher sulfur content can only be burned in power stations provided with a full array of cleansing apparatus. Reported in Energia es Atomtechnika (Budapest), Nos. 5–6, 1978, p. 208. In the European U.S.S.R., less than one percent of all coal reserves have a sulfur content of under 0.5 percent and only about 20 percent have sulfur content under 1.5 percent. More than half of all coal mined west of the Urals today contain sulfur in excess of 2.5 percent. The sulfur content of shales is also quite high, reaching about 1.5 percent. V.S Al'tshtuler, Novye processy gazifikatsii tverdogo topliva (Moscow: "Nedra," 1976), p. 191

According to him, in the 1976–1980 period alone, these consumers will need an *increment* of natural gas and petroleum amounting to 56 million tons of oil equivalent, and no relief is in sight until nuclear plants are able to assume a large part of urban heat supply.[42]

As the foregoing analysis intended to prove, the impending strain on oil and gas resources and the conflict between domestic and export needs will chiefly center on fuel supplies to power plants, industrial and municipal boilers. The problem of geography which, combined with technological constraints in cogeneration, prevents a greater use of coal is not amenable to speedy solution. Even in the longer term, it is a moot question whether an economically acceptable answer can be found for the transport problem of Siberian lignites and whether the Soviet leadership is willing to make the huge effort needed for the venture. The very poor performance of the country's coal industry in the current Five Year Plan is not encouraging.[43] In addition, the massive investment requirements, long lead times and very incomplete economic data have so far discouraged planners from a forceful commitment to solid fuels. Nor is there agreement today among the pro-coal forces concerning the most economic way of supplying massive amounts of coal from Siberia and Kazakhstan to the European provinces.[44] On the other hand, Robert Campbell suggests that investment and other cost escalations for West Siberian oil and gas (against the unrealistically optimistic estimates), combined with recent quantitative evidence about the very low opportunity cost of gas burned in power stations and consequent resistence of the practice by gas officials may generate much greater effort to solve the problems in the coal industry.[45] At any rate, what seems certain is that the requirement for oil and gas in boiler uses will continue to be determined primarily by the size of the shortage of soild fuels west of the Urals and by the rate Siberian and Kazakh coal fields can expand production and supply consumers in the European provinces. The ambitious nuclear program will also have an influence on that requirement, but over the next decade its impact will still be quite limited.

Gas versus Oil

In stationary processes substitution between the two hydrocarbons encounters no technological problems. In both boiler and furnace uses the required changes in equipment are simple and cheap. Many, perhaps even the majority, of plants are also designed to burn both fuels since, until recently, inadequate storage capacity for natural gas re-

[42] N. A. Dollezhal' and L. A. Melent'ev, "Rol' iadernoenergeticheskoi sistemy v toplivno-energeticheskom kompleksee SSSR," Vestnik AN SSSR, No. 1, 1977, p. 89. Another very recent source states unequivocally that in city TETsy even the share of oil and gas cannot diminish in the future. L. M. Tsirul'nikov et al., "K voprosu o vrednykh vybrosakh krupnykh TES," Teploenergetika, No. 4, 1978, p. 73.

[43] During the first 3 years of the current Five Year Plan, coal production increased by only 21 million physical tons or less the 3 percent. To reach even the lower end of the range given in the Plan Directives for 1980, production in 1979 and 1980 would have to grow by almost 70 million tons, clearly an impossible feat. Output in the Ukraine actually declined significantly. Ekonomicheskaia gazeta, No. 5, 1979, p. 1 and No. 4, 1977, p. 2; Pravda Ukrainy, Oct. 25, 1978 and Materialy XXV s"ezda KPSS (Moscow, 1976), p. 137.

[44] L. Dienes, op. cit. (1977), pp. 55–57. For a very recent view of a strongly pro-Siberian planner, who does not think it is economic to attempt shipment of East Siberian (Kansk-Achinsk) brown coal west of the Kuzbas. See Pravda, Aug. 25, 1978, p. 5.

[45] Comments by Robert W. Campbell in "Soviet Energy Policy and the Hydrocarbons; Comments and Rejoinder," Discussion Paper No. 7. Association of American Geographers, Project on Soviet Natural Resources in the World Economy (Syracuse University, Department of Geography, February 1979).

sulted in significant seasonal oscillation of supply. However, the impending exhaustion of most gas fields west of the Urals, making them available for seasonal storage, will largely eliminate this difficulty in the future. The long distance piping of crude oil costs less than one-fifth that of natural gas.[46] In addition, as of now, on an even calorific basis, crude oil exports to the West earn twice the currency of gas exports at present prices. If such price relationships were to continue, economic logic would work against a massive surge of gas deliveries for the foreign market beyond the existing long-term contracts (mostly barter deals for large diameter pipes) and for the growing use of gas to replace oil at home.[47]

The recent upsurge of Soviet oil export was certainly made possible by the already noticeable substitution of natural gas for residual fuel oil (*mazut*),[48] though a general tightening of fuel allocation and norms was also a factor. The geographic dimension strongly influences the replacement of oil by gas and the required proportions between the two hydrocarbons as well. Since natural gas is much more expensive to transport than crude oil (which is now refined in all major economic provinces), the chief gas producing provinces and those consumers relatively close to the principal Trans-Ural, Asian sources of supply, including imports from Iran and Afghanistan, enjoyed the largest quantities and highest shares of this fuel already in 1975. In addition, for political and environmental reasons, the Moscow area has long received preferential allocation of this clean, high quality energy source.[48a] However, only now are the vast reserves of North-West Siberia beginning to make a large impact on Soviet fuel supplies. Consequently, the locational advantage of the Ural and Volga regions with respect to these huge fields should favor a greatly increased role for gas in these provinces and also in the entire northern half of the Russian Plain. In the past few years, the Ural-Volga area already experienced a significant substitution of gas for fuel oil and natural gas also provided most of the increments in energy consumption as a whole. Soviet work on energy modelling and my own tentative studies all indicate that West Siberian gas yields greatest economic effect in the Urals and the northern half of the European USSR.[49] Indeed, all present and future gas pipelines from the vast fields of the Lower Ob' area are heading to these provinces.

Soviet energy planners and officials are aware of the opportunities offered by the much wider use of natural gas. Recent research by scientists of this industry, however, indicates a growing concern about the present technological pattern of allocation and particularly about the vast quantities of gas burned under boilers.[50] They may thus

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[46] A crude oil pipeline can transport more than five times as much calories as a gas pipeline of the same diameter, while pumping stations require less fuel than compressor stations. In addition, steel pipes for gas lines are subject to more stringent quality requirements than those for crude oil pipelines.

[47] Although prices charged in 1976 varied widely among West European nations, even the highest priced hard currency importer. Austria paid only $45.2 per 1000 cu. meters of Soviet gas, equivalent to $7.37 for a barrel of oil. Vneshniaia torgovlia SSSR v 1976 godu (Moscow: "Statistika," 1977), passim.

[48] S. A. Orudzhev, Gazovaia promyshlennost' po puti progressa (Moscow: "Nedra," 1976), p. 59 and V. I. Manaev, "Bashkirskaia ASSR: Kompleks segodnia i v budushchee," Ekonomika i organizatsiia promyshlennogo proizvodstva, No. 2 (1977), pp. 46–67.

[48a] See chart on p. 199.

[49] See section, "A Tentative Regional Model for Fuel Allocation," in Chapter 9, Dienes and Shabad, op. cit. For a recent Soviet work on this topic see A. A. Makarov and L. A. Melent'ev, Metody issledovaniia i optimizatsii energeticheskogo khoziaistva (Novosibirsk: "Nauka," 1973).

[50] Il'ina and Utkina, op. cit. in footnote 10 and op. cit. in footnote 11.

resist the further expansion of this fuel in the boiler market even when it substitutes for oil, demanding more coal for that purpose, and rather push to replace petroleum for export in smelting, heat treatment, petrochemicals, i.e. in furnace-type equipment and as raw material.[51]

Because transport and distribution account for much of the cost of gas and because the final distributor network is still skeletal, significant displacement of oil by gas inside the USSR is most probable in concentrated bulk uses. Planners will find such a switch for scattered, smaller consumers much more costly and in many cases physically impossible. Many industrial and smaller municipal boilers may find it difficult to change to gas from fuel oil, while in power stations, glass and cement plants, industrial furnaces, forges and other metal-treating devices (the latter, even when small, invariably located in big cities), the substitution of gas presents much less of a problem. As a corollary, this also suggests that hard coal could often be a more economical substitute for oil in dispersed uses than in concentrated ones. The market comprised by industrial boilers, many of which are scattered, and minor power stations will likely be shared by all three of the major fuels, though one of the latter may dominate in certain geographic regions.

In big thermal plants and large industrial boilers a determined effort to reduce the proportion and, eventually, the absolute volume of petroleum used should have some success. Coal and lignite, however, will not be available in sufficient quantities in most Soviet regions to substitute for the oil and provide the increment for many years, if at all. As already shown, for example, total boiler fuel demand in the European USSR will continue to exceed greatly the quantities of all solid fuels produced there and hauled across the Urals. The relief to petroleum must come as much from natural gas as from solid fuels, though even coal and gas combined will not be able to cover all boiler requirements before the latter part of the 1980's. Despite the low relative productivity of gas in electric stations, a significant absolute growth of gas consumption in thermal plants and large industrial boilers must be expected.

The present wide price difference between oil and gas on the Western export market is also unlikely to last very much longer. In addition, the increasingly apparent difficulties in the USSR petroleum industry and rising West European interest in Soviet gas both point to a rapid expansion in the importance of that commodity in Soviet foreign commerce. Most experts now believe that gas will become the leading hard currency earner by the mid 1980's, replacing oil in that role. According to one analyst, Soviet gas export to West Europe under contracts signed before 1977 should exceed 50 percent of Soviet oil imported by that region in calorific terms already in 1980.[52] East Europe, too, is evidently accepting increases in gas deliveries in place

[51] Indeed, the share of natural gas in the fuel supply of power stations have remained stable since the mid-1960s (Table 3) and in the fuel supply of large regional boilers increased from 37 percent to 42 percent during the first half of the 1970's. By contrast, the share of gas in the fuel mix of furnace type equipment almost doubled (from 17 percent to about 30 percent) between 1970 and 1975. It must be noted, however, that fuel consumption in power plants and other boilers has been growing much faster than in furnaces and related equipment (Table 1). I. P. Kurnosov et al., "Ispol'sovanie prirodnogo gaza v narodnom khoziaistve," Ekonomika gazovoi promyshlennosti, No. 11, 1977, pp. 30–31.

[52] U.S., CIA, USSR : Development of the Gas Industry, p. 22.

of most or all of the increments in petroleum supply beyond the present decade.

It is clear, however, that even when world prices for the two hydrocarbons are equalized, oil exports yield a higher return for the economy than gas exports as long as the delivered cost of gas through most of the European USSR remains below that of fuel oil per calorific unit. This had been the case during the entire 1960's but may not have been so by the mid seventies since the cost of gas was increasing far more rapidly than the cost of oil.[53] There are signs, however, that for the next few years at least and perhaps longer, the economics may again favor gas on the domestic market.[54] If this is so, the rising share of gas in Soviet exports to hard currency areas may also have non-economic motives, or at any rate motives impossible to quantify, i.e. anxiety about the adequacy of oil reserves, West Europe's desire for diversification of supply, perhaps Soviet perception of strategic dividends from greater interdependence that long-term gas exports entail. Natural gas today is also exported indirectly, being converted first into ammonia, in order to obtain a higher value per quantity foregone. Indirect exports via methanol could also naterialize in the future on a large scale. The USSR may very well have a greater comparative advantage this way than in the direct sale of gas, especially if Western equipment, paid by the chemicals produced, are installed.

Hydrocarbon Exports at the Expense of the Domestic Market: The Regional Impact

If petroleum and gas exports receive priority at the expense of domestic requirements, the major Soviet regions are likely to be unevenly affected. To gauge this impact, I ran several scenarios of a simple linear program (a standard MPS package for the spatial allocation of boiler and furnace fuels, with data and results described and analyzed in my larger work)[55] in which exports were treated as a priority up to the calorific total prevailing today. Concurrently, the lower limit of consumption in each of the eight major economic regions was treated as an unbounded variable. It became quite clear that the provinces west of the Volga would have to bear the brunt of any such restriction, because even if significant equipment changes towards coal were made, substitution possibilities would be minimal on account of the severe shortage of solid fuels. Eastern coals could reach the area in fairly small quantities only and at high economic penalty to the energy system as a whole. With the lower limit of

[53] In 1968 the average delivered cost of gas to major consuming centers in the European USSR was claimed to be only 3.4 rubles per ton of standard fuel equivalent. It stayed below 3.5 rubles in all economic regions west of the Urals, except the North-West, where it reached close to 6 rubles. The cost of the fuel oil per ton of standard fuel were more than double that in each region, again excepting the North-West. For neither of the two hydrocarbons did these costs include full finding costs, but these expenses were known to be larger for oil than for gas. A. E. Probst and Ia. A. Mazover, eds., Razvitie i razmeshchenie toplivnoi promyshlennosti (Moscow: "Nedra," 1975), p. 71 and N. V. Mel'nikov, Mineral'noe toplivo (Moscow: "Nedra," 1971), p. 183 and ibid. (footnote 52), pp. 14–17.

[54] Large scale economies associated with the full development of the enormous gas fields in North-West Siberia and the gradual improvement of infrastructure should moderate cost increases for gas at least until the mid eighties as compared to cost escalation of the previous 8–10 years, particularly since the large incremental investment made in mature fields west of the Urals should also come to an end very soon. By contrast, since the mid seventies it is the oil industry which is experiencing an exceptionally rapid rise in costs. Mature fields are requiring very heavy investment, the geographic distribution of reserves has sharply worsened and, in contrast to gas, it is smaller and smaller fields which must now provide the increment.

[55] Dienes and Shabad, op. cit.

regional demand as an unbounded variable, energy consumption in the model was cut back by the largest quantities in the northern half of the European Plain west of the Volga Valley. With further diversions from the domestic market for export, demand restrictions in the southern half of the European USSR also began to approach those in the northern, central and western parts of the European Soviet Union. Clearly, the energy situation in these formerly fuel-rich and exporting provinces is almost as serious as further north, a problem I have analyzed in detail elsewhere.[56] As the compact area west of the Volga and south of the 60° parallel still concentrates half of all Soviet industry and contains a disproportionately high share of the country's skilled labor, it is a moot point how far Soviet planners could reduce consumption here to give exports priority.

The third major region to be affected by such cut-backs (assuming a spatial optimum of fuel allocation is pursued) would be the Far East. Although the absolute volumes that could be diverted are small, the percentage relative to original demand is much higher even than in the northern half of the European USSR. The explanation lies not only in the high marginal cost of local coals, but also in the isolation and distance of the Far East from other centers of energy production. This makes the substitution of fuels (transported from other regions) for those exported extremely costly to the economy as a whole. BAM (Baykal-Amur Mainline), the huge railway now under construction, will improve matters, but will not invalidate this conclusion.

The Interaction of Energy Policy Issues and Regional Development

Decisions concerning the fuel-energy sector are closely intertwined with questions involving the spatial dimensions and structure of the Soviet economy as a whole. The striking geographic disparities in resource endowment and energy demand have momentous consequences for investment strategy and regional economic policy. Most signs indicate that these consequences will increase in importance in the future. For many years now, the Soviet energy industries have received some three-tenths of all productive capital investment in industry, i.e. not counting that for supporting infrastructure.[57] If investment in energy-utilization on the consumer end is included, the Soviet energy system probably claims a full half of all productive industrial investment and well over one-sixth of total investment in the national economy.[58] The potential and far reaching impact of major regional decisions concerning any of the fuel-energy industries is obvious both within the strongly interconnected energy system and on the economy at large. However, the full costs involved in the various spatial alternatives of industrial expansion, resource transfer and

[56] L. Dienes, "Basic Industries and Regional Economic Growth: the Soviet South," Tijdschrift voor Economische en Sociale Geografie (The Netherlands), No. 1, 1977, pp. 2–15 and Chapter 7 in I. S. Koropeckyj, ed., The Ukraine Within the U.S.S.R.: An Economic Balance Sheet (New York: Praeger, 1977).

[57] Nar. khoz. SSSR. Various issues.

[58] N. Feitel'man, "Aktual'nye problemy razvitiia toplivno-energeticheskogo kompleksa," Ekonomicheskie nauki, No. 4, 1976, p. 32 and E. A. Nitskevich, "Problemy sovershenstvovaniia toplivno-energeticheskogo balansa promyshlennosti," Promyshlennaia energetika, No. 8, 1976, pp. 30–31.

substitution have never been and probably cannot be assessed and Soviet scholars themselves have no difinite answers. The uncertainties, therefore, leave a wide field for ministerial and region pressure groups to push their pet projects and developmental schemes.

The available evidence suggests that Soviet planning organs have lately been engaged in a continuing crucial energy debate, but that no firm decision has yet been taken on long term energy policy. The crux of the debate concerns the adequacy, role, feasible and rational speed of development of hydrocarbon resources as against those of coal, particularly Siberian lignites. In his recent book, the author has examined this controversy within the context of the administration and planning of Soviet energy industries, though the literature is admittedly sketchy and permits only a brief assessment.[59]

Such controversy, of course, is not peculiar to the USSR but, together with the role of nuclear power, non-conventional energy sources and conservation, is also focal to the search for an energy policy elsewhere, not least in the United States. However, the much larger size, the comparatively unprospected and environmentally very harsh character of most of the Soviet land mass, combined with a relative backwardness of technology, all lead to a quite different preception of the energy problem in the USSR than is the case in Western countries. Even in the case of oil, where the proved reserve situation is the least satisfactory, the problem is not seen as an absolute shortage of available resources, still less as a problem of import dependency. Rather, the "energy problem" in the Soviet Union is viewed basically as a question of geographic obstacles, i.e. construction and transport bottlenecks, plus investment requirements and lead times, retarding expansion. Equally, it is regarded as a question of uncertainty concerning the best path of development for domestic and export needs in the face of increasingly difficult and costly technical-economic choices on the basis of very incomplete data. Soviet planners know that the exigencies facing the country a decade hence must be anticipated and confronted today or very soon. But they also know that once heavy commitment of capital and other resources to a certain line of expansion is underway, the decisions made will not be easy to reverse, badly uneconomic though they may turn out to be. It is therefore not surprising that the much heralded 15 Year Plan for 1976–1990, of which the fuel-energy economy was to form a cornerstone, has been seriously delayed. At the time of this writing, no comprehensive energy policy is available even in a rough skeletal form. The long-term plan itself has been renamed a general outline, with references to length of period and starting date deleted.[60]

In the last few years, Soviet economic planning has come to focus on the territorial-production complex, or its larger variant, the national-economic complex, as the most effective geographic unit of development de novo. Fully a dozen of the 15 or so territorial production complexes (TPC's) where development is now underway or is in an incipient stage are in the Asiatic USSR, with at least ten of them

[59] Dienes and Shabad, op. cit., ch. 10.
[60] T. Shabad, "News Notes," Soviet Geography: Review and Translation, November 1977, pp. 699–700.

in Siberia and adjoining northern Kazakhstan.[61] All but one or two of the TPC's now emerging in Soviet Asia are associated with the energy production cycle. Fuel and electric power production and a few giant energy intensive enterprises in close proximity (electrometallurgical, electrochemical, pulp and paper plants) form the backbone of these complexes. The remaining TPC's are based on the extraction and processing of copper, polymetallic and phosphoric minerals which are also heavy power consumers but whose location is oriented to raw material rather than power sources. Where oil and gas dominate the production complex, as in Tiumen' Oblast (West Siberian Lowland), the preponderance of the energy industries in the structure of the TPC is particularly striking. The mobility of these fuels compared to other energy forms generally results in agglomeration of associated consuming industries at great distance from the often isolated and harsh regions of hydrocarbon extraction. In 1973–1975, some two-thirds of all industrial fixed assets and almost one-half of industrial output in Tiumen'Oblast were accounted for by oil and gas extraction and the electric power capacity serving it.[62] Nor is it likely that this share will diminish significantly in the future with the further development of the production complex.[63]

By contrast, locationally associated consuming industries inevitably form a crucial part of the TPC's associated with the huge hydroelectric projects and lignite development in the Enisei-Angara-Baikal zone of southern Siberia and with the surface mining of low quality coal in northeast Kazakhstan. The long distance transmission and transport of these energy sources are technologically far more problematic and costly. Consequently, the close geographic association of vertically linked industries is imperative. In addition, the more favorable, if still harsh, natural environment, a better developed infrastructure and larger population are giving rise to a greater variety of supportive and more peripherally linked activities than in the primeval swamps of the West Siberian Plain. Throughout the 1960's, less than a third of all capital investment in the industrial sector of East Siberia went into the production of energy; the rest flowed into energy consuming and supporting industries. At the beginning of the seventies, energy production per se contributed only one-seventh of total industrial output compared to almost one-half in Tiumen' Oblast in 1975.[64] No quantitative data are available concerning the individual

[61] See, inter alia, Gertrude E. Schroeder, "Soviet Reigonal Development Policies in Perspective," paper prepared for the 1978 NATO Colloquium, The U.S.S.R. in the 1980's: Economic Growth and the Role of Foreign Trade. Brussels, 1978; A. T. Khrushchev et al., Novye promyshlennye kompleksy SSSR (Moscow: "Prosveshchenie," 1973) and Adresa Desiatoi Piatiletki (Moscow: "Molodaia Gvardiia,' 1976) and Victor L. Mote "Predictions and Realities in the Development of the Soviet Far East," Association of American Geographers, Discussion Paper No. 3, Project on Soviet Natural Resources in the World Economy (Syracuse University, 1978), pp. 29–42.

[62] Tiumenski Industrial'nyi Institut, Nauchnye trudy, Vypusk 43, Kompleksnye planirovanie na promyshlenykh predriiatiiakh (Tiumen, 1975).. p. 76 and G. P. Bogomiakov, "Tiumenskii kompleks i ego budushche," Ekonomika i organizatsiia promyshlennogo proizvodstva, No. 5, 1976, p. 7.

[63] The development of refinining and petrochemical capacities (and that of the wood processing industry, with almost no technological links to hydrocarbons), at the so thern limit of the West Siberian Plain should increase the importance of associated (and other) industries in the future. By that time, however, dry natural gas output from the northern half of the Plain will have accelerated very greatly. Most of the gas does and will continue to leave West Siberia immediately upon extraction.

[64] Akademiia nauk SSSR, Sibirskoe otdelenie, Institut ekonomiki, Mezhotraslevye sviazi i narodnokhoziaistvenye proportsii Vostochnoin Sibiri i Dal'nego Vostoka (Novosibirsk: "Nauka," 1974), p. 185. Bogomiakov, op. cit., p. 7 and Akademiia nauk SSSR, Sibirskoe otdelenie Ekonomicheskie problemy razvitiia Sibiri (Novosibirsk, 1974), p. 38.

production complexes in the Enisei-Baikal zone, but qualitative descriptions and schematic presentations indicate that they are destined to be more broadly developed and multifaceted than the TPC of Tiumen' Province.[65]

The scale and complexity of regional development in pioneer areas, remote from established centers of economic activity, have long been vexing and debated issues in Soviet literature. Linked to these issues are considerations regarding the speed of development, the nature and location of the supply bases and the choice of transport modes. Obviously, the more remote, unpopulated and environmentally rigorous a pioneer province may be, the more difficult and expensive it becomes to strive for a complex, multifaceted economic structure and the less likely is it to succeed. Similarly, the more pressing is the nation's need for a given resource or product of a remote region, the more likely is a crash attempt to make it available, a strategy which by definition, cannot result in balanced development and may preclude it even for the long run.

Thanks to its better climate, considerable agricultural land and the Trans-Siberian railway, the southern belt of Siberia is both more habitable, and, especially west of Lake Baikal, more accessible to the established centers of economic activity than regions farther north. In diminishing degree from west to east, the Ural-Baikal zone has already become an integral part of the vital economic triangle of the country, a part of the nation's ecumene. Vast though the natural riches of this zone may be, oil and gas so far have not been among them and the resources present have tended to be much more expensive and difficult to transport and/or require local use and processing. Since World War II, these resources, with the exception of grain from the Virgin Lands, also did not seem to appear quite as vital and indispensable to planners as hydrocarbons from the wilderness of the West Siberian Northland. For all these reasons, the development of the southern Siberian belt in recent decades has been proceeding in a relatively measured though deliberate fashion, largely free of crash programs and with some attention given to a degree of balance among economic activities, the creation of regional industries and the long term needs of a permanent population.

It is otherwise with the development of the central and northern zones of Siberia. Here the change in Soviet attitudes, strategies and methods has been clearly marked. Robert North, a Canadian scholar, who has examined the problem in depth, has found "that both the conditions for remote area development... and accepted criteria for evaluating them are coming closer to those in northern North America." The Soviet view is gradually shifting towards the prevalent opinion here, which is unenthusiastic towards complex development with large towns.[66] For the northern part of the West Siberian Plain, with its giant deposits of natural gas, the "tour-of-duty" method now holds great interest, whereby employees are flown in from southernly base cities to make-shift settlements for a predetermined period and

[65] Ekonomicheskie problemy razvitiia Sibiri (ibid.), pp. 144–147 and I. I. Belousov, Osnovy uchenila ob ekonomicheskom raionirovanii (Moscow: MGU, 1976), inset following page 168.

[66] Robert N. North, "Soviet Northern Development: The Case of N.W. Siberia," Soviet Studies, October 1972, pp. 171–199; reference on pages 198–199.

returned for rest and recreation before their next tour. However, even further south along the middle Ob', with larger settlements, serious shortcomings in the construction of housing and social infrastructure have resulted in an increasing emphasis on a highly capital intensive, automated and labor saving technology.[67] In addition, the pressure to produce hydrocarbons for the national and export markets has become so great and the size of these reserves so large that a crash exploitation of these resources alone was decided to be both justified and clearly necessary whatever other resources may or may not be utilized later on.

North's excellent study was published when the crash development of the more accessible oil fields of Tiumen' Oblast was already underway but the exploitation of the more northernly gas fields had barely begun. Similarly, the debate over complex, diversified versus narrow, exploitative development was still very vocal.

Since the time of that study, the swiftest possible development of the north Tiumen' gas fields has also become a national priority. The performance of the Soviet energy sector in the Tenth Five Year Plan, and for some years beyond 1980 as well, clearly hinges on hydrocarbons from Tiumen' Oblast, and on natural gas at least as much as on oil. At the same time, as the supply of manpower continues to tighten, the shift away from the strategy of complex development of remote areas appears to have accelerated. A recent source reveals that the traditional method of providing permanent residence for all employees and their families in the oil and gas industries, supporting industries and service activities would require a minimum increase of 600,000 in the urban population of Tiumen' Province by 1980.[68] Though such would still fall far short of complex development since it places almost exclusive emphasis on only two related resources, such a strategy is proving clearly unfeasible. The author suggests to add the expedition method to the tour-of-duty method on a significant scale. The former entails flying in workers to serve in the North from outside West Siberia altogether, from old oil and gas regions in the European USSR. The expedition method, now being implemented, would reduce the influx into the base cities of Tiumen' Oblast, where the infrastructure and social services are already strained well beyond capacity.[69] The more diversified development strategy with well-serviced, permanent cities near the new gas and oil fields still has its few defenders and may still be regarded as the socialist ideal.[70] It is clear, however, that demographic and geographic realities and the urgency of national energy needs have overtaken Soviet planners. As these strains increase, the likelihood that ideology and central planning will continue to sustain a developmental strategy for the Soviet North fundamentally different from that followed in the northlands of the West is diminishing every year.

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[67] Ibid., p. 197.

[68] A. Khaitun, "Sotsial'no-ekonomicheskie problemy osvoeniia neftianykh i gazovykh raionov strany," Planovoe khoziaistvo, No. 9, 1977, pp. 88–95.

[69] Ibid., pp. 186–189 and 197–198. The expedition method has now been adopted in the West Siberian oil industry on a large scale. Drillers flown in from the Tatar and Bashkir ASSR's, Kuibyshev and Saratov Oblasts are planned to sink 700,000 meters of wells in Tiumen Province in 1978. This amounts to one-tenth or more of all the planned meterage of drilling in the Tiumen oil industry for that year. Pravda, June 5, 1978, p. 2.

[70] Such as V. Perevedentsev, the noted demographer and sociologist, heard by the author at a public lecture in Moscow in late 1976.

Conclusion

Rational energy planning involves the balancing of economic and strategic interests, short term and long term gains and concerns in all societies for their own stability. The stability of the Soviet system and the power of those who run it is plainly the paramount goal of Moscow policy-makers. Economic strength and well-being, as determined by the leadership, however, are clearly perceived as an important fulcrum of system stability. The evidence is undisputable that in the USSR today the rationality of energy decisions fully embodies economic realities at home and abroad. In addition, the energy industries, with their relatively narrow range of products, restricted technical coefficients and locational constraints are subject to significant structural and technological convergence throughout the world.

Congruence With World Trends

Recent trends in the Soviet fuel-energy system have shown a general congruence with those of other countries at similar stages of development. It is true that Soviet planners were slow in appreciating the advantages of hydrocarbons and petrochemicals, that excessive fear of investment risks, structural conservatism and military needs prolonged the dominance of coal and iron. Most other parts of the world, however, were equally coal dominated until the 1950's and, when it came, the Soviet shift to hydrocarbons was purposeful and rapid. Until recently, petroleum received most of the emphasis and the natural gas industry suffered from considerable immaturity, but again Soviet experience here is hardly unique. In refinery activities and the use of petroleum, the structural needs of the economy prevailed over the philosophical dislike of burning oil for stationary uses, particularly under boilers. Refinery output in the Soviet Union has come to resemble that in Western Europe much more than that in the United States, and for similar reasons. The inadequacy and high cost of coal resources in the European USSR, the country's economic heart, resulted in a huge demand for heavy distillates as industrial and power station fuel.

The increasing global dependence on oil products throughout the 1960's, combined with the tightening of easily available supplies outside the Middle East, culminated in the dramatic actions of OPEC and the radical transformation of the world petroleum market. During the same period in the USSR, a corresponding rapid growth in the economy's dependence on easily accessible hydrocarbons, together with rising East European needs, also resulted in mounting pressure on supplies. Absolute increases of petroleum output during the second half of the 1960's failed to grow and declined significantly for gas. Yearly rates of increase dropped sharply for both fuels. The USSR extricated itself from that supply squeeze by the crash development of West Siberian oil and, a bit later, natural gas resources. Although the full cost and enormous efforts required to make these fuels available to the country's industrial heartland were seriously underestimated as was the lead time needed to develop the vast gas reserves, Soviet planners entered the 1970's with a more cautious attitude to-

wards their hydrocarbon riches. In particular, a perception of the increasing value and relative scarcity of petroleum when compared to other fuels was beginning to be shared by a growing number of specialists. The USSR also served notice on the COMECON countries that it would impose a ceiling on its oil deliveries to Eastern Europe. The quadrupling of world prices and the Arab embargo against the West dramatically reinforced already present but still tentative ideas about the change in the direction of Soviet energy development.

It may be said, therefore, that the radical transformation of the world energy market found the USSR more or less in step. High ranking officials began to call for the curtailment of the use of petroleum (and even gas) under boilers, the sharply accelerated development of surface coal deposits, nuclear power and the long heralded extra high voltage lines to bring Siberian power to the energy hungry European USSR. Hydrocarbons were to be devoted increasingly to technological uses and exported to earn hard currency, though the latter crucial role was seldom explicitly stated in published literature. Concurrently with all these, the Soviet press began to stress the theme of energy conservation in all areas of the economy.

Developments since the later sixties, however, clearly show that Soviet planners underestimated the difficulties encountered in the new energy era. In that, again, they have not been far out of step with the world at large. They have overestimated the speed at which the output of hydrocarbons from remote and/or inaccessible areas and strata can be expanded and delivered to centers of demand and have been excessively optimistic about the investment cost and construction effort required to exploit the reserves of Tiumen' Oblast. The planners have also been overconfident about the growth of proved reserves for oil and outside West Siberia about the growth of gas resources as well. Finally, they have seriously underrated the difficulties and the lead time needed to lessen the dependence on petroleum by restructuring the energy balance towards a greater role of coal and nuclear power.

Since the late sixties, the expected contribution of gas from northwest Siberia has been successively scaled down and the full development of these enormous fields pushed further into the future. Plans to replace exhausted oil and gas reserves west of the Urals, but even in Central Asia, by tapping deeper strata and offshore deposits, remained grossly underfulfilled. In 1970–75, for example, 63 percent of all exploratory drilling was allocated to the European USSR with very disappointing results.[71] West Siberian oil resources, still remote but better located and more transportable than Siberian gas, were indeed crash developed to compensate for both of these shortfalls. Such crash response and adjustment, however, only underscore earlier overoptimism and miscalculations. Attempts to accelerate coal production so far also have not born fruit. Three years through the Tenth Five Year Plan (1976–1980), the coal industry has fallen far short of its target and the long term problems it faces in accelerating output are proving very severe.[72] Finally, Soviet planners, too, are finding that nuclear power is no panacea, that its growth rate, while rapid, is slower

[71] Iu. I. Maksimov and Z. P. Tsimdina, Optimizatsiia razvitiia i razmeshchenila neftegazovoi promyshlennosti (Novosibirsk: "Nauka," 1977), pp. 58–59.)
[72] See footnotes 43 and 44.

than expected and its contribution to the energy balance will remain quite modest for the rest of the century.

Nor are Soviet planners finding it much easier than Western decisionmakers to effect a substitution of more abundant fuels for scarcer ones, at least in the short and medium term. The physical structure and design of fixed equipment, transport facilities and modes constrain both groups the same way. In particular, the shift towards a greater use of coal is proving to be still more difficult than in the United States. Even conservation so far is bringing only minor relief, despite the centralized chain of command which should make implementation easier than in Western countries. The sectors where demand can be limited by fiat without hurting production targets, namely households, private transportation and some services, are very small consumers. Soviet managers are insensitive to price and beyond some tightening of allocation norms, no ready instrument exists to save energy in the industrial and agricultural sectors.[73]

Specific Features of the Soviet "Energy Problem"

Having stressed that general developments in the Soviet energy economy have conformed to world trends, that the system shares certain universal problems, that the perceptions of Moscow planners concerning the role of different fuels are roughly congruent with global views, one must also emphasize that the "energy problem" for Moscow assumes substantially different contours than for Western powers, including the United States. In both total and individual conventional energy sources, the Soviet Union is endowed with fuel and hydroelectric potential much larger than any Western power. With the probable exception of Canada, this holds true on a per capita basis as well. Despite the energy intensive nature of Soviet industralization, the USSR has also exploited and depleted its potentials much less extensively than Western states, whose national territories are much smaller and where industralization began significantly earlier.

In this "resource vault," Soviet gas reserves assume a particularly critical role. Hydrocarbons are the most valued, most sought after sources of primary energy today; they are also the most chancy and exhaustible fuels, for which reserve additions often do not materialize and which are, therefore, very difficult to plan for. Moscow's massive reserves of gas in the proved and indicated categories thus represent a solid, central pillar of long term energy policy, clearly missing in West Europe and North America. The frequently touted large gas potentials remaining in the US and Canada are altogether less tangible; only a fraction of them may ever be transformed to the proved, recoverable category even with much higher prices. While in the USSR, location (northwest Siberia), distance and transport bottlenecks impose severe limitations on the annual increments of this fuel,

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[73] The 1978 annual plan notes that the five-year targets for saving fuels, electricity and metals are not being met. Val Zabijaka, Summary of the USSR Annual Plan for 1978 (Washington. D.C.: U.S. Department of Commerce. Overseas Business Reports, July 1978), p. 2.

One poignant example: The 1978 annual plan sets the task of economizing 6 million tons of standard fuel in all boiler and furnace uses and similar conservation targets characterized the plans of the previous two years. Yet in 1976, the Ministries of Ferrous Metallurgy and Construction Materials alone consumed 600,000 tons standard fuel more than was allotted to them in the plan. Ekonomicheskaia gazeta, No. 52, 1977, p. 2.

these supply increments today are far larger than anywhere else in the world. The size of proved reserves and steady improvements in transport technology will guarantee that they will remain so probably for the rest of the century. An expanding market in West Europe also insures a long term and increasing role for natural gas in Moscow's export plans. The growing importance of gas cannot fully compensate for possible serious shortfalls in the output of other fuels, particularly oil. Natural gas, however, is clearly the ace in Soviet energy plans and provides a partial but critical cushion for the uncertainties faced by Soviet planners with respect to other sources of supply.

In facing such a version of the "energy problem," Soviet energy planners operate in a political-institutional environment different from that found in Western countries. They also operate with a technology factor that makes their position quite distinct and presents them with a political dilemma peculiar to closed societies. On balance, the first probably expedites the development of energy potential, the second retards expansion and is likely to do so for a number of years yet.

Decisionmakers in the Soviet energy system operate quite free from popular pressures and public concerns. The serious policy struggles that are clearly present in the USSR take place within the ministerial arrangement, among the administrative bodies responsible for energy development. Public awareness and articulation of social and environmental issues are subdued. When they surface, they most often do so after the fact, after project completion, when remedial action may be taken.[74] Nor does public attitude towards energy producers and the visceral issues of prices, subsidies and proper profit margins have any influence on resource development and policy in the institutional environment of the USSR. Prices and profits there are basically accounting devices, not used as direct instruments of investment and labor allocation. Over the past decade energy prices have tended to express relative scarcities and marginal utility tolerably well and in most ways have been more sound economically than those in the US.[75] But apart from retail prices for the small household-communal sector, where they have an impact on conservation, they have no role in energy policy or the direction and proportion of resource development.

If, for better or worse, the nearly complete absence of the public voice in the respective Soviet institutions makes energy development more expeditious than in the West, a relative backwardness of technology restrains expansion considerably, though unequally in the different energy sectors. As in the past, this relative backwardness continues to offer Moscow planners opportunities for technology transfer. In my view, however, the increasing pressure on hydrocarbon resources and, consequently, hard currency exports means that barring some very large oil discoveries in reasonably accessible provinces very soon,

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[74] Most clearly, the thorough Soviet commitment to nuclear energy and the development of the breeder reactor have spurred no public debate, not even mild questioning. Characteristically, up till now Soviet nuclear plants have had no outer protective shell and they have been put on stream in roughly half the time than such plants in the U.S. for recent years. Safety features are designed essentially for normal operation and "little credence is given to the possibility of a loss-of-coolant accident". There seems to be a slow change in attitude towards a greater appreciation of safety (the latest 1000 MW reactor will have a containment structure) and the ecological problem of the whole fuel cycle. Still, it is safe to say that what constrains the pace of expansion in nuclear power generation is not public or even scientific ambivalence or controversy, but simply bottlenecks in equipment capacity and possibly skilled labor. Robert Campbell, Soviet Energy R. & D.: Goals, Planning and Organization (Santa Monica: Rand Co., R–2253–DOE, May 1978), pp. 32–35 and Chapter 6 (by Phil Pryde) in Dienes and Shabad, op. cit.

[75] See footnote 31.

the Soviet energy economy is about to enter a new era. Without significant qualitative developments in East-West commercial relations, implying institutional and radical policy changes in the USSR, past practices most likely will be unable to keep the energy economy on its present course for very long.

Prospects

In the past, expanding technology imports were paid for by the sale of natural resources among which hydrocarbons have proved to be pre-eminent. Coal has not become an exportable commodity on a large scale and has little chance of becoming so within the next two decades. Nor do non-fuel minerals and forest products even remotely approach oil and gas in their hard currency earning potential. Because of the huge reserve cushion, Moscow leaders have been willing to mortgage large quantities of natural gas in long term compensatory agreements for Western pipes and equipment to speed up the production of this fuel. Under such contracts gas exports in the 1980's may surge still more. For several years, however, hard currency earnings from natural gas cannot hope to equal those derived from the sale of petroleum today, let along provide both increased earnings and compensate for very possible declines in oil exports. In contrast to gas, the USSR so far has been very reluctant to make any long term commitments on petroleum deliveries, as the long prevarication with Japan in the first half of the seventies over the sale of Tiumen' oil (now a dead issue) has already proved. Since that time, the problems and uncertainties facing the Soviet oil industry have increased and so has Russian reluctance to mortgage this resource in long-term contracts.

Yet the mounting technological and geographic difficulties in the USSR energy system, combined with the developing long range squeeze on labor and capital resources and the consequent sharp decline in economic growth would call for Western technical assistance and cooperation on a much wider scale than formerly. And to break the tightening energy bottleneck such assistance would, in Campbell's words, have to be applied across a broad spectrum of energy technologies not just in certain key areas as heretofore.[76] The Soviet petroleum industry would be most clearly affected. However, current efforts to attract foreign technology into the natural gas and, perhaps, coal industries would also have to intensify and closer cooperation sought in the development of nuclear power as well. Although such a course would involve obvious risks, particularly with respect to as yet undiscovered oil, the richness of the USSR energy potentials are undisputed by most experts. The Soviet "energy problem" is basically that of location and distance, the crippling lack of spatial congruence between demand and resources and the technology to conquer such obstacles in time.

While the economic logic of such a scenario may be obvious, I find it highly improbable. To throw the door open to Western assistance across the whole spectrum of the energy field, to make such broad participation financially secure and economically attractive against opportunities elsewhere, would demand considerable institutional modifications in the Soviet system. It would require imagination, flexibility

[76] Robert W. Campbell, "Implications for the Soviet Economy of Soviet Energy Prospects," mimeographed paper, United States, Department of State, September 1977, p. 16.

and a feeling of security from the aging bureaucrats of the Kremlin which they hardly seem to possess. And it would require a political climate of sufficient confidence and trust which is unlikely to exist in the near future. Even if the next generation of leaders, soon to take over in Moscow, would be willing to promote such wholehearted cooperation, it should take some time for a new hierarchy and set of power relations to get established after the present leaders pass from the scene.

The alternative is economic retrenchment. Of all industrial powers, the USSR alone has the option again to turn inward and drastically reduce its trade if determined to do so. The country today does have the technical ability to develop its riches alone only with the help of East Europe, albeit at a much slower pace than could be made possible by a massive surge of technology infusion from abroad. Thanks in particular of its mammoth gas reserves already on the shelf and the easy substitutability of gas for oil in most stationary uses, the USSR could weather a peaking even some downturn in its petroleum production. Given the size of the Soviet sedimentary basins and the relatively low level of exploration, the Soviet oil industry is most unlikely to have yet passed its mid-point. Its collapse is not imminent even without any foreign technology. A severe reduction of oil exports would still leave Moscow enough hard currency to avoid a disaster in case the harvest fails. She would also continue to receive pipes and equipment for the gas industry under barter contracts already in effect and likely to be enlarged but most other hard currency imports would have to be drastically curtailed. In the longer term, the processing and transport and therefore much greater use of Siberian lignites (from Kansk-Achinsk) should become possible entirely through Soviet efforts, since Russian research on this problem is quite advanced.

I do not believe that such a retrenchment would come about suddenly or through a conscious choice. If the Kremlin leaders lack the flexibility, confidence and imagination to make a whole-hearted commitment for open economic cooperation, they also lack the requisite ruthlessness and relentless drive to make it alone. As the protracted and so far inconclusive dispute between pro-hydrocarbon and pro-coal forces also seems to show in a limited field, procrastination, a hope of continuing with past policies appear to be the order of the day. I feel my assessment made two years ago concerning the lack of any long range energy plan still holds. The leadership will gamble on dramatic new oil finds, at least until the early eighties, will try to avoid committing itself and postpone any radical decision on the fuel economy.[77] And it is this inaction, rather than deliberate choice, which is likely to back the country gradually toward autarchy again. Economic isolation will not be complete (it never is), or even reach the level of the fifties. But if petroleum exports beyond the COMECON indeed falter, and the debt-service ratio rises much beyond the current level (28 percent in 1977), both less favorable Western terms and Soviet concern itself will begin to limit trade with hard currency countries.[78] Step by step, the freedom

[77] Dienes, op. cit. (1977), especially p. 60.

[78] The debt-service ratio is defined as principal and interest payments as a share of hard currency exports. Indeed, Soviet orders for Western machinery and equipment declined sharply between 1975 and the end of 1977 reflecting both the completion of orders for the huge Orenburg project and Moscow's desire to reduce its hard currency trade deficit and thus improve its balance of payment. During this period, however, oil and gas earnings as well as receipts from other traditional hard currency exports and arm sales also increased very substantially. U.S., CIA, The Soviet Economy in 1976–77 and Outlook for 1978 (ER–78–10512. August 1978), pp. 11–14.

of action will be reduced, economic responses to world market development increasingly circumscribed. In the opinion of this analyst, such a gradual retrenchment toward autarchy is much more likely than a conscious choice for it. It is also more probable than the robust Western participation in Soviet resource development called for by the opposite scenario.

There remains a third possibility: to shift Soviet oil export (or most of it) from CMEA to Western markets. Without oil deliveries to COMECON, the strain on domestic energy supplies would disappear and hard currency earnings could continue on current levels even with a decline in petroleum output. As one scholar put it, "it is one thing to sacrifice hard currency in order to fulfill fraternal socialist obligations (or more realistically, to maintain economic and political power over East Europe), it is quite another to do so at the expense of Soviet economic development." [79] Since, at least nominally, Soviet prices to East Europe are nearing world levels and since, from Moscow's point of view, control over gas and electric power exports, nuclear plants and reprocessing may become an adequate substitute for petroleum deliveries as an instrument of economic and political leverage, some analysts have suggested that the effects of such a shift on CMEA relations may not be very grave.[80]

Control over other forms of energy exports may indeed provide Moscow with sufficient leverage without the oil. However, the consequences for East Europe of a loss of Soviet petroleum (or most of it) would be profound even with a nominal world price. Such a price level for Russian oil in rubles, even if reached in a year or two, would not signify a burden to these states equal to that imposed by equivalent imports from Western companies or OPEC countries directly. East European exports for Soviet petroleum could not be shifted to the world market without a sharp reduction in the volume earned both because of structural and quality differences in market requirement and acceptance. This was frankly admitted recently by a respected Hungarian writer discussing that country's prospect.[81] For the terms of oil imports to be identical from Soviet and world market sources, East Europe would have to operate within and without COMECON on roughly equal terms over the whole gamut of economic relations. This is not the case today nor is it likely to be through the next decade.

Barring the unlikely arrangement to furnish more than small quantities of Third World oil to East Europe in lieu of Soviet petroleum on Soviet account, these countries will be unable to pay for both in-

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[79] Comments by Jonathan P. Stern in "Soviet Energy Policy and the Hydrocarbons; Comments and Rejoinder," Discussion Paper No. 7. Association of American Geographers, Project on Soviet Natural Resources in the World Economy (Syracuse University, Department of Geography, February 1979).

[80] Comment by Arthur W. Wright, ibid., and Robert W. Campbell, "Implications for the Soviet Economy of Soviet Energy Prospects," mimeographed paper. U.S. Department of State, 1977.

[81] Figyelö (Budapest), No. 44 (November 1978), p. 2. Another source reveals that the 1976–80 Hungarian energy plan specifies the purchase of 800,000 tons of oil from Iraq annually, and according to the author, the quantity will probably exceed 1 million tons per year. However, even though machinery, the most preferred export group, comprised 60 percent of that country's export to Iraq during 1970–75, it will be impossible to offset the increased oil import with current Hungarian export goods. It is essential to conduct market research on new possibilities in Iraq, especially since further growth of petroleum import from the Middle East is planned. The author takes as given that the present 8 million ton level of oil imports from the U.S.S.R. will continue. L. Horváth, "Possible Development of Hungarian Economic Relations with the Countries of the Arab Gulf," in Hungarian Academy of Sciences, Institute for World Economics, Studies on Developing Countries. No. 95. Economic Relations of Africa with the Socialist Countries, vol. 1 (Budapest, 1978), pp. 74–76.

cremental supplies (which must now come from hard currency areas) *and* for Russian exports lost. East European perception concerning the propriety of Soviet action also should be quite different if present supplies of oil were to be denied in favor of capitalist markets from their perception of the current freeze on increase in the quantities furnished for rubles. For all these reasons, I am convinced that Moscow planners would embark on such an action only with the greatest of reluctance, if at all.

In the writings of COMECON energy problems, East European officials and scholars all take the continuation of current Soviet petroleum supplies as a datum.[82] They find the securing of essential future increments, from whatever sources, a colossal enough task. Additional Soviet deliveries now require hard currency payments or long term investments in the USSR at a mere 2 percent interest rate. This huge interest subsidy which, assuming a five year developmental period before Soviet repayment in kind, would raise the true price of Russian oil more than 60 percent above its nominal price,[83] is quietly opposed by the Hungarians, who press for the renegotiation of investment terms.[84] On the other hand, some Hungarian scholars are also convinced that securing sufficient increments of petroleum from the Third World will exceed the strength of the individual East European states. It will be feasible only by creating long-term commercial arrangements with Third World countries in a joint CMEA framework.[85]

Where does this leave us? Predictions are hazardous but should not be entirely shirked. The future cannot, like Proteus, assume any wild and zany shape, for the past does constrain. The physical environment, the state of technology, its embodied infrastructure, long established institutions, none of these are liable to sudden and bizarre changes save in very exceptional circumstances. The field of energy certainly cannot boast with notable structural and technological flexibility in the short and even medium term. Soviet institutions and administrative arrangements are quite rigid, slow to respond and prone to screen out the risky and the new. And since the fall of Khrushchev, the Kremlin leadership has been one of the most conservative, cautious and least innovative anywhere in the world. This analyst, therefore, feels justified in emphasizing the constraints and difficulties (geographical, technological, political and institutional) which obstruct, delay and in some cases downright confound the adjustments called for by economic forces in the Soviet energy system. He claims no access to any crystal ball. If he feels that a gradual, unplanned retrenchment is more probable than the other two scenarios, he may be expressing his own belief in the strength of institutional and technological inertia against the hubris of formal economic rationality.

[82] E.g. the Deputy Minister of Hungarian heavy industry in Kapolyi La'szló, "Hazai energiakincsünk szerepe energiagazda'lkoda'sunkban," Energia és Atomtechnika, No. 10, 1978, p. 401 and sources in footnotes 81, 84 and 85.

[83] H. G., Trend, "OPEC's Price and Soviet Price for Oil Deliveries to COMECON," Radio Free Europe, Background Report/273 (Eastern Europe) Dec. 14, 1978, p.3.

[84] According to a most recent Hungarian claim, the annual aggregate hydrocarbon imports of the Soviet Block during the next 10–20 years may rise to near 110 million tons of oil equivalent. Assigning all of that to East Europe (directly or indirectly via the U.S.S.R.) would still imply a less than 1.5 percent average annual growth over a 15 year period, and it is inconceivable that energy increments from domestic sources and Soviet gas could do more than match this rate. The source flatly states that individually the small COMECON countries are unable to create long-term commercial arrangements to guarantee such imports.

[85] Figyelö (Budapest), No. 52 (December 1978), pp. 10–11.

Appendix

FUNCTIONAL BREAKDOWN OF OIL AND GAS USE 1976 AND 1980

[Million tons of standard fuel; 1 ton=7 million kilocalories]

	1976		1980 gas and oil
	Natural gas	Oil	
Mobile uses		[1] 195.0	[2] 230
Liquified gases	[3] 5.3	[3] 7.0	[4] 16
Field use and losses	3.1	[5] 20.0	[2] 32
Gas pipelines—fuel	[4] 18.0		[4] 43
Gas pipelines—losses	[4] 6.6		
Gas processing plants—fuel and losses	3.6		[2] 6
Petroleum refining—fuel and losses	[6] 2.5	[6] 29.0	[4] 38
Blast furnaces	10.1	[7] .5	[8] 15
Open hearth furnaces	6.8	[7] 3.5	[8] 11
Chemical raw materials, industrial lubricants, bitumen (hydrocarbons other than liquid gases)	22.2	[9] 45.0	[2] 85
Household furnaces and stoves	15.8	Neglig.	[2] 24
Subtotal (A)	94.0	300.0	500
Steel pipes	1.8		
Rolled steel	6.4		
Furnaces in nonferrous metallurgy	2.8		
Cement kilns	12.4		
Furnaces and ovens for glass, ceramics, other construction and refractory materials	12.2		
Forges and related devices for shaping metals	8.3		
Other applications	[10] 11.1		
Subtotal (B)	55.0	[2] 60.0	[2] 170
Subtotal A and B	149.0	360	670
Minenergo and industrial power stations	111.3	[11] 136.0	[11] 315
Industrial boilers	49.1		
Municipal boilers	33.0	[2] 45.0	[2] 110
Small boilers and isolated power stations	[10] 10.1		
Total power station and boiler use	203.5	181.0	420
Net addition to stock and storage and to fill news pipelines	[12] 15.5	[4 13] 1.0	[4] 45
Apparent consumption (production minus net export)	368.0	541.0	[4] 1,140

[1] Estimated by assigning all gasoline and most kerosene consumed to mobile uses. Fuel oil and diesel fuel were assigned according to their percentages in the transport and, for the latter, agricultural, construction and "other" sectors. The output of refinery products for 1975 is available from R. W. Campbell, Soviet Fuel and Energy Balances (Santa Monica, Calif.: Rand Corp. Research Rpt. R-2257, 1978), appendix. The consumption breakdown by sectors is given in Vestnik statistiki, No. 1, 1978, p. 9.

[2] Arbitrary estimates by the author, which appear reasonable but which cannot be supported by solid evidence. They were also expected to help the columns sum up to total apparent consumption.

Apparent consumption for 1976 is factual, converted to standard ton equivalents from physical tonnage given in Nar. khoz. SSSR za 60 let, p. 205 and Vneshniaia torgovlia SSSR v 1976 g., pp. 26 and 38

[3] Total for 1975 given in A. M. Nekrasov and Pervukin eds, Energetika SSSR v 1976–1980 godakh (Moscow: "Energiia," 1977), p. 149, was adjusted upward and broken down between oil and gas according to Campbell, op-cit (1978). Appendix.,

[4] For 1976 Ekonomika gazovoi promyshlennosti, No. 11, 1977, p. 27; for 1980 Nekrasov and Pervukhin, op. cit, (1977), pp. 149 and 151.

[5] Field and transport losses are conservatively estimated to be about 3 percent. A recent source, V. V. Arenbrister, Tekhniko-ekonomicheskii analiz poter' nefti i nefteproduktov (Moscow: "Khimiia," 1975), pp. 18–19, claims 5 percent for total losses (in addition to internal fuel use in the various operations) from fields through supply depots of refined products. Of this 5 percent, less than one-third or 1.6 percent was lost during the refinery operation.

[6] Total for 1975 is given by Nekrasov and Pervukhin, op. cit. (1977), pp. 149 and 151. It was adjusted upward slightly and the consumption of natural gas separated out according to Campbell, op. cit. (1978). Appendix.

[7] Consumption of oil in blast and open-hearth furnaces projected from 1972 and 1974 data as given in Ministerstvo Chernoi Metallurgiia SSSR, Ekonomika chernoi metallurgii, No. 5 (Moscow: "Metallurgiia," 1976), pp. 91–93 and N. I. Pertov et al., Tekhnicheskii progress i toplivo-energo-potreblenie v chernoi metallurgii (Moscow: "Metallurgiia," 1975), p. 131.

[8] Natural gas consumption projected from 1970, 1975 and 1977 volumes as given in Gazovaia promyshlennost', No. 6, 1978, p. 12. Growth in oil consumption is given in Energetika (Prague), No. 9, 1977, p. 455.

[9] Natural gas is claimed to provide 44 percent of all raw material for chemical synthesis. Most of the rest today originates from petroleum. Ekonomika gazovoi promyshlennosti, No. 11, 1977, pp. 30–31 and G. F. Borisovich and M. G. Vasilev, Nauchno-tekknicheskii progress i ekonomika khimicheskoi promyshlennosti (Moscow: "Khimiia," 1977), p. 29. Heavy, non-fuel refinery products from Campbell, op. cit. (1978). Appendix.

[10] The categories "other branches of industry" and "other branches of the economy" given in Gazovaia promyshlennost', No. 6, 1978, p. 29, were divided between furnace-type applications and boiler use as in the table. This conforms to data about gas consumption by all types of electric stations everywhere. Nekrasov and Pervukhin, op. cit. (1977), p. 111.

[11] Nekrasov and Pervukhin, op. cit. (1977), p. 151.

[12] Residual for the columns. Data unavailable, but this figure is reasonable, since net additions to storage have been increasing from 1,700,000 tons of SF equivalent in 1973 to over 6,800,000 tons of SF equivalent in 1975. The 1976–80's plan calls for very rapid growth of storage. Data from S. A. Orudzhev, Gazovaia promyshlennost' po puti progressa (Moscow: "Nedra," 1976, p. 71.

[13] According to Nar. khoz. SSSR za 60 let, p. 83 stocks of all fuels declined during 1976, evidently in response to the export drive. Since the latter concerned only hydrocarbons, and primarily petroleum, it is reasonable to assume that petroleum stocks were drawn down somewhat. On the other hand, 2,000 km of new oil pipelines had to be filled up in 1976.

Note: Except where otherwise noted, all 1976 figures for natural gas are from a recently released authoritative study in Gazovaia promyshlennost', No. 6, 1978, p. 29. Figures noted with numbers are a mixture of Soviet and Western data and the author's calculations derived from a variety of sources as explained above.

SOVIET REPLACEMENT INVESTMENT: A RISING POLICY IMPERATIVE

(By Stanley H. Cohn*)

CONTENTS

SUMMARY

Rising resources constraints compel a switch of the Soviet economy to a growth strategy which emphasizes productivity of productive inputs. In this vein constraints on rates of increase in investment require higher rates of return on capital. This goal calls for greater emphasis on investment which replaces obsolescent assets with new equivalents incorporating later technology, rather than investments in new plants and equipment. This course is the main channel for furthering the infusion of new technology into the system.

Replacement investment has been less than half the share of total investment compared with the United States economy share. Furthermore, its share has been rising very gradually over the past decade. The official estimates of replacement investment are somewhat inflated in terms of technological impact since they include a considerable ingredient of retired, obsolescent assets which have been transferred to lower priority claimants. The most promising type of replacement investment lies in the mechanization of largely manual auxiliary industrial operations, particularly materials handling. This emphasis is particularly advisable as labor stringencies loom ever larger.

Official policies have hitherto mitigated against this investment strategy. Although official asset lives have been reduced twice since 1963, they are still longer than those specified in U.S. and Western European business tax codes. In other words, Soviet planners still understate asset obsolescence. In addition, actual service lives tend to be even longer than those set by official standards. If service lives are too lengthy, the official amortization allowances designated for financing asset replacement are insufficient. Productive assets can be retained for long periods only if heavy maintenance expenditures occur.

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Essentially the investment tradeoff from a plant manager's perspective is between replacement and prolonged maintenance. Such maintenance outlays, termed capital repairs in Soviet parlance, are pervasive throughout the system. Since it is a labor-intensive, non-specialized activity within the Soviet institutional context, capital repairs tend to be highly wasteful in the use of manpower and equipment. The deficiency of spare parts production by machinery sectors forces enterprises to manually fabricate replacement parts in their own small repair shops. Financial incentives are biased in favor of repairs and against replacement in the earmarking of amortization allowances for the two activities.

The institutional environment also mitigates against the adoption of a concerted replacement strategy. The planning process does not explicitly provide for replacement investment, meaning that there is no assurance that machinery production plans are keyed to replacement requirements. The pattern of managerial incentives is skewed toward current performance; not toward innovation. Essentially a replacement decision is an innovation decision, the culmination of the research and developmental process. To the extent that prices of new machinery products tend to be inflated, a further barrier is erected to discourage a manager from selecting the replacement option. The most serious constraint to encouragement of the desired investment strategy at the grass roots level is the absence of any risk bearing propensity by Soviet managers. Since successes are only partially rewarded and failures are fully penalized, Soviet managers prefer to be risk averters. For investment policy such behavior leads to a preference to make do with the old technology, to choose continued maintenance of old assets rather than their replacement with technologically advanced assets.

Some of the official constraints may be overcome with comparatively minor policy changes. However, until the system of managerial incentives is completely revamped, full implementation of the new investment policy is not likely.

Policy Setting

The main economic challenge to the Soviet leadership in recent years has been the maintenance of a respectable growth rate in the face of rapidly declining increments to the labor force and a falling rate of increase in investment. While the traditional wherewithal of the system to sustain rapid growth is increasingly frustrated by growing factor input stringencies, the leadership is faced with mounting claims by consumers, producers, and the armed forces for a slower expanding total output. The Soviet Union is not unique in its challenge, in fact, its human and non-human resource endowment is, and will continue to be, more favorable than those for the other major industrial powers, except for the United States. Rather, the conspicuous deficiency of the traditional Soviet growth strategy is its failure to achieve sufficient progress in the use of the basic productive resources already in place. Its productivity performance has been poor, considerably below that of Japan and Northwestern Europe and only marginally ahead of that of the United States.[1] Considering the economy's in-

[1] Stanley Cohn, "The Soviet Path to Economic Growth: A Comparative Analysis", Review of Income and Wealth, March 1976.

ferior level of technological endowment and the consequent technological borrowing possibilities, it should have been much higher. Other industrialized market economies exceeded the historic Soviet productivity performance at similar stages of development.

Of course, Soviet economists and political leaders are aware that the new growth strategy, termed "intensive" development in Marxist parlance, must focus upon productivity improvement. They have advanced proposals for a new strategy and made marginal changes in policy intended to improve productivity performance. Proposals and policies concern improved manpower utilization, better utilization of physical plant and equipment (capital stock) and more effective economic organization (management). In this compendium the manpower issues are discussed in the contribution of Murray Feshbach and L. Nolting and those of organization in the contribution of Gertrude Schroeder. This contribution will explore the issue of the more efficient use of investment resources.

Economy in the use of capital resources is given further urgency by the limitations which have been set on their availability and absorbability. The heavy demands imposed on the economy by the defense effort (see the contribution of Abraham Becker) and the increasingly sensitive official response to the demands of consumer (see the contributions of Beth Denton, Henry Morton and A. Welihozkiy) have set a ceiling on the proportionate claim of investment on national product. Even if there were no such limitation on the total investment effort, an effective limit would be set by factor proportions constraints. Given the marked deceleration of manpower increments to the labor force, a reduced rate of increase in capital stock is imposed by the law of diminishing returns. If capital investments were increased to offset the decline in labor inputs, sharply reduced returns to additional investment would result. If it is, therefore, uneconomic to accelerate the rate of new investment, it becomes all the more imperative to extract greater return from the present level and reduced increments to the stock of productive capital.

The Soviet leadership has stressed accelerated adoption of advanced technology as the key to higher productivity. Investment, particularly in machinery and equipment, is the path by which technology enters the productive process. The most expedient strategy for achieving this aim is through replacement of obsolescent machinery and equipment by counterparts incorporating more advanced technology. Thus, a policy which has placed primary reliance on technological progress must be complemented by one which places greater stress on replacement investment in existing enterprises rather than investment in new enterprises or expansion of existing enterprises. Not only is technology embodied into the production process with less time lag through the replacement approach, but at lower cost, since costly new plant is not required.

Alongside this imperative and advowed policy intention is the sharply contrasting laggard performance in implementing the new investment course. Available estimates clearly indicate that the replacement share of capital investment in Soviet industry is far below that of the United States and other major market economies. Furthermore, the share has increased very slowly during the Ninth and Tenth Five-Year Plans.

In order to explain the low Soviet propensity toward replacement investment, it is necessary to examine existing investment policies with regard to asset maintenance and obsolescence, the extensive second hand utilization of retired assets, the pervasive nature of heavy capital repair expenditures, and the institutional environment which influences investment choices both by central planners and plant managers. Conceptually a replacement decision involves a choice between continued maintenance of an existing asset or its retirement and scrappage and replacement with a new asset incorporating newer technology. Therefore, it is necessary to investigate official guidelines with regard to asset lives and capital repairs, as well as the investment decisions themselves. Since the official guidelines have been observed in the breach, it is further desirable to ascertain the extent to which official preferences are disregarded by lower level decision makers.

Replacement Share of Investment

Soviet leaders and economists have asserted that the share of investment devoted to replacement is too small to sustain the rate of technological progress needed to offset the rising scarcity of productive inputs. Since there is no standard definition of replacement investment or any systematic collection of appropriate statistics,[1a] any comparison between Soviet and U.S. investment efforts must be regarded as approximate. Soviet investment of this type are based upon the estimates of Soviet economists or upon fragments gleaned from official pronouncements. U.S. estimates are based upon annual surveys conducted by the McGraw-Hill Publishing Company.

However, since the replacement investment portion of the total is so disparate between the two economies, differing concepts of replacement are of minor consequence. For the United States the surveys indicate that replacement and modernization investment averaged around 57 percent of the total for the period 1949–1968 and around 56 percent in the mid-seventies.[2] Soviet estimates are based upon two different methodological approaches. The preferred approach involves the collation of data from statistical reporting forms of enterprises for a limited number of benchmark years. For the USSR as a whole the estimates range from 24 percent for 1972 [3] to 20 to 33 percent for the years 1965, 1970, and 1973.[4] For the Ukrainian republic which produces about a fifth of national output, the replacement investment proportion is estimated at 15.6 percent of 1973.[5]

The less satisfactory approach is to use retirements of assets as proxies for replacement. This approach is flawed by the assumption that retirement and replacement decisions coincide. It also erroneously

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[1a] In published Soviet statistics re-equipment and reconstruction investment are lumped with investments involving expansion of existing enterprises. This investment aggregate is expressed as an annual proportion of total centralized capital investment. During the nineteen sixties the proportion was around 61 percent, rising to 64–65 percent in the seventies with a very gradual upward trend. As is explained in the textual discussion, the reequipment and reconstruction share of the aggregate ranged between a third and a half.

[2] McGraw-Hill Publications Company, Annual McGraw-Hill Survey of Business' Plans for New Plants and Equipment.

[3] V. K. Senchagov, Effektivnost' ispol'zovaniia osnovnykh fondov. 1974. p. 87.

[4] L. M. Smyshlaeva, Ekonomicheskii rost i proportsii kapital'nykh vlozhenii, 1976, p. 107.

[5] Akademiia Nauk Ukrainskoi SSR, Struktura kapital'nykh vlozhenii v narodnogo khoziaistva i puti ee sovershenstvovaniia, 1977, p. 30.

assumes that replacement costs of new assets do not exceed original costs of the retired assets. Since replacement costs are inevitably higher, the retirement proxy understates replacement investment. Offsetting these drawbacks of this approach is the advantage of a large number of annual observations. For industry, estimates using this methodology range from 12 to 16 percent for the late sixties [6] and 9 to 12 percent for the early seventies.[7] Another set of estimates shows a range of 15 to 18 percent for the 1970–76 period.[8]

Finally, analysis of official comparisons between the completed Ninth Five-Year Plan and the forthcoming Tenth Plan estimated the replacement investment share for the economy as a whole at 15.5 percent for the earlier period and with a planned rise to 19.2 percent for the later quinquennium.[9] The industry proportion was planned to be 23.6 percent, compared with 20.2 percent 1971–75.[10]

Whatever may be the impact of data limitations on the differing Soviet estimates, the Soviet industrial replacement efforts is proportionately less than half that for the United States. Of course, the much more rapid growth of capital stock in the USSR necessarily requires a higher share of investment in new producing units. However, this statistical conclusion does not mean that the Soviet emphasis is economically sound; rather it leads to the opposite conclusion on efficiency grounds.

The impact of a heavy emphasis on new investment in plant and equipment on the technical structure of industrial and agricultural capital stock can be seen in a comparison of the two economies (table 1).

In both industry and agriculture the equipment and plant shares are reversed with both Soviet sectors having a predominence of plant.

The dynamics of technical structure tell a similar story. In Soviet industry the average annual growth rate for equipment is minutely

TABLE 1.—TECHNICAL STRUCTURE OF SOVIET AND U.S. CAPITAL STOCK

[Portions of the total]

	U.S.S.R.[2]		United States[2]	
	Equipment	Plant	Equipment	Plant
Manufacturing:[1]				
1958	38.2	61.8	57.2	42.8
1977	39.2	60.8	60.2	39.4
Agriculture:				
1963	33.8	66.2	56.0	44.0
1977	25.4	74.6	57.2	42.8

[1] For the U.S.S.R., total industrial capital stock less that of the electric power sector; for the United States total manufacturing.

[2] The Soviet estimates are gross stocks in 1955 rubles; the U.S. estimates are gross stocks in 1972 dollars.

Source: U.S.S.R—Estimates of author derived from base year values and annual indexes published in Narodnoe Khoziaistvo. United States—"Fixed Nonresidential Business and Residential Capital in the United States, 1925–75", Survey of Current Business, April 1976 and updated in the Survey of Current Business, September 1978.

[6] Iu. Liubimtsev, Tsikl vosproizvodstva i amortizatsiia osnovnykh fondy, 1973, p. 56.

[7] A. Shnelderov, "Vosproizvodstvennye proportsii kapital'nykh vlozhenii", Voprosy ekonomiki, August 1975, p. 28.

[8] M. Zavalishchin, A. Masal'skii, "Novye normy, amortizatsii utogi i problemy", Plannovoe khoziaistvo, May 1978, p. 67.

[9] Unpublished estimates of Constance Krueger.

[10] V. Ostapenko, I. Birlutkova, "Questions of the Financing of the Reequipment and Modernization of Operating Enterprises", Joint Publications Research Service, No. 71698, Aug. 17, 1978.

higher than that of plant while in the United States the equipment component has increased more than twice as rapidly (table 2). In Soviet agriculture the plant component has increased half again as rapidly as that of equipment, while in the United States the growth of farm equipment stock has been somewhat more rapid. Clearly Soviet investment policy choices have been adverse to optimal infusion of advanced technology in its two major sectors.

TABLE 2.—GROWTH RATES OF TECHNICAL COMPONENTS OF SOVIET AND U.S. CAPITAL STOCK

[Annual average rates]

	U.S.S.R.		United States	
	Equipment	Plant	Equipment	Plant
Industry (1958–77)	9.7	9.4	3.5	1.4
Agriculture (1963–77)	6.8	9.9	3.4	3.0

Source: See table 1.

A high plant component is to be expected in an economy which has stressed investment in new productive facilities, but the consequences for technological progress are unfavorable since equipment is the main carrier of new technology. To some unquantifiable degree the large plant share reflects the rigors of the Soviet climate. It also reflects a differing relative price structure. Recent calculations indicate that the buying power of the dollar relative to the ruble is greater for construction than for producer durables, 1.35 dollars to the ruble for construction compared with only 1.98 for durables.[11] The relative inefficiency of Soviet construction, as compared with the United States, is a further reason to stress replacement investment in which the construction ingredient is minor.

Not only would the return be higher on replacement investment as a whole but this changed strategy can be pinpointed toward maximum benefit by eliminating disproportionalites in the structure of industrial capital endowment. Traditionally Soviet investment has stressed heavy capitalization in the production processes themselves, while largely allowing auxiliary production operations, such as materials handling, warehousing, and repairs to be performed by unskilled labor with little mechanical equipment. Mechanization of these operations would not only upgrade a previously neglected component of production, but would also yield the greatest labor savings in a period with ever tightening labor stringencies. More than half of Soviet industrial workers are in the unskilled category. In the Moscow region during the Tenth Five-Year Plan replacement investment is slated to stress mechanization of auxiliary production processes.[12]

Within this auxiliary operations grouping, fixed capital has mainly been devoted to machinery repair and tool fabrication operations, with little being alloted to materials handling and warehousing. A survey of plants within the Estonian Republic disclosed half of all capital investment as devoted to the first two operations and only 10

[11] See contribution by James Noren and Imogene Edwards, "Comparisons of the Size and Structure of Soviet and American Economies" in this compendium.

[12] A. A. Palamarchuk, V. N. Savinkov, Rekonstruktsiia promyshlennykh predpriiatii. 1975, p. 45.

percent to the latter two, even though the employment proportions were 27 and 25 percent, respectively.[15] Heavy capital endowment in repair operations is an inefficient use of investment resources, as will be discussed in the section on 'Capital Repairs" in this study. Clearly the materials handling operations represent a potential high return possibility for future invetment.

Transfers of Retired Assets

The estimated proportions that reported replacements comprised of total fixed investments are overstated in terms of their technological significance. These replacement assets do not necessarily embody new technology. All too frequently newly manufactured replacement equipment is technologically obsolescent. Another productivity retardant lies in the transfer of used assets between ministries and enterprises. Since these transferred items of equipment have usually been retired on the books of the donating organization, their addition to the asset holdings of recipient organizations thwarts the avowed purpose of replacement investment policy.

It has been common practice to transfer retired assets without charge from one enterprise or ministry to another. The scale of such free transfers is of major magnitude, while direct sales of used assets are of minor importance. According to one Soviet economist, the "free" transferred portion of retired industrial assets has ranged from 29 to 44 percent between 1965 and 1973 with no discernible trend; by contrast sales of such asset ranged only between 2½ and 7 percent.[14] Other economists arrive at similar estimates with the transferred portion of industrial assets estimated at 28 percent for 1971, 44 percent in 1972, and 46 pecent in 1973.[15] The incidence of the scale of outgoing transfers is quite divergent around the industry average with a high of 66 percent for electric power and lows of 37 percent for fuels and 33 percent for construction materials.[16]

The transferred component is a smaller share of total asset additions, amounting to 13.4 percent for industry in 1973.[17] However, this proportion is of major significance if it is compared with proportion that all replacement investment comprises of total fixed investment. If the highest of the aforementioned estimates of replacement investment for industry is used, 33 percent for 1973, obsolete transferred assets comprise about 29 percent of the total replacement component. For lower estimates of replacement proportions, the transferred asset share is correspondingly higher. Again the variance is large among branches of industry around the 13.4 percent average with high proportions of 31.3 percent for construction materials, 25.5 percent for electric power and 21.0 percent for food processing.

As might be expected, transferable assets are of the more mobile, general purpose variety, such as electric motors, generators, vehicles, and machine tools. There is less possibility of transferring specialized

[13] E. Vitsur, "Problems of Increasing the Yield on Capital", Joint Publications Research Service, Translations of Economic Affairs, No. 844, Aug. 25, 1978.
[14] V. A. Milaev, "Voprosy optimizatsii vybytiia osnovnykh fondov", Finansy S.S.S.R., March 1975, p. 26.
[15] Iu. V. Korenkov, D. M. Pelterovich, Tekhnicheskii progress i optimal'noe obnovlenie proizvodstvennogo apparata, 1975, p. 40.
[16] A. Shneiderov, op. cit., p. 27.
[17] Ibid.

production equipment. For the most part, recipients of such assets are lower priority claimants of capital goods, such as repair shops which obtain metal cutting tools from the machinery production branches.[18] Agriculture with its lower planning priorities was also a major beneficiary of retired assets until the late sixties, when its access to new equipment was given higher priority.[19]

Of course, such heavy reliance upon transfers of old technology contradicts the professed aim of the leadership to rapidly infuse technological progress into the system through the replacement process. It also means that the published data for investment both overstate the real economic value of such additions to capital stock and the degree to which genuine replacement investment is occurring. One Soviet economist has openly alleged that capital stock accurals and discards are inflated because transfers out are reported as retirements and transfers in as replacement investment.[20] However, transfers are not included in published investment statistics.[20a]

Not only are transferred assets classified as accruals, but they are valued at original cost. Although accrued depreciation charges are also transferred as accounting offsets on the books of the recipient organization, the reported aggregate estimate of gross capital stock is inflated by this practice, even though that of net capital stock reflects only the remaining economic value of the assets.[21] Since there is no official presentation of a net capital stock time series, the gross series upon which the external analyst must rely should, therefore, be appropriately discounted.

Asset Lives

While they are not one of the operational decision variables which determine the level of replacement investment, official asset service lives provide useful indicators as to the planner's replacement expectations. They indicate the changing official attitude toward obsolescence and form the basis for the size of the depreciation allowances which provide the principal source of replacement finances.

Service lives of productive assets have been liberalized (shortened) twice during the postwar period, in 1963 and 1975. This trend reflects the progressive displacement of engineering by economic criteria, the rising recognition of obsolescence in addition to physical wear and tear as a determinant of useful asset lives. Long service lives require heavy maintenance expenditures if they are to be implemented. Shortened asset lives mean comensurately lowered maintenance costs, which are termed "capital repairs" in Soviet accounting terminology. The basic operational decision involves the trade-off between replacement and maintenance of existing assets.

Obsolescence as a determinant in investment decisions was deliberately ignored until the early sixties. Such disregard was explained

[18] Kurenkov and Palterovich, op. cit., p. 40.
[19] Ibid., p. 43.
[20] A. V. Vorob'eva, Osnovye fondy i sebestoomost' produktsiia promyshlennosti, 1966, p. 26.
[20a] A. Sheiderov, op. cit., p. 27.
[21] I. Grunfest, B. Shchelkov, Bukhgalterskii uchet v promyshlennom predpriiatii, 1969, p. 95. Bertrand Horwitz, Accounting Controls and Soviet Economic Reforms of 1966, 1970, p. 13.

by both Marxian theory and the obsession with maximization of growth with secondary regard for its cost. The shortened standard asset lives which were introduced in the 1963 and 1975 liberalizations explicity recognized economic obsolescence, as well as wear and tear. However, as will be detailed in the discussion of actual asset retirement practice, it was still given minor consideration. A survey intended to elicit motives for asset retirement by machine tool enterprises in the late sixties indicated that obsolescence explained barely a seventh of such decisions, with over 80 percent induced by physical wear.[22] This disappointing behavior illustrates the gap between official asset lives and their practical application which overwhelmingly is biased toward even more prolonged asset usage.

Perhaps the most comprehensive comparison between Soviet and market economy official asset depreciation policies has been provided in estimates of a Soviet economist for the late nineteen sixties (table 3). He compared service lives in market economies for industrial equipment, as indicated by business tax depreciation allowances. Although tax lives do not necessarily coincide with actual business practices, the analog with official Soviet asset lives is appropriate. Except for the questionable estimate for Japan, Soviet asset lives still exceed those in market economies. In addition to more rapid write-offs, the market economies also provide for accelerated depreciation in which as much as half of total depreciation is taken within two years and over two-thirds within five years.[23] By contrast Soviet depreciation has always been "straight line" with equally proportionate deductions taken over the life of an asset.

TABLE 3.—*Comparative service lives for industrial equipment*

	Years		*Years*
Belgium [1]	8	Japan [1]	16
Canada [1]	10	Sweden [1]	5
France [1]	10	United States [1]	12
Germany [1]	10	Soviet Union (1963–75) [2]	17
Italy [1]	10	Soviet Union (1975–) [2]	14

[1] V. Iu. Budavei, Problemy amortizatsii v promyshlennosti, p. 183.
[2] Iu. V. Kurenkov, D. M. Palterovich, Tekhnicheskii progress i optimal'noe obnovlenie proizvodvennogo apparata, p. 51.

Even with the second reduction in official service lives in 1975, Soviet productive assets are still programmed for longer lives than in the United States (table 4). Longer official service lives are prevalent in nearly all industrial sectors. This conclusion is reinforced by the adoption of accelerated depreciation in the business tax structures of the major industrial market economies.

A Soviet economist estimates that in the mid-seventies, machinery becomes obsolescent after 8.2 years on average. He compares this undocumented estimate with the official average service life of 12.2 years in the 1975 standards to arrive at his approximation of the degree to which obsolescence is still disregarded.[24]

[22] Kurenkov, Palterovich, op. cit., p. 60.
[23] V. Iu. Budavei, Problemy amortizatsii v promyshlennosti, p. 183.
[24] D. A. Baranov, Sroki amortizatsii i obnovleniia osnovnykh proizvodstvennykh fondov, 1977, p. 216.

TABLE 4.—COMPARATIVE OFFICIAL ASSET SERVICE LIVES (YEARS)

Industrial sector	Soviet Union		United States
	1963–74	1975–	1975
Electric power	25.6	21.3	8–12
Oil drilling	18.2	17.0	6
Oil refining	19.6	16.1	16
Coal	17.5	15.1	10
Ferrous metals	27.8	22.7	18
Machinery	25.6	21.3	8–12
Chemicals	26.3	19.6	11
Woodworking	12.8	10.6	10
Construction materials	23.8	19.2	14–20
Textiles, apparel	27.8	23.3	9–14
Food processing	28.6	23.3	12–18
Glass	26.3	20.4	14

Source: Soviet Union—M. Zavalishchin, A. Masal'skii, "Novye normy amortisatsii itopi i problemy," Plannovoe khoziaistvo, May 1978, p. 67. United States—Department of the Treasury, Internal Revenue Service, "Tax Information on Depreciation", Publication 534.

Another indicator of excessive official service lives are continuing large write-offs of assets retired prematurely with insufficient accrued amortization deductions. In 1976 such losses amounted to 17.7 percent of original asset cost for the economy as a whole and 20.9 percent for industry.[25]

Furthermore, even the higher 1975 amortization deductions carmarked for replacement have proved to be insufficient to finance desired rates of replacement. In such instances the Ministry of Finance and Gosplan have authorized the transfer of accumulated capital repair amortization funds up to a limit of 20 percent to finance such replacements.[26] For the United States surveys by the Treasury Department show that tax lives of assets have closely approximated actual service lives since the depreciation liberalization of 1962. The same identities apparently prevail for other market economies.[27] For the Soviet economy official asset lives have generally been shorter than actual lives. One Soviet economist, after noting that information on the age distribution of capital is scarce and unsystematically sampled, collected data from working papers of research institutes and concluded that in the early seventies actual service lives in manufacturing somewhat exceeded official norms, but in mining were generally lower. In agriculture actual service lives have been shorter than those officially prescribed. Premature retirements in farming are explained by poor maintenance, inadequate repair services, open air storage of equipment and unqualified mechanics.[28] In economic terms service lives should be 30 to 50 percent longer.

Other Soviet economists have used retirements as proxies for actual service lives. This substitute approach disregards the relatively young age distribution of Soviet productive assets, thereby overstating actual

[25] Zavalishchin, Masal'skii, op. cit., p. 72.
[26] B. Senchagov, "Razvitie sotsialisticheskogo khozlaistvennogo mekhanizma", Voprosy ekonomiki, May 1978, p. 42.
[27] Richard Pollack, Tax Depreciation and the Need for the Reserve Ratio Test, U.S. Treasury Department, 1968, pp. 5, 10–11.
[28] Kurenkov and Palterovich, op. cit., p. 57.

service lives.[28a] As late as 1976 the average retirement rate for equipment assets in industry was only 2.3 percent, implying average service lives of over 43 years. The overstatement of actual lives on the basis of scattered evidence would range from a third to 40 percent among branches of industry. Whatever confidence one can place in these estimates of actual service lives, it is plausible to conclude that official asset lives are unusually long and are often further extended in actual practice.

Capital Repairs

As noted earlier, the Soviet decision maker at the production level is faced with the choice of asset maintenance or replacement investment. In Soviet practice maintenance expenditures fall under two categories—current and capital repairs. Current repairs, which are financed as a component of production cost, covers preventive maintenance and routine servicing of machinery and equipment. Capital repairs, which are financed out of earmarked amortization allowances, involve major renovating outlays to replace defective or worn parts of existing assets. In U.S. accounting the capital repair concept does not exist in that repair expenditures are charged to production cost unless there are major repairs. In the latter case they would be classified as net investment.

Therefore, in the Soviet context capital repairs are an alternative to replacement investment. Since their purpose is to restore assets to full working potential rather than to increase productive potential, they draw upon the existing state of the arts. They do not incorporate new technology. They become a necessary complement to long asset service lives. Even the reduced service lives introduced in 1975 cannot be sustained without extensive capital repairs.[29] Service lives would have to be further reduced to U.S. or Western European levels to elimate the reliance on heavy capital repairs outlays.

The magnitude of capital repairs is considerable in its economic impact. In 1976 in industry capital repairs were a quarter as large as gross investment and for industrial equipment investment nearly two-fifths as large. They exceed asset retirements by nearly double for all industrial assets and by 80 percent for equipment assets.

Capital repair is a highly labor-intensive activity which exerts a heavy drain on scarce manpower and material resources. In the early seventies this activity absorbed a tenth of the entire industrial labor force and a third of the nation's stock of metalcutting tools.[30] Within

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[28a] A retirement rate is mathematically the reciprocal of an asset service life. A 2.5 percent rate means an average service life of 40 years, a 2.0 percent rate an average life of 50 years, a 4.0 percent rate an average life of 25 years, etc. The key word is average, implying that the age distribution of all capital stock in the sector is not skewed toward new (young) or largely depreciated (old) capital. The unqualified use of retirement rates as proxies for service lives assumes that the average age of all capital stock is half of the life derived by computing the reciprocal of the retirement rate.

Actual average service lives of fixed assets in Soviet industrial sectors are much lower than those implied by existing retirement rates. For example, in a sector with an existing 2.5 percent retirement rate, if the average age of capital stock is only 10 years rather than the 20 years implied by the existing retirement rate, use of the rate as a proxy for average service life would overstate service lives by 100 percent (double).

The retirement rate is determined by the ratio of current retirements to the value of the capital stock. As the stock ages, a larger share of the stock will be retired in any one year, hence the retirement rate will rise. Such a trend will lead to a paradoxical conclusion of this simplistic identification of service lives with retirement rates persists. As the stock ages, the implied service life will decline!

[29] Baranov, op. cit., p. 168.

[30] A. Shneiderov, "Vosproizvodstvennye proportsii kapital'nykh vlozhenii", Voprosy ekonomiki, August 1975, p. 34.

the machinery sector a quarter of the labor force and a fifth of productive assets were devoted to this activity.[31] Employment in repair operations has been increasing more rapidly than in production with an unskilled labor proportion more than double. In the Ukraine in 1975 capital repair outlays for industrial equipment exceeded new equipment investment.[32]

The inefficiency of capital repair operations is largely explained by its atomized structure. Since equipment repairs depend upon the ready availability of spare parts, specialized repair organizations have not flourished in a system in which there has been little incentive for spare parts production by machine building enterprises. There is no counterpart in the Soviet economy to the follow-up repair services provided by U.S. producers of production equipment. Consequently, enterprises which have purchased capital equipment must service and repair their equipment in their own machine shops. For example, in machine tool plants spare parts production comprises only one percent of total output, compared to 12 to 18 percent in the major market economies. The cost per unit of spare parts produced in plant machine shops is estimated to be three to five times higher than in plants of specialized parts producers.[33] These in-plant repair shops employ over three million workers.[34] A special survey of Moscow enterprises indicated that 94 percent had their own capital repair shops.[35] Their technological level was considerably below that of producing organizations.

In addition to high cost repair services, expenditures for capital repairs are also increased by the tendency to retain assets in production long past their physical lives and by the low durability of many types of production equipment.[36] The decentralized structure of repair services, in turn, thwarts the attainment of standardization of equipment parts and components.

The extent of this inefficient form of investment is magnified by size of current repairs, which are estimated to be equal to capital repairs. The distinction between the two types of repair operations is often shaded. A sample survey in 1971 disclosed that instead of parity between the two types of repair, in actuality only a third of the capital variety and two-thirds devoted to preventative maintenance and routine servicing.[37] Undoubtedly the concealment of current repairs under the capital rebric is explained by more adequate sources of financing. In any event, the burden of repairs is a major one for the system.

The costly alternative posed by capital repairs is best summarized by comparing total capital repairs costs of groups of assets with their original investment costs over their lengthy service lives. The ratios are as follows: building—1.16, power machinery—1.11, production machinery—.95, and transport machinery—1.09.[38] Since for machinery, avearge service lives are now programmed for 12.2 years and

[31] M. I. Shkitina, Rasshirennoe vosproizvodstvo osnovnykh fondov, 1975, p. 66.
[32] S. Pokropivnyi, "Povyshenie effektivnosti remonta promyshlennogo oborudovaniia", Voprosy ekonomiki, February 1978, p. 39.
[33] Iu. V. Rebrov, Problemy ispol'zovaniia osnovykh proizvodstvennykh fondov, 1974, p. 76.
[34] Ibid., p. 72.
[35] A. I. Chernyi, Ekonomika remonta mashin i oborudovaniia, 1971, p. 23.
[36] Shneiderov, op. cit., p. 34.
[37] A. I. Chernyi, op. cit., p. 44.
[38] Kurenko, Palterovich, op. cit., p. 193.

their physical lives average only 7.3 years, at least one capital repair cycle is still required. If the above ratios exceed 1.0, additional repairs are required because of some combination of actual lives exceeding the already generous official service lives and of poor durability of equipment.

If the capital repair alternative delays the practical application of new technology and is wasteful in its use of scarce manpower and material resources, why have Soviet decision makers continued to give it heavy stress? The answers may be found in the pattern of incentives offered to managers in general and financial incentives with regard to capital repairs in particular. The general incentives issue will be discussed in a following section. As for financial incentives of investment choice, they have been skewed in the direction of capital repairs. Soviet enterprises are required to set aside a specified amortization allowances to replace capital that contributes to the production process. Amortization rates depend upon the official service lives for productive assets. The total amortization allowances are separated into separate earmarked funds for replacement investment and for capital repairs. Until the new depreciation rates and service lives were introduced in 1975, over half of the total allowance was allocated to capital repairs. In 1975 the capital repair proportion was reduced to 40 percent.

The higher capital repair allocations existing prior to the 1975 revisions were clearly excessive and distorted investment choices toward maintenance. In 1973 capital repair outlays in industry were 15 percent below such allocations and 50 below in construction.[39] Furthermore, much of the the expenditures were being wasted on low yield repairs.

Apparently the reduced 1975 capital repair amortization allocations are still too generous. In 1976 actual capital repairs for buildings exceeded allowances by 44 percent, but they fell considerably below allowances for other asset components—15 percent for transmission facilities, over 18 percent for machinery and equipment, and 18 percent for transport equipment.[40] This excess financial commitment is the counterpart to the earlier discussion as to the insufficient of amortization allowances designed for replacement, accompanied by official sanction to transfer funds from the capital repairs portion.

Institutional Environment—Planning and Incentives

Despite official intentions and the widespread support of planners and economists, the policy of greater emphasis upon replacement investment has shown minor progress. Explanations for such lagging performance may be found in the institutional environment, both in terms of planning practices and the system of managerial incentives. Apparently the elaborate planning procedures do not make explicit provision for replacement of obsolescent capital assets at either the central (Gosplan) or ministerial levels.[41] Long term planning is es-

[39] Ibid., p. 191.
[40] Zavalishchin, Masal'skii, op. cit., p. 69.
[41] A. Shneiderov, A. Shakhnazarov, "Sovershenstvovanie narodnokhoziaitvennogo planirovaniia rekonstruktivnykh rabot", Planovoe khoziaistvo, July 1978, p. 94.

sential if such capital replacement plans are to be sustained by production of the necessary technologically advanced production equipment. Replacement decisions have generally been responses to unexpected contingencies rather than as vital ingredients in preconceived plans.

In effect, replacement investments are the innovation decisions which represent the final stage of the research and development process.[41a] As such, they should be related to earlier stages. However, to date the Soviet research and development process has not been institutionally coordinated. Therefore, the pool from which appropriate technological innovations can be drawn has not been optimally determined by coordinated R&D planning, but is the chance result of uncoordinated domestic research and development efforts and of available foreign developed technology. Within this second choice pool of available technology, the possibilities of successful adaptation are further constrained by the frequent lack of provision in the plans for sufficient production of the equipment intended to replace obsolescent and retired assets. The equipment share in replacement investment is approximately double that for construction, the reverse of the proportions for new investment. A greater emphasis on replacement does not require a proportionate increase in machinery production because there is some substitution of replacement for new investment, but surveys have shown that past rises in the total investment share in favor of equipment have been matched by a proportionate rise in machinery production some two-thirds as large.[42] Between 1960 and 1975 the share of equipment manufacturing in the total production of goods and services necessary to support investment rose from 21 to 35 percent with commensurate decreases in the production shares of construction services and building materials.[43]

Soviet economists are skeptical as to the capability of the machine building industries to produce the equipment required, within the present planning context, to bring the replacement rate to a level which fully recognizes obsolescence, a rate nearly double the recent ones. As a dramatic example, a Soviet economist estimated that if the Soviet economy matched the U.S. replacement rate for metalcutting tools and stamping-pressing equipment, existing production capacity could sustain only 50 to 60 percent of requirements. In future years production capability would be even lower.[44]

If planning has not been structured to favor replacement investment, the existing system of managerial incentives further frustrates the desired policy. The economics of innovation incentives are discussed in the Schroeder-Greenslade contribution in this volume and in historical depth in scholarly monographs.[45] The consensus of research on this topic is that financial incentives for innovation are still weak compared with those for maximization of current production. Berliner has concluded that the several innovation bonus funds devised in recent

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[41a] For an explanation of the various stages of the research and development process and a definitive discussion of the innovation stage see Joseph Berliner, The Innovation Decision in Soviet Industry, MIT Press, 1976.

[42] N.I. Budunova, Effektivnost' kapital' nykh vlozhenii i rekonstruktsiia v promvshlennosti. 1978, p. 95.

[43] N. Solov'ev, Ekonomicheskaia gazeta, No. 49, December 1978, p. 10.

[44] I. M. Ivanov, "Proportsii rashirennogo vosprizvodstva v usloviiakh intensifikatsii" in K. K. Val'tukh, Problemy narodnokhoziaistvennogo optimuma, 1973, p. 235.

[45] Joseph Berliner, op. cit.

years do not compensate for the loss in the production bonus fund as production is disrupted to install replacement equipment.

A replacement decision is one which involves risk bearing by the manager who undertakes this action. His alternative of additional maintenance expenditures on obsolescent equipment do not expose him to the uncertainties of the production impact, especially in the near term, which adjustment to a new machine entails. Risk bearing for a Soviet manager is asymmetrical—he assumes all of the onus for failure, but does not reap the full rewards of success. The increase in his income is slight compared with that he would receive by meeting production targets using traditional production processes.[46]

An innovating manager confronts another barrier. Prices of new capital goods are usually higher than the assets they replace. This is a normal economic expectation, but in many instances the price differential between the old and new assets exceeds their productivity differential, sometimes blatently so. One economist cites the case of heavy machine tools in which prices of the new models were four times as high as those which they replaced, but were only 30 to 40 percent more ductive.[47] Although both Soviet and foreign economists have asserted that inflated prices on new equipment are a deterrent to replacement investment, it is not clear as to the degree to which such inhibitions prevail in actual practice. It is the impact on total productivity, not just that of the capital factor, which should influence production decisions. In addition, financial constraints have not been important determinants of managerial actions, as compared with physical shortages of productive inputs. Nevertheless, their negative influence should not be wholly disregarded.

In the crucial trade-off decision between extended maintenance and replacement, there are both real and financial biases which favor the capital repair alternative. As noted earlier, availability of replacement equipment depends upon coordination with production plans, a practive observed more in the breach than in compliance. On the other hand, as also noted earlier, spare parts are generally fabricated in enterprise repair shops, albeit at high cost. The financing bias is less clear. However, one scholar has observed that in the sixties capital repair amortization funds were under control of the enterprises, while the replacement funds counterpart was under the control of higher administrative echelons and, thereby, less accessible.[48] The same writer also claimed that since they were a continuous process, repair decisions were largely an enterprise responsibility, while decisions regarding investment were more centralized.[49] This differential access to accrued depreciation allowances apparently still prevails in the seventies. A recent source indicates that depreciation accruals designated for replacement are deposited with the Stroibank to the account of intermediate administrative echelons to be redistributed among all enterprises under their control. By contrast, the capital repair portion of the accrued allowances are deposited to the accounts of individual enterprises in the Gosbank where they remain at the disposal of the enterprises.[50]

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[46] Ibid., p. 445.
[47] T. V. Il'ina, "O finasirovanii zatrat na zamenii oborudovaniia", Finansy SSSR, August 1977, p. 45.
[48] Robert Campbell, Accounting in Soviet Planning and Management, 1963, p. 158.
[49] Ibid., p. 159.
[50] V. K. Senchagov, V. V. Ostapenko, V. A. Miliaev, Amortizatsionnyi fond v usloviiakh intensifikatsii proizvodstva, 1975, pp. 27–28.

In summary managerial incentives are tilted heavily toward maintenance of old assets and against their replacement, thereby hampering infusion of new technology.

Conclusion

Any significant future increase in productivity of capital and in the acceleration of technological progress is dependent upon a rising rate of replacement investment. The exhortations of the leadership, as reflected in the texts of the Ninth and Tenth Five-Year Plans, have not been matched with equally strenuous efforts to readapt depreciation guidelines, managerial incentives, investment planning, and coordination of the research and development process essential if the new investment strategy is to be achieved.

There have been initial policy changes in the apparent intention to reduce excessive investment project starts, in the reduction in standard asset lives, and in the reordering of depreciation allowances in favor of replacement rather than capital repairs. However, asset lives are still too lengthy if economic obsolescence is to be fully recognized and the portion of amortization allowances earmarked for capital repairs is still too generous. These necessary reforms could be implemented without disruption to the existing economic organization.

More sweeping changes lie ahead. The planning process must make explicit provision for replacement expenditures and these plans must be accompanied by appropriate production directives to the machine building sectors. This requirement will impose a greater burden on Gosplan, but does not imply any divergence from traditional resource allocation processes. However, investment decisions cannot be simply ordered from on high, they must also be implemented through suitable managerial incentives. Since a replacement investment decision is essential a risk venture for a manager, there must be sufficient incentive for him to assume the risk rather than choose the more certain alternative of continuing current production methods, albeit at the cost of heavy maintenance expenditures. In order to attain this requirement, fundamental reforms will be necessary in the environment in which a manager operates. Heretofore, Soviet leaders have shown little flexibility in their receptivity to significant organizational changes of this scope. Replacement investment would be qualitatively improved if there were closer coordination in the research and development process so that efforts could be focused on technical advances of maximum potential benefits to the ultimate users.

The institutional changes required to obtain greater return from the economy's investment efforts are similar to those needed for overall productivity improvement. Technology is a key ingredient if growth is to be maintained in the face of tightening resource constraints. Although the leadership vehemently voices this theme, they have not shown any inclination to undertake the institutional reforms necessary for its full implementation.

SOVIET–EASTERN EUROPEAN ECONOMIC RELATIONS, 1975–78

(By Martin J. Kohn*)

CONTENTS

TABLES

I. INTRODUCTION

This paper will deal with the Soviet Union's economic relations with Eastern Europe since early 1975, when substantial price changes were introduced in intra-COMECON trade.[1] Those price changes altered the Soviet Union's terms of trade vis-a-vis Eastern Europe as a whole sharply in the USSR's favor, though the impact varied markedly from country to country.

One objective of the paper is to explore what the Soviet Union has done to mitigate the adverse effects on Eastern Europe of the price overhaul it instigated almost four years ago. It will also investigate what other ends Soviet aid measures have been designed to serve. (The term aid in this paper will be used loosely in that it includes loans even in the absence of evidence that the loans are on concessionary terms.)

Another question to be examined is whether the period since early 1975 has been characterized by a substantial tightening of Eastern Europe's economic ties to the Soviet Union. More precisely, have Soviet aid, and developments such as increasing difficulties in trading with the West, led to what is often referred to as a "turning in-

*I would like to express my appreciation to four people who have been particularly helpful in the preparation of this article: Joseph C. Kramer and Irene B. Jaffe, who offered valuable comments on the text; Shauna Abdalla, who performed numerous calculations and typed the manuscript in her customary speedy and impeccable manner; and John R. Patton, who did the necessary computer work most efficiently.

[1] Eastern Europe refers to Bulgaria, Czechoslovakia, East Germany, Hungary, Poland and Romania. These countries will also be referred to as "the six." Eastern Europe plus the Soviet Union are referred to as the East or the Warsaw Pact countries.

ward," distinguished by a significant reorientation of Eastern European trade back toward the Soviet Union (and Eastern Europe itself) and by other manifestations of intensified economic integration with the USSR.

My chief conclusions are: (1) the USSR has extended substantial amounts of aid to Eastern Europe in the form of trade surpluses; but (2) there is no one-to-one correlation between such aid and the terms of trade effects of the 1975 price changes; (3) furthermore, how much *net* aid the USSR has extended is uncertain, in view of an apparently considerable flow of Eastern European credits to the USSR in recent years; and (4) the last four years do not appear to have been marked by any dramatic turn toward closer Soviet-Eastern European economic ties, beyond what was already in the works before 1975.

II. The 1975 Price Changes

Much has been written about the price changes of 1975, so the basic facts will be only briefly summarized here.[2] Intra-CEMA trade prices were supposed to be governed or guided during the 1971–75 period by averages of so-called world prices for the 1965–69 period. However, in early 1975—a year ahead of schedule—CEMA trade prices were revised at Soviet instigation. Prices for 1975 were to be based on averages of world prices for the preceding five years for most goods and, temporarily, for the preceding three years for a few goods, notably oil.

The 1975 overhaul not only updated the reference period but it also scrapped the previously prevailing principle under which intra-CEMA trade prices for a given five-year period were to be based on prices from some fixed preceding period. In 1975, a new formula was introduced, according to which, in theory, CEMA trade prices would be changed each year and would be based on world prices of the immediately preceding five years. (Those prices that in 1975 were set according to the average of the preceding three years were to switch to the five-year base in 1976.)

The premature abandonment of the 1965–69 reference period and the institution of a new formula as well as of a new base period were attributable to the price movements of the 1970s in the non-communist world. These had driven intra-CEMA trade price relationships drastically out of line with world price relationships, with a very high opportunity cost for the USSR. The largest and most significant gap that emerged was between the CEMA and world prices for oil. With the huge jump in oil prices in 1973 and 1974, oil became the USSR's largest hard currency earner by far. Thus the opportunity cost to the Soviets of oil sold to Eastern Europe—which obtains most of the oil it consumes from the USSR—became immense.

III. The Terms of Trade Effects of the 1975 Price Changes

According to calculations the author has made employing unit values as proxies for prices, the Soviet Union's terms of trade vis-a-

[2] See, for example. Martin J. Kohn and Nicholas R. Lang, "The Intra-CEMA Foreign Trade System: Major Price Changes, Little Reform," East European Economies Post-Helsinki.

vis the Eastern European six improved by about 11 percent from 1974 to 1975 when changes in unit values are weighted by 1974 trade values. The improvement recorded was about 14 percent when 1975 trade value weights were applied. The range of changes with respect to individual countries was wide. The most adversely affected of the six, the computations show, were the GDR and Czechoslovakia. The GDR's terms of trade vis-a-vis the USSR deteriorated by 21 percent with 1974 weights, by 25 percent with 1975 weights. For Czechoslovakia, the deterioration was 15 and 19 percent. Least affected were Poland and Romania. The terms of trade of both countries worsened by only 2 percent with 1975 weights. With 1975 weights, the figures were 4 percent for Poland, 5 percent for Romania. In the middle were Bulgaria and Hungary. The deterioration with 1974 trade value weights was 7 percent for Bulgaria, 10 percent for Hungary. With 1975 trade value weights, the figures rise to 12 and 16 percent, respectively.

Calculations with the same method for 1976—using 1974 and 1976 weights—imply that, essentially, the USSR's terms of trade with respect to the six stayed about the same in 1976 compared to 1975. The figures actually indicate a slight deterioration—about 1 percent—in the USSR's position. But given the shortcomings of both the method and the data, one cannot consider this evidence of deterioration as statistically significant.

Once again, the movements from 1975 to 1976 for individual countries—as implied by the calculations for 1974 to 1976 changes—appear to have varied widely. From 1975 to 1976, Soviet terms of trade appear to have improved substantially vis-a-vis Romania and Bulgaria—by 13 and 10 percent when 1974 value weights are applied. A slight improvement for Moscow vis-a-vis Czechoslovakia—3 percent—is indicated. Deterioration of 3, 5, and 7 percent is indicated for Hungary, Poland, and the GDR, respectively.

In comparing 1976 with 1974, all six Eastern European countries but one were in a worse position with respect to their terms of trade vis-a-vis the USSR. Using 1974 trade value weights, deterioration was as follows: Bulgaria and Czechoslovakia, 18 percent; Romania, 15 percent; GDR, 13 percent; and Hungary, 7 percent. Only Poland's position seems to have improved—by 3 percent with 1974 value weights. Using 1976 trade value weights changes the figures only moderately—in the expected upward direction—except for Hungary, for which a sizable rise to 18 percent was recorded (see table 1).

Because data inadequacies were even more serious in 1976 than previously, the amount of confidence one can place in the findings, particularly for individual countries, for 1976 is not great.

No calculations were made for 1977, owing to lack of data. Soviet trade statistics are the source of the figures from which unit values are calculated, and the trade statistics for 1977 so drastically reduced the data for the physical quantities of goods exported and imported that construction of meaningful export and import price indices was rendered impossible. However, it is likely that the Soviet Union's terms of trade moved to its advantage in 1977.

TABLE 1.—SOVIET-EASTERN EUROPE TERMS OF TRADE, 1976 VIS-A-VIS 1974

[1974=100]

	Soviet export prices		Soviet import prices		Terms of trade index	
	1974 weights	1976 weights	1974 weights	1976 weights	1974 weights	1976 weights
Bulgaria	153	165	130	138	118	120
Czechoslovakia	155	165	132	135	118	123
German Democratic Republic	159	166	141	147	113	113
Hungary	151	164	140	139	107	118
Poland	154	165	159	166	97	99
Romania	159	167	139	146	115	115
6 countries combined	155	165	141	146	110	113

The main reason is the movement in the price of oil in CEMA trade. In 1975, the unit values for Soviet oil exports to the five Eastern European countries—taken collectively—to which the USSR ships oil (Romania is the lone non-oil importer) rose by 89 percent. In 1976, however, the rise was only 9.4 percent. This is very close to what was called for by the new moving-average formula. The average world price that seems applicable to Soviet oil exports to Eastern Europe was about 8 percent higher in 1971–75, the period for determining the 1976 price, than in 1972–74, the interval on which the 1975 price was supposed to be based. The relatively small increase in the oil price in 1976 was a major contributing factor to the apparent stability of Soviet terms of trade vis-a-vis the six as a whole in 1976. In 1977, however, according to the formula, the oil price should have risen by about 30 percent (the increase in what appears to be the applicable price from the average in 1971–75 to the average in 1972–76).

If one assumes that: (a) all prices in Soviet trade with Eastern Europe moved in relation to each other from 1976 to 1977 as they had from 1975 to 1976; and (b) the unit value for oil exports was 22 percentage points higher in 1977 than in 1976 (as the formula suggests would be the case), then—with 1974 trade value weights—the terms of trade would have moved by 4 percent in Soviet favor in 1977.

What actually happened in 1977 is not known, since information on how unit values for Soviet oil exports changed is lacking. In fact, they may have risen slightly less than the formula indicates, since in the case of Hungary, the Soviets were planning to increase the oil export price in 1977 by only 22½ percent rather than 30 percent. Nor is there information on how unit values of other goods changed in 1977. But it seems probable that prices of Soviet oil exports to Eastern European countries rose much more steeply in 1977 than in 1976. There is thus a presumption that the terms of trade moved more favorably from Moscow's standpoint in 1977 than the year before.[3]

[3] Making use of the official Soviet indices for the physical volume of Soviet trade with all CEMA countries (not just the Eastern European six) and of the official Soviet figures for the value of Soviet trade with CEMA countries, one can compute alternative terms of trade indices. The change in the Soviet Union's terms of trade vis-a-vis the rest of CEMA computed in this fashion is 4 percent—the same change considered as a plausible estimate for 1977. However, not only does the index computed with the official volume index apply to a larger group of countries but it differs also with respect to weights used. The national estimate of a 4 percent improvement in Soviet terms of trade last year used 1974 value weights. The estimate of a 4-percent increase derived from the official volume indices involves dividing value indices by those volume indices in order to derive prices indices. As explained in Kohn-Lang, Eastern European Economies: Post Helsinki, p. 142, this results in the price indices being weighted by terminal year—in this case, 1977—values. It should also be noted that the terms of trade index using official volume figures derived for 1976 differs substantially from the terms of trade changes computed from disaggregated data on the value and volume of Soviet trade. The terms of trade changes from 1975 to 1976 implied by the official volume and value indices was a 5 percent rise in the USSR's favor. As indicated on p. 247, the author's indices suggest a slight deterioration.

A few key points about the method used in constructing the terms of trade indices and about the data used in the indices are presented in the Appendix.

IV. Soviet Aid Since 1974

The price changes of early 1975 must have jolted the economies of Eastern Europe, or at least the four of them whose terms of trade vis-a-vis the USSR deteriorated sharply. Unlike the USSR, these countries are not self-sufficient, and for all of them the Soviet Union is the largest trading partner. Except for Romania, all of these countries trade more with the USSR than with each other. The share of the Soviet Union in total trade is over 50 percent for Bulgaria, in a range of from slightly less than 30 percent to slightly less than 35 percent for Czechoslovakia, the GDR, Hungary and Poland, and a not negligible slightly-less-than-20 percent for Romania.

The Soviets promised aid at the time of the price changes, announcing that they stood ready to extend 10-year loans on generous terms to Eastern European countries. Indeed, the Soviets apparently did promptly provide loans—though on what terms we do not know—through substantial trade credits. Evidence that such credits were extended is provided by the large trade surpluses the Soviets ran with Eastern Europe in 1975–77 and through the first three quarters of 1978. In the fourth quarter of 1978, the USSR's trade as reported by official Soviet statistics suddenly moved into deficit—and a very large deficit at that. The abrupt switch from surplus to deficit at the end of 1978 will be discussed in the following section.

The surplus in 1975 was 555 million rubles, up sharply from a 105 million ruble positive balance in 1974. The surplus then steadily rose to 880 million rubles in 1976 and 1,414 million rubles in 1977. The surplus through the first three quarters of 1978 totaled 1,292 million rubles, 25 percent higher than in January-September 1977. The total surplus for the three years and nine months was 4,142 million rubles, an annual average of 1.1 billion rubles.

It should be stressed that we do not know what portion of the post-1974 surpluses were credits. Indeed, we cannot be absolutely sure that they were net credits at all.[4]

Uncertainty arises because:

A part of the trade surpluses may have been offset by deficits on the unreported invisibles transactions between the Soviet Union and its Warsaw Pact partners.

Part of the surplus might reflect debt repayment rather than credit extension. As table 2 shows, the U.S.S.R. had been substantially in the red in its trade with Eastern Europe in 1972 and 1973. (Table 2 appears at end of text.)

There appears to have been a sizable flow of credits from Eastern Europe to the Soviet Union in 1975–78, in the form of financial and real resource flows, largely to help build the Orenburg pipeline. (See next section.)

However, the U.S.S.R.'s promise to extend credits coupled with the very large magnitude of the surpluses and the prolonged period over which they continued strongly imply that they were intended to help ease Eastern Europe's economic burden. A prime Soviet motiva-

[4] To the extent that they are credits, much still remains obscure. Information on when, how, and in what form repayment is to be made is unknown.

tion in allowing these surpluses must have been to hold down the severe reduction in imports and/or rise in exports by Eastern Europe that insistence on balance in the wake of the 1975 price changes would have necessitated.

It is interesting to see how these surpluses have been distributed among countries for the period as a whole and year by year.

By far the biggest surplus for the entire three year, nine-month period was with the GDR. At 1,745 billion rubles, it was over twice as great as the U.S.S.R.'s second largest surplus, 794 billion rubles with Poland. The surpluses with Czechoslovakia, Bulgaria, and Hungary were 708 million, 698 million, and 419 million, respectively. Romania—the Eastern European maverick—ran a surplus with the Soviet Union of 223 million rubles.

The surplus with the GDR was the largest for all Eastern European countries in each year 1975–77 and in the first three quarters of 1978 as well. Poland ran very substantial deficits in 1976 and 1977, Bulgaria in January–September 1978.

These results are of course influenced by the size of the Soviet Union's trade turnover with individual countries in any given year and by changes in Soviet trade turnover from year to year. However, abstracting from these effects by taking the trade balance as a proportion of trade turnover does not significantly alter the picture. The normalized Soviet surplus with the six together steadily rises, from 2.4 percent in 1975 to 5.4 percent in January–September 1978. For the period as a whole, the GDR deficit with the U.S.S.R., at 7.3 percent of turnover, is by far the largest. Czechoslovakia (4.0 percent), Bulgaria (3.9 percent), and Poland (3.8 percent) follow. The Hungarian ratio was 3.0 percent. The Soviet deficit with Romania equaled 3.4 percent of turnover.

The rankings of the normalized balances within years are also revealing. In 1975, the order very closely approximates the ranking of the six by amount of terms of trade deterioration vis-a-vis the U.S.S.R.[5]

In 1976, the normalized trade balance ranking changed, with Poland moving into the second spot and the other four countries each dropping down a notch. The 1977 ordering stayed the same. The surplus/turnover ratio was over 5 percent for Poland in both 1976 and 1977. The terms of trade movements were much different in 1976. Furthermore, the close correlation between the size of the normalized Soviet trade surplus and the extent of terms of trade deterioration disappeared.

The ordering in the first nine months of 1978 changed considerably. The highest surplus/turnover ratio was with Bulgaria (7.3 percent), followed by the GDR (6.7 percent), Hungary (6.6 percent) and Czechoslovakia (5.7 percent). Poland's ratio fell sharply to 3.4 percent. Unplanned shortfalls in Soviet deliveries to Poland may be the prime explanation.

The most striking feature of the Soviet trade balance with Eastern Europe in the 1975–78 period is the huge surplus with the GDR.

[5] The terms of trade ranking in 1975, in descending order of deterioration, was GDR, Czechoslovakia, Hungary, Bulgaria, and—almost identical—Romania and Poland.

Why did the Soviet Union evidently lend such large sums to the GDR? The answer would seem to lie in a combination of GDR strengths and weaknesses which gives it considerable leverage over the USSR. The GDR is the Soviet Union's largest Eastern European trading partner and furnishes the Soviets mainly finished manufactures, including large quantities of presumably high quality machinery and equipment. Thus the USSR has a strong interest in doing nothing to disrupt the GDR economy. And the GDR's economic strength gives it considerable bargaining power in dealing with the Soviets. It is significant that the GDR continued to run a large deficit with the Soviet Union in 1976 even though its terms of trade vis-a-vis Moscow appear to have improved somewhat. Indeed, the 1976 terms of trade improvement may itself have been evidence of GDR bargaining power in the annual price negotiations.

The GDR's bargaining power is also a function of weakness, of its political vulnerability resulting from its proximity and close involvement with the FRG. The contrast between the GDR and FRG economies is obvious and painful enough for both the Soviet Union and the GDR, and neither country presumably wishes to risk making the contrast any starker, and the potential for discontent among the East German public any greater, by weakening the GDR economy.

The large amounts of credit apparently extended to Poland in 1976–77 may reflect mainly the leverage of weakness that Poland can exert on the Soviets. The Soviet trade credits extended in 1976 may have been associated with growing concern over Poland's financial problems with the West. Western financial circles were already becoming apprehensive over the Polish debt in 1976, and Soviet trade credits in 1976 may have been part of an effort to facilitate Polish efforts to step up exports to and curtail imports from the West.

The large 1977 credits and perhaps those in 1976, too, probably indicated a Soviet effort to help ease economic strains in Poland in the aftermath of the mid-1976 disturbances triggered by the abortive price increases. The threat of a financial debacle and/or widespread, serious internal unrest ignited by economic malfunctions is doubtless a powerful spur to the Soviet Union to aid Poland.

In late 1976, the USSR announced that it was extending a one billion ruble credit to Poland. No details about the credit were disclosed, but presumably it has been reflected in subsequent USSR trade surpluses. Interestingly, the Soviet surplus with Poland decreased sharply in January-September 1978, to only 164 million rubles.

The steep rise in the Bulgarian ratio in 1978 could also be a reflection of Soviet assistance to a country in financial difficulties with the West. Bulgaria's hard currency debt has increased very rapidly, and its debt service ratio is second only to Poland's.

It should be emphasized that generalizations about the pattern of Soviet trade imbalances vis-a-vis Eastern Europe are tentative. There is no direct evidence that Moscow has deliberately tailored the size of Soviet trade surpluses with individual countries to serve specific economic and political goals. Furthermore, the ranking of ratios can only be partially explained, in any plausible manner, by policy considerations. In addition, random and unforeseen factors doubtless

affect trade balances, too.[6] However, there does seem to be some indication of a correlation between the size of normalized surpluses and the bargaining power of individual Eastern European countries stemming from their political and economic strengths and weaknesses.

Trade credits through trade imbalances are only one form of aid that the Soviets can provide. It has been rumored, for example, that the Soviet Union has from time to time extended direct hard currency loans to Eastern European countries in difficulty with Western creditors. It is also rumored that the International Investment Bank (IIB) makes hard currency loans to Eastern European countries for balance of payments purposes. It can be argued that such loans, if they do take place, are really Soviet loans, since the IIB, though nominally a supranational organization, borrows and lends only at Soviet direction.

V. Soviet Trade Deficit in the Fourth Quarter 1978

In the fourth quarter of 1978, the USSR ran a 1,123 million ruble deficit with Eastern Europe, almost as large as the 1,292 million ruble surplus in the preceding nine months. The sudden emergence of a huge surplus resulted from a surge in Soviet imports, which were 54 percent higher than in the fourth quarter of 1977. Exports by contrast were only 10 percent greater. The rise in exports was in line with the increase earlier in the year, 11 percent from January–September 1977 to the same nine months in 1978. The rise in imports between these two intervals was 10 percent.

No official explanations have yet been offered. It seems most unlikely, though, that Soviet imports rose by anything approaching the reported increase. Even without the harsh winter conditions that commenced before the end of the year, such a jump presumably would have imposed unacceptable economic strains on Eastern Europe and created insurmountable logistic problems for all concerned. There have been no reports of price changes, nor were any expected, that could explain the leap.

Presumably, therefore, much of the increase is an accounting phenomenon, reflecting the recording in the fourth quarter of accumulated resource flows from Eastern Europe to the USSR. One plausible though purely speculative explanation is that the fourth quarter figures include a tally of some of the goods and services Eastern Europe provided to the construction of the Orenburg pipeline. A joint Soviet-Eastern European project begun in 1975 and completed in 1978, the pipeline, stretching 2,750 kilometers from the Urals to the Czechoslovak border, is supposed to provide Eastern Europe with 15.5 billion cubic meters of gas annually from 1980 to 1990. Eastern

[6] In this connection, it should be understood that before 1975 balance, year in, year out, was not the norm. First, it is unlikely that the bilateral trade agreements between the U.S.S.R. and its CEMA partners called for balance each year even in the less economically turbulent period before 1975 (though balance over the long run was, and probably still is, expected or sought). Furthermore, random or unplanned factors presumably would prevent balance even where balance is intended. However, the recent surpluses are much different from what might ordinarily be expected. For example, in the three years 1975–77 for Eastern Europe minus Romania (dropped from this particular calculation as an anomalous case), the unweighted average of the fifteen ratios—consisting of three annual ratios for each of five countries—of the Soviet trade surplus to the U.S.S.R.'s total trade turnover with the given country in the given year was .038. This was almost twice as large as the —.021 unweighted average for the ratio of Soviet trade balance to trade turnover for the same five countries in 1971–74. (Both of these ratios are different from zero by a statistically significant margin, but the degree of significance is much greater in the case of the .038 ratio.)

Europe contributed to the building of the line through loans, equipment exports, and, for some countries, by providing manpower.

The value of these "accounting" imports in the fourth quarter can be estimated as about 1.6 billion rubles. This figure was computed by applying the percentage change in imports for the first three quarters of 1978 from the same period in 1977 to actual 1977 fourth quarter imports from each Eastern European country. The "hypothetical" import figure thus calculated was then subtracted from the reported fourth quarter import total for each country. The residuals were then summed to yield an estimate of "excess imports." [7]

The 1.6 billion rubles thus computed (about $2.4 billion at current exchange rates)—if indeed it does reflect contributions to Orenburg—should be added to known Eastern European assistance to the Soviet Union in connection with the pipeline. The International Investment Bank raised $2.5 billion in syndicated loans for the project. These funds were then lent to Eastern European countries, which, in turn, made them available to the Soviet Union. Moscow then used the money to purchase equipment in the West.

These loans, and all other Eastern European contributions to Orenburg, are credits to be repaid by exports of Soviet natural gas. But the syndicated loans still leave Eastern Europe saddled with a hard currency liability to the West, via the IIB.

The funds and resources provided by Eastern Europe to Orenburg serve as a reminder that the Soviet trade credits discussed in the previous section should not be viewed as net credits.

VI. Little Evidence of "Turning Inward"

There has been widespread speculation in recent years among Western observers that the countries of Eastern Europe would have to tighten their economic ties with each other and, most important, the Soviet Union. Such speculation has stemmed in large measure from the price changes of 1975 and Eastern Europe's sizable trade deficits with the West.

The prognosis of an economic "turning inward" by the East reflects the following assumptions:

> Eastern Europe is unable to rapidly expand its exports to the West because of sluggish Western demand, concomitant strengthening of Western protectionism, and lack of competitiveness in Western markets. In order to reduce or eliminate their hard currency trade deficits, and thus keep their rapidly mounting hard currency debts within manageable bounds, the Eastern European countries must therefore curtail their imports from the West. Consequently, Eastern Europe will have to turn to the Soviet Union for goods that, under more propitious financial circumstances, it would buy in the West.
>
> Because of adverse terms of trade movements resulting from Soviet directed price changes, Eastern Europe would have to ship a larger proportion of its exports to the Soviet Union in return for needed imports.

[7] Romania was excluded from the calculation. Consistent with Romania's role of odd man out in Eastern Europe, Soviet imports from Romania fell in the fourth quarter, resulting in a Soviet trade surplus.

To the extent that the USSR eased, at least temporarily, these pressures on Eastern European economies—through credits, for example—Moscow could compel Eastern Europe, by way of repayment, to broaden its participation in so-called integration programs desired by the Soviet leadership for economic and/or political reasons.

Evaluating the turning-inward hypothesis is difficult. Determining: (a) The elements that constitute economic ties; (b) how to rank them according to importance; and (c) how to measure changes in the degree of tightness of various types of economic links presents formidable, in some respects insoluble, problems. However, despite the impossibility of a definite or fully satisfactory assessment, the available evidence, fragmentary and ambiguous as much of it is, suggests (a) no significant strengthening of intra-East economic ties or of Eastern European economic dependence on the Soviet Union has taken place and (b) no such strengthening seems likely in the foreseeable future.

A. Trade: Eastern Europe

Eastern Europe's trade—obviously a key element in assessing the turning-inward thesis—does not appear to have shifted markedly toward the USSR or Eastern Europe itself since 1974. Analysis is handicapped by the limited amount of Eastern European trade data in real terms. Constant price series (and these of unknown soundness) are available only for Hungary, Poland and the GDR, and only through 1977. But these physical volume data, supplemented by more comprehensive and up-to-date figures in current prices, indicate that the share of Eastern European trade accounted for by the USSR and by Eastern Europe itself did not change significantly in 1974–76, probably rose fairly sharply in 1977, but apparently fell back again in 1978.

According to official data, changes in Hungary's physical volume of trade have been marked by sharp fluctuations since 1974. But the division of trade between socialist and non-socialist countries seems to have been much the same in 1977 as in 1974.[8] In 1977, real exports to socialist countries were 18 percent higher than in 1974, real exports to non-socialist countries—19 percent higher.[9] The corresponding figures for imports in constant prices are 28 percent and 23 percent.

In Poland, the share of trade measured in real terms with socialist countries actually fell in 1974–76—as calculated in 1970 prices by a Western economist—from 67 to 65 percent for exports, from 54 to 50 percent for imports.[10] In 1977, however, the downward movement was reversed, very sharply in the case of imports. There was no change in real exports to non-socialist countries in 1977. Such exports to socialist countries rose by 13 percent. As for Poland's real imports, there was a 19 percent rise vis-a-vis socialist countries, an 11 percent decrease vis-a-vis non-socialist countries. As a result, the share of Polish trade with

[8] There is no breakdown in the constant price series for any of the three countries within either the socialist or non-socialist categories. However, since Eastern Europe and the U.S.S.R. account for the bulk of the trade of all three countries, the socialist category is presumably a reasonable proxy for the Warsaw Pact countries alone. But the movements in socialist country trade obviously tell nothing about the six's trade with each other vs. their trade with the U.S.S.R.

[9] See Statistical Yearbooks. Hungarian Central Statistical Office.

[10] See Discussion Paper Series, Department of Economics, University of Windsor, Zbigniew M. Fallenbuchl, "Policy Alternatives in Polish Foreign Economic Relations," Serial No. 55, pp. 35–36.

socialist countries rose considerably—to 68 percent in the case of exports, to 57 percent in the case of imports.

The turnabout in 1977 was the result of Poland's efforts to reduce its hard currency trade deficit in order to bring its external financial position under control.

Official GDR figures on total trade turnover in real terms show a faster rate of increase in trade with non-socialist countries than the socialist world in 1974–76—23 percent vs. 12 percent. In 1977, however, real trade with non-socialist countries fell by 10 percent. It rose by 10 percent with socialist countries. 73.5 percent of GDR trade, measured in 1970 prices, in 1977 was with socialist countries. The share in 1974 had been 75.5 percent.[11]

Data in current prices after 1975 are roughly consistent with the patterns traced by the constant price figures. The huge jump in the share of Eastern European trade accounted for by Warsaw Pact countries in 1975 was of course due to the enormous price increases in intra-CEMA trade that year and thus sheds no light on changes in real shares. (Similarly, the steep increase in the non-socialist proportion of Warsaw Pact country trade in 1973–74 was due to a very high rate of inflation in the non-socialist world at a time when CEMA prices were for the most part stable.) After 1975, however, there do not appear to have been any huge differences in price movements in the socialist and non-socialist worlds. Thus current price data can be informative.

As measured in current prices, the share of the six's exports accounted for by the USSR fell from 34.5 percent in 1975 to 32.8 percent in 1976.[12] The proportion of intra-Eastern European exports rose slightly, from 27 to 28 percent. In 1977, the share of exports to the Soviet Union rose to 33.5 percent. Data on the proportion of exports within Eastern Europe are incomplete but the available statistics indicate a slight decline may have occurred.

Eastern Europe's imports from the USSR were 31 percent of the total in 1976, down slightly from 31.8 percent in 1975. In 1977, there was a substantial increase, to 33.6 percent. The share of imports within Eastern Europe apparently declined moderately.

Preliminary data imply a possible decline in the East's share of Eastern European trade in 1978. Eastern Europe's trade with the developed West, after increasing only marginally in 1977, rose sharply in 1978, more rapidly than in any year since 1974. The six's exports to the West advanced by 14 percent, imports by 13.6 percent. As noted, Eastern Europe's imports from the USSR increased somewhat less, by 11 percent. Exports to the USSR also rose at a slower pace—by about 10 percent—if one excludes those fourth quarter Soviet imports that appear to have been an accounting phenomenon rather than representative of real flows of goods.

B. Trade: Soviet Union

As for the Soviet Union itself, the official indices of the physical volume of trade suggest some reorientation of its trade Eastward since

[11] See Statistisches Jahrbuch der Deutschen Demokratischen Republik.

[12] Current price figures are taken from CIA's unclassified, "Handbook of Economic Statistics."

1976.[13] In 1974–76, trade with the West rose much faster than trade with communist countries. Exports in constant prices to the socialist world and the CEMA component of it were 5.3 and 3.9 percent higher, respectively, in 1976 compared to 1974.[14] Exports to the rest of the world in real terms rose by 23.3 percent in these two years. Soviet imports from socialist countries and the CEMA nations among them increased by 13.0 and 11.3 percent, respectively, in 1974–76, far below the 44.2 percent rise in imports from the rest of the world in the same period.

In 1977, exports to the non-socialist world continued to rise more rapidly than those to the socialist world. The increases were 8 percent to socialist countries as a whole, 8.2 percent to CEMA countries and 11 percent to the rest of the world. But imports from the rest of the world fell by 6.3 percent in 1977, while growth in real imports from socialist countries accelerated to 9 percent, with a 9.5 percent rise in purchases from CEMA countries. (The decline in imports, we know from current price data, reflected a drop in non-grain as well as grain imports.)

Official current price figures for 1978 show a resumption of growth in imports from non-socialist countries. But the rate of increase was only 7 percent, lower than the rate for imports from socialist countries even when an adjustment for fourth quarter imports from Eastern European countries is made. Exports to the non-socialist world in 1978 grew by 2.1 percent compared to 11.5 percent to socialist countries.

For the Soviet Union, alternative, non-official constant price measures of trade are available. An index of hard currency trade in real terms prepared by Paul G. Ericson and Ronald S. Miller shows the same pattern—even though the specific rates of change differ markedly—as the official index (which covers all non-socialist trade not just that in hard currency).[15] Real hard currency exports rose by about 30 percent in 1974–76, with growth then falling off to 2 percent in 1977. Imports in constant prices rose by 63 percent in 1974–76, then declined by 16 percent in 1977.

With respect to socialist countries, using the price indices for exports and imports constructed by the author on the basis of unit values, changes in Soviet trade with the six in 1971–74 and 1974–76 were calculated. In 1974 prices, Soviet trade with Eastern Europe grew by 6½ percent a year in 1971–74 but changed hardly at all in 1974–76.

According to these calculations, Soviet exports, in 1974 prices, to Eastern Europe fell by about 4 percent in 1975, then rose by about 1 percent in 1976. Soviet imports in 1974 prices rose by nearly 3 percent in 1975, then declined by a little more than 1 percent in 1976. Thus in 1976 compared to 1974, Soviet real exports to Eastern Europe were about 3 percent lower, Soviet real imports from Eastern Europe about 1 percent higher.

These calculations suggest that not only did Soviet trade with Eastern Europe grow less rapidly than with the rest of the world—as the

[13] Constant price trade indices appear each year in the Soviet handbook of foreign trade statistics, Vneshnyaya Torgovlya.

[14] The U.S.S.R.'s trade with Eastern Europe accounts for about 90 percent of its trade with CEMA.

[15] See their article, "Soviet Foreign Economic Behavior: A Balance of Payments Perspective," in this volume.

official indices also imply—but that Soviet-Eastern European trade actually stagnated.

The reorientation of Soviet economic activity away from the West after 1976, as reflected in the trade statistics, has, at least to date, been marginal. The curtailment of imports that underlies the shift in trade patterns has been part of a successful effort to reduce the huge hard currency trade deficits of 1975 and 1976 and is also a reflection of Soviet difficulties in absorbing the goods it has been importing. Despite the curtailment, however, the share of both exports and imports accounted for by the non-socialist world in constant prices, according to the official indices, appears to be higher than it was in 1974.

C. Other Aspects of Economic Relations

There does not appear to have been any significant tightening of ties with respect to other aspects of Soviet-Eastern European economic relations since 1974. Despite the realization that East-West trade could not expand at the very rapid rate of the first half of the 1970s—indeed, might have to cease expanding altogether—no significant initiative has been undertaken to conduct Soviet-Eastern European or intra-East economic relations in a more efficient, integrated manner. Coordination of national economic plans appears to remain negligible, as do multilateral arrangements in trade and other economic activities. Bilateral dealings still predominate.

Bilateralism is apparently the prevailing mode even in so-called specialization and cooperation agreements. A Soviet press article in April 1979 said the USSR was taking part in 125 bilateral and 84 multilateral such arrangements.[16] One would think, particularly as regards production specialization, that multilateralism would be the rule, assuming that the objective of such arrangements is to avoid duplication of effort and maximize efficiency. Production specialization agreements are often cited by the Soviet and Eastern European commentators as examples of successful economic integration and of the progress that is allegedly being made toward greater integration. The agreements are generally of an intra-industry character, with individual countries being assigned the task of producing a specific product or product component in a given industry. How effective or important to the economies of the East these agreements are is difficult to gauge. The number of these agreements is often mentioned and statistics cited to show that they account for a significant amount of economic activity. For example, about 30 percent of intra-CEMA trade in machinery and equipment is supposedly covered by specialization agreements.[16a] However, such statistics do not indicate how much overall production is covered by these agreements, how well they work out in practice, how much specialization is actually carried out, to what extent the agreements may apply to already established production patterns, etc. There is at least room for skepticism about the effectiveness of specialization agreements. For example, an Eastern European official told the author that a product his country produced very well was assigned under a specialization agreement to another country. The other country then proceeded to keep high quality output for itself, passing low quality items to its CEMA partners.

[16] See *Economicheskaya Gazeta*, No. 15, April 1979.
[16a] *Pravda*, April 14, 1978.

D. "Special Long-Term Cooperation Programs"

With respect to the future, the USSR is currently pressing Eastern Europe to implement a series of joint development schemes first proposed in 1976. These so-called special long-term cooperation programs call for coordinated Soviet-Eastern European investment and production, carried out through bilateral as well as multilateral arrangements, in five broad areas: fuels, energy and raw materials; agriculture; machine building; transport; and consumer goods. At the 32nd CEMA session in Bucharest in mid-1978, the Soviets urged rapid formulation of concrete plans in the first three of these areas so that operations could be initiated in the five-year plans commencing in 1981. At Bucharest, the USSR laid the most emphasis on joint development of atomic energy facilities, the most specific proposals relating to nuclear power.

The long-term cooperation programs, as envisioned by the Soviets, would appear to involve substantial amounts of investment in projects on Soviet territory. Joint investment projects in the USSR have been perhaps the major form of cooperative CEMA activity. There are several such projects being carried out during the current Five-Year Plan period. The major ones, in addition to the Orenburg pipeline (the largest), include asbestos mining facilities at Kiembayev, a cellulose plant at Ust Ilim, and the recently completed electric power transmission line from Vinnitsa in the Ukraine to Albertirsa in Hungary. Investment in joint projects in 1976–80 is scheduled to total 9 billion rubles, half by the USSR, half by other CEMA members.[17] 4.5 billion rubles would equal perhaps 3 percent of total Eastern European investment in this period, a considerably smaller proportion for the USSR.[18]

The six are clearly resisting Soviet efforts to enlist their participation in the long-term cooperation programs. Though proposed over two years ago, the programs have not advanced beyond general statements of goals and intent. Eastern Europe's opposition presumably reflects fear that the programs could be costly and a threat to what economic independence it has.

The USSR's capacity to pressure Eastern Europe into supporting the programs is limited. Though all of the countries there except Romania heavily depend on the USSR for energy and other raw materials, which the Soviets still supply on terms more favorable than are available in the non-communist world, several factors restrict Soviet leverage:

As already noted, the USSR is concerned about potential economic and consequent political instability in Eastern Europe. It is thus presumably reluctant to push integration schemes if the resource drain on Eastern Europe, even if subsequently repaid with interest, could intensify economic strains there.

The new CEMA price setting formula did not eliminate the terms of trade advantages Eastern Europe enjoyed with respect to the USSR, but it narrowed it. Furthermore, a small—10 to 15

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[17] See John R. Haberstroh, "Eastern Europe: Growing Energy Problems," East European Economies: Post Helsinki, p. 391.

[18] See Marie Lavigne, "Le Commerce Intra-CAEM et son Influence sur le Development Economique Sovietique," The USSR in the 1980s: Economic Growth and the Role of Foreign Trade, NATO Colloquium, January 1978, p. 191.

percent—but growing share of intra-CEMA trade is apparently now conducted at prevailing world prices, further diminishing the benefits to Eastern Europe of trade with the USSR. Finally, some Eastern European economists maintain that the Western import content of Eastern European exports to the Soviet Union is substantial, considerably higher than in Soviet exports to Eastern Europe. This means that the terms of trade advantage for Eastern Europe is less than the prices at which the USSR and Eastern European countries trade would suggest. Therefore, with the difference in real resource terms between importing from the West and the USSR substantially decreased, Soviet bargaining power has been correspondingly weakened. (The sharp rise in oil prices in the non-communist world thus far in 1979 has, presumably, increased the previously diminishing advantage to Eastern Europe of buying oil from the USSR under the lagged, moving average price formula. However, the Soviet Union's actions in 1975—and its present policy of charging the equivalent of the going world price for a rising share of its oil exports to Eastern Europe—suggest that the Soviets might abruptly scrap or revise that formula should the gap between world and CEMA oil prices continue to widen.)

Doubts about Soviet reliability as a supplier may have been raised in Eastern European minds. Eastern Europe now depends on Soviet oil for over 15 percent of its energy consumption. But Soviet oil output, at best, is likely to grow very slowly. Growth is already decelerating. Consequently, given the other demands on Soviet oil output—domestic consumption, sales to the West—oil exports to Eastern Europe might fall. Consequently, even though overall Soviet energy exports to Eastern Europe are still expected to increase through 1980 and even though natural gas exports are likely to rise beyond that date, total Soviet energy deliveries to its Warsaw Pact partners may well level off in the 1980s. This prospect would presumably enhance Eastern European reluctance to commit itself to long-term cooperation programs. Though Eastern Europe is linked to the Soviet Union by a variety of energy transmission facilities, what matters to the six is how much energy the Soviets can provide.

TABLE 2.—SOVIET TRADE BALANCES WITH EASTERN EUROPE

[Millions of rubles]

	1969	1970	1971	1972	1973	1974	1975	1976	1977	1st 3 quarters 1978	1971–74	1975–78 3d quarter
Bulgaria:												
Turnover	1,754.1	1,816.5	2,068.7	2,345.2	2,554.8	2,904.1	3,990.8	4,465.5	5,513.3	4,379.6	9,872.8	17,989.2
Exports	876.1	844.0	984.0	1,121.4	1,230.8	1,478.5	2,059.6	2,276.7	2,658.7	2,348.8	4,814.7	9,343.8
Imports	877.2	972.5	1,084.7	1,223.8	1,324.0	1,425.6	1,931.2	2,188.8	2,494.6	2,030.8	5,058.1	8,645.4
Balance	−.3	−128.5	−100.7	−102.4	−93.2	−52.9	123.4	87.9	164.1	318.0	−243.4	698.4
Bal/To	−.0002	−.0707	−.0487	−.0437	−.0365	.0182	.0332	.0197	.0318	.0726	−.0247	.0388
Czechoslovakia:												
Turnover	2,001.9	2,193.2	2,421.8	2,625.9	2,759.6	3,029.5	3,911.2	4,543.3	5,117.3	4,222.5	10,836.8	17,794.3
Exports	998.7	1,082.7	1,217.6	1,253.7	1,345.0	1,511.1	2,019.5	2,320.5	2,680.4	2,230.7	5,336.4	9,251.1
Imports	1,003.2	1,110.5	1,204.2	1,372.2	1,405.6	1,518.4	1,891.7	2,222.8	2,436.9	1,991.8	5,500.4	8,543.2
Balance	−4.5	−27.8	13.4	−118.5	−51.6	−7.3	127.8	97.7	234.5	238.9	−164.0	707.9
Bal/To	−.0023	−.0127	.0055	−.0451	−.0187	−.0024	.0327	.0215	.0476	.0566	−.0151	.0398
German Democratic Republic:												
Turnover	3,031.5	3,295.0	3,443.4	3,705.5	3,965.3	4,315.3	5,623.4	5,997.2	6,727.5	5,582.2	15,429.5	23,930.3
Exports	1,565.1	1,738.1	1,715.9	1,670.8	1,856.4	2,164.6	2,980.3	3,217.9	3,661.2	2,978.4	7,407.7	12,837.8
Imports	1,466.4	1,556.9	1,727.5	2,034.7	2,108.9	2,150.7	2,643.1	2,779.3	3,066.3	2,603.8	8,021.8	11,092.5
Balance	98.7	181.2	−11.6	−363.9	−252.5	13.9	337.2	438.6	594.9	374.6	−614.1	1,745.3
Bal/To	.0326	.0550	.0034	−.0982	−.0637	.0032	.0600	.0731	.0884	.0671	−.0398	.0729
Hungary:												
Turnover	1,277.2	1,479.9	1,660.6	1,881.7	2,063.5	2,282.3	3,273.7	3,492.1	4,026.6	3,348.8	7,888.1	14,141.2
Exports	630.0	758.3	880.8	903.6	975.6	1,134.5	1,657.7	1,771.3	2,066.5	1,784.8	3,894.5	7,280.3
Imports	647.2	721.6	779.8	978.1	1,087.9	1,147.8	1,616.0	1,720.8	1,960.1	1,564.0	3,993.6	6,860.9
Balance	−17.2	36.7	101.0	−74.5	−112.3	−13.3	41.7	50.5	106.4	220.8	−99.1	419.4
Bal/To	−.0135	.0248	.0608	−.0396	−.0544	−.0058	.0127	.0145	.0264	.0659	−.0216	.0297
Poland:												
Turnover	2,090.7	2,349.8	2,519.9	2,802.7	3,000.3	3,583.6	4,853.3	5,235.0	6,068.0	4,875.2	11,906.5	21,031.5
Exports	1,078.9	1,214.9	1,292.4	1,306.9	1,445.0	1,838.2	2,447.2	2,750.1	3,195.9	2,519.4	5,882.5	10,912.6
Imports	1,011.8	1,134.9	1,227.5	1,495.8	1,555.3	1,745.4	1,406.1	2,484.9	2,872.1	2,355.8	6,024.0	10,118.9
Balance	67.1	80.0	64.9	−188.9	−110.3	92.8	41.1	265.2	323.8	163.6	−141.5	793.7
Bal/To	.0321	.0340	.0258	−.0674	−.0368	.0259	.0085	.0507	.0534	.0336	−.0119	.0377
Romania:												
Turnover	833.3	918.6	935.5	1,052.7	1,130.3	1,190.8	1,525.8	1,599.9	2,025.4	1,453.6	4,309.3	6,604.7
Exports	428.8	444.6	426.5	470.3	519.1	578.5	702.1	770.2	1,003.5	715.1	1,994.4	3,190.9
Imports	404.5	474.0	509.0	582.4	611.2	612.3	823.7	829.7	1,021.9	738.5	2,314.9	3,413.8
Balance	24.3	−29.4	−82.5	−112.1	−92.1	−33.8	−121.6	−59.5	−18.4	−23.4	−320.5	−222.9
Bal/To	.0292	−.0320	−.0882	−.1065	−.0815	−.0284	−.0797	−.0372	−.0091	−.0161	−.0744	−.0339
Total:												
Turnover	10,988.7	12,053.0	13,049.9	14,413.7	15,473.8	17,305.6	23,178.2	25,333.0	29,118.1	23,861.9	60,243.0	101,491.2
Exports	5,578.4	6,082.6	6,517.2	8,726.7	7,380.9	8,705.4	11,866.4	13,106.7	15,266.2	12,577.2	29,330.2	52,816.5
Imports	5,410.3	5,970.4	6,532.7	7,687.0	8,092.9	8,600.2	11,311.8	12,226.3	13,851.9	11,284.7	30,912.8	48,674.7
Balance	168.1	112.2	−15.5	−960.3	−712.0	105.2	554.6	880.4	1,414.3	1,292.5	−1,582.6	4,141.8
Bal/To	.0153	.0093	−.0012	−.0666	−.0460	.0061	.0239	.0348	.0486	.0542	−.0263	.0408

Appendix

As explained in Kohn, "Developments in Soviet-Eastern Europe Terms of Trade, 1971–75," The Soviet Economy in a New Perspective, the terms of trade indices were derived using a method devised by Hewett in Edward A. Hewett, Foreign Trade Prices in the Council for Mutual Economic Assistance, London: Cambridge University Press, 1974. Hewett computes the export and import price indices, from which the net barter terms of trade are derived, by taking unit values from individual categories in the Soviet trade nomenclature. The indices for individual categories were then combined into an overall export (or import) index by weighting the individual indices in each category by the full value of the exports (or imports) in that category. Thus the weights for each category are larger than the value of the exports (or imports) used in computing the individual category indices, since the unit values could be calculated only for a part of the total trade listed in each category.

Unit values are of course an imperfect method for compiling price indices, particularly where unit values may apply to relatively heterogeneous groups of goods and where changes in the composition of the groups could thus cause changes in unit value unrelated to price changes.

The justification for using unit values to construct proxy export and import price indices is that errors caused by distortions resulting from such factors as composition changes will move randomly and thus, with a large enough sample, cancel out.

If use of unit value indices can be justified on principle, it should be stressed that the indices computed in this paper must be treated with much caution. The value of trade entering into the unit value calculations, as already noted, accounts for far less than total trade, the proportion being particularly small with respect to Soviet imports.

Furthermore, the data have become progressively more inadequate. The official 1976 trade statistics eliminated much detail available in 1975 and previous years. For example, the value and volume figures were eliminated for individual nonferrous metals, and for individual components of the broad ferrous metals category. Thus the unit value calculations from 1976 data reflect more aggregated categories and are thus less satisfactory than in preceding years.

As already mentioned, the data for 1977 are so scanty as to preclude computing export and import price indices from unit value indices.

For all of their limitations, however, the terms of trade indices computed from unit values derived from Soviet data can be viewed as useful indicators of the general direction and magnitude of terms of trade changes.

PRICE CHANGES IN SOVIET TRADE WITH CMEA AND THE REST OF THE WORLD SINCE 1975

(By Raimund Dietz*)

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SUMMARY

Since 1975, foreign trade prices have changed within the CMEA to an extent unknown before in that organization's history. These price changes were caused by the extreme increase in world market raw materials prices—especially in the rise of crude oil prices imposed

*Vienna Institute for Comparative Economic Studies. Here I should like to thank all persons who supported me in preparing this article, Ms. R. Meichl for carefully storaging the data from Soviet and Hungarian sources, my colleagues Messrs. B. Askanas, G. Fink, F. Levcik and D. Renning for critical and helpful comments, and last but not least F. Prager for the translation of the text. The responsibilities for errors remain, of course, the author's.

by the OPEC cartel in the fall of 1973, and the modification of the Bucharest price formula, which led to a speedier adjustment of intra-CMEA prices to world market prices.

Since there is a preponderance of raw material imports by the East European countries over exports of manufactured goods to the Soviet Union, the Soviet terms of trade vis-à-vis their East European partners has improved considerably since 1975—by over 10 percent in 1975 alone. By 1980 they will have improved by an estimated 30 percent to 40 percent, bringing in their wake a tightening of Eastern Europe's economic link with the USSR. The extent of price changes is remarkable. Soviet export prices increased by approximately 39 percent in 1975 and by approximately 9 percent in 1976, while import prices rose by 26 percent and 6 percent respectively. The price increases vary considerably in trade with the various countries, and consequently so do the terms of trade. This is mainly due to the differences in the countries' commodity structures. The highest terms-of-trade gains accrued in the USSR's bilateral relations with the GDR and Czechoslovakia—being trade of the highest degree of complementarity (raw materials against finished products) in Eastern Europe.

In trade with the rest of the world Soviet terms of trade apparently react with great sensitivity to economic fluctuations. In 1975, when the inflationary tendencies in the raw materials sector abated and the recession set in the West, Soviet terms of trade declined by more than 10 percent, thus more than compensating the improvement achieved against the CMEA countries.

The new sliding price formula constitutes a compromise with respect to the welfare effects, in that the USSR participates in the general raw materials price increases without suddenly overburdening the other CMEA countries. In terms of systemic theory, the new price formula attempts to create a path between two snags: On the one hand, this formula with its annually changing prices is a disturbing element in intra-CMEA trade whose proper functioning would be better served by a fixing of intra-CMEA prices coincidental with the five-year plan periods. On the other hand, the sliding price formula helps avoid major frictions in intra-CMEA trade by speeding up the adjustment of intra-CMEA prices to world market prices; for an excessive price gap would lead to supply problems—despite medium term supply contracts frequently including fixed quantity provisions.

The extent of the inconsistencies in published Soviet statistical data for 1975 and 1976 on volume changes in foreign trade is startling. The price indices derived from these do probably underplay the extent of price changes in trade with Eastern Europe considerably. Individual foreign trade positions were extensively reduced in 1977, thus making calculation of reliable unit value indices virtually impossible.

We calculated the price indices on the basis of the unit value method, following the approach used by E. A. Hewett, Martin Kohn, and others. But deviating from Hewett's method we decided to use Paasche indices when calculating price indices for individual commodity groups. When aggregating the prices indices we weighted them with the values of the base year.

1. The Mechanism of Price Formation in Intra-CMEA Trade

Almost 90 percent of Intra-CMEA trade is conducted in transferable rubles (TR), 10 percent in hard currencies, the rest, being apparently 1–2 percent of the total turnover, are multilaterally cleared balances.[1] The TR is not convertible; rather it is an accounting unit, serving to mediate in the exchange relations between any two CMEA partner countries, and of economic significance only in bilateral relations. It follows that there are 21 such distinct relationships between the seven European CMEA countries. Overstating the point, we might say that all these different TRs have nothing in common but their name and their common locality—in the accounting sheets of the offices of the International Bank for Economic Cooperation (IBEC) in Moscow.

Corresponding to monetary bilateralism we encounter bilateralism in price formation. Prices in intra-CMEA trade are arrived at in bilateral bargaining procedures, often involving trading of commodity group against commodity group. The socio-economic conditions prevalent in the CMEA inhibit the development of a price formation mechanism wherein prices would, on the one hand, reflect the specific conditions of production and demand within the CMEA area and, on the other hand, give evidence of, and promote, the interconnection of the CMEA economies with the world market.

While admitting that the system of "commodity-money relations" has its weak points, we may assume—at least for some countries—that since the economic reforms had become operative in the sixties, the national price formation mechanisms fulfill certain price functions. In the international or interstate field such mechanisms do not exist—be it that autonomous market forces cannot "bite," be it that there is no supernational body empowered to control foreign trade prices in the same manner as the national price authorities do. World market prices (WMPs) are used for guidance by the CMEA partners in their bilateral bargaining; they serve as a substitute to bridge this functional and institutional gap. However, the world market prices are not directly applied: they are modified according to an agreed formula.

1.1 The Bucharest Price Formula

Great difficulties are encountered in particular when ascertaining world market prices of investment goods. The modalities of ascertaining and applying the WMPs have undergone changes with the build-up of the CMEA institutional apparatus and with the development of bilateral trade. The decisions of the IX. Council Meeting of Bucharest (1958) mark an important turning point in this respect. Bilateral relations between partner countries—meaning, of course, relations between the USSR and her East European allies—were put on an "equal footing." In the years immediately following World War II and in the mid-fifties, the USSR demonstrably acquired considerable price advantages. The new regulations fixed the modalities for price formation in more accurate detail than formerly, and—in principle—as binding for all partners. Criteria for the choice of the main commodity

[1] Such balances sooner or later are compensated in goods as laid down in the trade agreements.

markets and the apportionment of transport charges were laid down for the documentation of world market prices.

However, even after Bucharest, considerable leeway was left for bargaining—a fact evidenced in the often extreme country specific price differences between commodities in foreign trade.

Following upon the Bucharest price ruling it was decided to introduce major price revisions at the bargaining of medium term plan periods only. Initially, prices were fixed up to 1965, the year of expiration of then current CMEA medium-term plans, i.e., the seven-year plans of the USSR and of the GDR, and the five year plans of the other East European countries. The prices laid down as the basis for this period were the average world market prices of the year 1957. With the five-year plan period 1966–1970 the switch was made to application of average prices of the preceding five-year plan period 1961–1965; for the expired five-year plan period 1971–1975 it was agreed to proceed similarly and to base price calculations on the reference period 1966–70. This price regulation was replaced by another, one year before expiration of the term.

In a period characterized by relatively stable WMPs and by the fact that comparatively little foreign trade with third countries is in evidence, a fixing of intra-CMEA prices on the basis of average WMPs of appropriate preceding five-year periods does hardly threaten to be an allocational bone of contention. It also facilitates the fixing of quantities and so provides the economic planners with a manageable framework. The sixties were indeed characterized by a remarkable degree of price stability in the world markets. It only remains to point to the divergency between the moderate but continuous rise in the prices of industrial finished products on the one hand, accompanied, on the other, by the general constancy of raw materials prices giving cause for complacency to industrialized countries poorly equipped with sources of raw materials. The Soviet Union, a leading supplier of raw materials and heavy importer of finished products was among the losers. In those days the USSR had to put up with a deterioration of her terms of trade.

Compared with other countries rich in raw materials, however, the USSR fared comparatively well. For the deterioration in her terms of trade caused by the divergence of prices in the two big commodity groups did not take effect until several years later, thanks to the application of the Bucharest formula in intra-CMEA trade.

A completely different situation confronted the observer in the seventies: In the course of the general inflationary developments world market prices followed an upward trend, and the dichotomy between prices of industrial finished goods and raw materials reversed direction. In the fall of 1973, OPEC increased world market crude oil export prices fourfold. Between 1972 and 1974 raw materials prices (incl. fuels) increased 2.5 times on the average. During the same period prices of industrial finished products rose by a mere 43 percent.[2]

1.2 The New Sliding Price Formula

It was a development that the Soviet Union would not and could not passively accept. As a consequence, the price formation rulings en-

[2] UN, Monthly Bulletin of Statistics, December 1976, Special Table E.

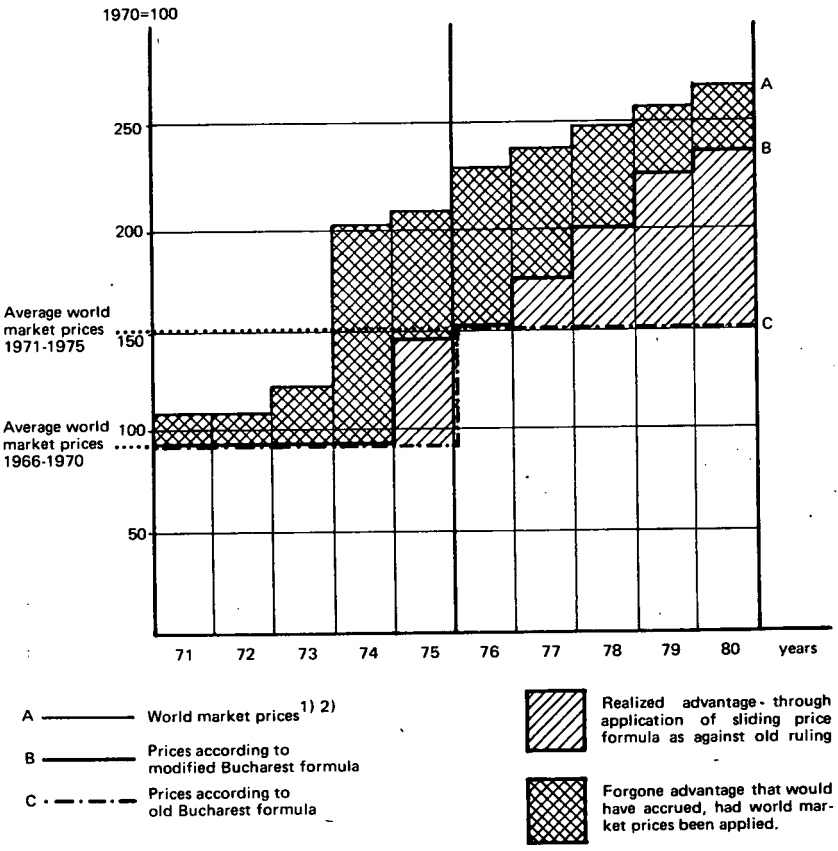
visaged to be valid for the whole five-year plan period 1971–75, were revised under pressure from the U.S.S.R. and replaced by a new regulation at the beginning of 1975. The price negotiations for 1975 were conducted on the basis of average WMPs of the years 1972, 1973 and 1974; and for each of the years 1976 to 1980, WMPs of each preceding five-year period were taken as the period of reference. Thus average WMPs of 1971–75 were applied for 1976, average WMPs of 1972–76 for 1977, and so on. In this new ruling the old price adjustment formula of five year jumps corresponding to the five-year plan periods was replaced by the formula of sliding five year period averages.

The following considerations were presumably decisive for the adoption of the new price rulings:

(a) Obviously the U.S.S.R. considered the revenue shortfall to be expected under the old rulings unacceptably high. Had the U.S.S.R.'s intra-CMEA trade been conducted at WMPs at the beginnings of the seventies, then terms of trade of the U.S.S.R. in her dealings with the six East European partner countries would have improved by 35 percent in the years 1971–74. In actual fact Soviet terms of trade hardly changed at all in that period.[3] The U.S.S.R. would have suffered losses in 1975 almost equalling those of 1974. An extension of that price formula to the years 1976–80 would have deprived her of all the price advantages that accrued as from 1977, and will continue through to 1980. The following chart illustrates the nature of the sliding price adjustment: it is a compromise. The new ruling gave the East European countries time to adjust to the new situation, administering the "oil shock" by easy stages.

[3] M. J. Kohn, Developments in Soviet-Eastern European Terms of Trade, 1971–75, in: Soviet Economy in a New Perspective, A Compendium of Papers submitted to the JEC, Washington 1976, pp. 67–80.

Development of Soviet Export Prices in Intra-CMEA Foreign Trade based on alternative price formulae



1) Weighted by structure of Soviet exports to CMEA in1974 and adjusted to Ruble/Dollar Parity.

2) Assumption: As from 1977, world market prices grow at an annual rate of 4%.

Source: Monthly Bulletin of Statistics, June 1978, December 1978; Vneshnyaya Torgovlya, various annuals; Own calculations.

Notes to Chart

UN statistics report average world market price increases in the range of 101 percent between 1970 and 1974. Since unit values are calculated in U.S. dollars, UN price indices must be revised downwards by the revaluation of the Ruble against the Dollar. This is because WMPs, which are expressed in dollars, must be corrected to that extent before they can serve as guideline values in intra-CMEA trade. For the USSR foreign trade with her CMEA partners price increases will result that are considerably higher, on the export side, than the WMP index (adjusted merely to the extent of the $ devaluation), because Soviet exports are predominantly raw materials weighted; while price increases below WMP averages will work out for Soviet imports.

Our presentation will be confined to the export side. Curve A in the graph indicates the (fictitious) Soviet price increases in rubles, WMPs (corrected by ruble revaluation, having been directly applied. Curve C illustrates Soviet export prices applying the unmodified Bucharest formula. Prices would have remained constant in 1975, than would have jumped suddenly in 1976 on commencement of the current five-year plan, thereafter remaining constant until 1980—which would have resulted in a considerable price gap between Soviet exports to the CMEA countries and those to the rest of the world.

Curve B shows the extent of price increases that would have resulted or would result if the new sliding price formula were strictly applied on WMPs. Following these, prices of Soviet exports to the CMEA countries would have risen by about 85 percent in the years 1975, 1976 and 1977. Actually, somewhat lower price increases were observed. The deviations may in part be due to the method of calculation. The UN price indices listed by SITC classification can only be very roughly aggregated into a fictitious overall index for the USSR, since Soviet foreign trade terminology differs radically from SITC terminology.[4a] Besides, it is uncertain whether the CMEA-countries take their cues from export prices in the world markets. As evidenced by the example of crude oil prices (cf. below), European OECD import prices were probably the predominant measure.

(b) Apart from the fact the lower intra-CMEA prices cause comparative income shortfalls for the USSR, they are also apt to cause rising CMEA demand for Soviet raw materials deliveries. But the Soviet raw materials export potential is not unlimited. Since the middle of the sixties, for instance, the Soviet energy export potential has risen more slowly than demand in the rest of CMEA.[4] A continuation of this trend must be expected. The sliding price formula has been an aid to the USSR in her efforts at least to hold the present level of energy exports to the West in order to earn the hard currency needed for her machinery and food (especially grain) imports. That formula puts a brake on CMEA demand for Soviet energy by gradually reducing the relative price advantage previously available to the CMEA countries on Soviet deliveries.

(c) Resort to the oil system of price formation that had been in force up to 1974 would have led to even greater divergence between world market and CMEA prices,[5] which would have led to considerable disturbances in intra-bloc trade. For such purchase and sale at "frozen world market prices" entails considerable comparative foreign trade losses to some countries in regard to certain goods, while yielding profits to others. This results in a narrowing down of the bilateral settlement of overall total trade flows to bilateral settlements of commodity groups (structural bilateralism). It means that within the system of national bilateralism—itself an impediment to foreign trade—raw materials are traded against raw materials, machinery for machinery, goods for which hard currencies can be earned against similar goods etc. In other words, a freeze-up of WMPs causes bilateralism to degenerate into an economic system of direct barter, since price relations in foreign trade are no longer acceptable. Now the frozen WMPs are used in the only way still acceptable, e.g., as a measure of value for similar goods, whose relative prices have not changed since the basic period—or only in comparable order of

[4a] P. Marer, Soviet and East European Foreign Trade, 1946–1969, Bloomington and London 1972, pp. 336.

[4] J. R. Haberstroh, "Eastern Europe: Growing Economic Problems", in East European Economies—Post-Helsinki, J.E.C. 1977, p. 379.

[5] N. Mitrofanova, "Tendentsi dvizheniya kontraktnykh tsen v tovarie stran SEV" (Tendencies of development of contract prices in CMEA Foreign Trade), Voprosi ekonomiki 8/1978, pp. 101.

magnitude.[6] While Holzman's argument was valid even during the period of relatively stable WMPs, it has now gained in pertinence. Had the old price formula—that applies average 1971–1975 WMPs to determine intra-CMEA prices for the years 1976–80—been applied, then price differences between intra-CMEA and WMPs would have become intolerable; and that would have inevitably led to further misfunctioning in intra-CMEA trade.

TABLE 1.—PRICES OF SOVIET PETROLEUM IN EXPORT TO CMEA IN 1970–80—OIL PRICE PER TON

	Imports into OECD-Europe[1]			U.S.S.R. exports to CMEA countries[2]			
	In dollars	Conversion factors	(1):(2) in ruble	Actual prices, in ruble	Prices according to new price formula	Yearly changes in percent	Price relation CMEA price/ OECD price (4):(2)×100
	(1)	(2)	(3)	(4)	(4a)	(5)	(6)
1970	16.5	1.111	14.8	15.5	----------	−0.9	104.7
1971	21.4	1.111	19.3	15.6	----------	.9	80.8
1972	22.4	1.206	18.6	15.5	----------	−.9	83.3
1973	28.7	1.358	21.1	16.0	----------	3.5	75.8
1974	80.2	1.321	60.9	18.1	----------	13.4	29.7
1975	88.0	1.386	63.5	33.5	33.5	85.1	52.8
1976	93.2	1.326	70.3	36.8	36.7	9.9	52.3
1977	100.1	1.356	73.8	----------	46.9	27.8	62.7
1978	101.3	1.46	69.4	----------	57.9	23.5	83.4
1979	116.5	[3] 1.50	77.7	----------	67.6	16.7	87.0
1980	128.1	[3] 1.50	85.4	----------	70.9	5.0	83.0

[1] Petroleum, crude and partly refined (SITC 331); 1977 and 1978: import prices of the 5 largest EC countries, 1979: estimated under assumption of price increase in dollars of 15 percent; 1980: ditto increase 10 percent.
[2] Petroleum (crude oil) and petroleum products.
[3] Estimated.

Source: OECD, Statistics of Foreign Trade, series C; Jahrbücher des Aussenhandels der UdSSR; U.N. Monthly Bulletin of Statistics 1978/12; Österr. Institut für Wirtschaftsforschung, Databank; own calculations. Vneshnyaya torgovlya SSSR various editions.

1.2.1 AN EXAMPLE: SOVIET OIL PRICE POLICY

The effect of the sliding price formula, newly introduced in 1975, may be demonstrated by reference to the prices of Soviet oil exports to the CMEA partner countries. In their negotiations, the CMEA countries obviously took their bearings from OECD (Europe) oil import prices rather than from WMPs. The fact that the OECD average price paid from 1972 to 1974 happens to be precisely the price paid the USSR by the CMEA countries in 1975 is, however, a coincidence. That price was, in 1975, 85 percent above that paid the year before (Table 1). In 1976, through the changeover, according to formula, from the 3 years' average 1972–74 to the 5 years' average 1971–1975, was more modest at 10 percent.[7] Here too, the correspondence between actual average price and model price is amazing, considering the differences in the prices valid for the various individual countries (Table 2). In 1977 Soviet crude oil prices rose more substantially again.

In the 1977 edition the USSR unfortunately no longer published crude oil export quantities.[8] Consequently price increases for 1977 can only be estimated for those CMEA countries that report their crude oil imports from the USSR (Bulgaria, GDR,

[6] F. D. Holzman, Foreign Trade and Central Planning, Cambridge, Massachusetts 1974, p. 105.
[7] For 1976, the old price ruling would have had the same effect on prices as did the new ruling.
[8] Concerning the overall reduction of Soviet foreign trade information, see p. (19).

Hungary, Poland). Inaccuracies had to be tolerated—they are due to the fact that up to 1976 exports of petroleum (including petroleum products) were reported by the USSR while the partner countries reported crude oil imports only. It may be assumed that prices rose again by a considerable margin in 1977 and 1978. We have calculated a price of about 58 rubles per ton for 1978. (Hungary, having always paid above-average prices in recent years, reported a 1978 price of 59.7 rubles per ton of Soviet crude oil).[9] In 1979 and 1980 price rises will presumably be more moderate: first, the price lag vis-à-vis WMPs has been largely caught up with; secondly because the latter have remained fairly stable, thanks to the moderation exercised by the OPEC cartel between 1975 and the beginning of 1979.

From Table 2 it may be seen that the selling price for petroleum is diversified considerably within the CMEA. In 1976, the USSR sold petroleum and petroleum products to Hungary for 44.7 rubles per ton, while the GDR had to pay merely 32.1 rubles per ton. Prices for other countries vary between these limits. It is only to a very limited extent that these differences may be explained by different transportation costs or on the basis of the differentiated share of petroleum products in total petroleum deliveries—the products being more expensive than crude oil. But these shares are small.

The price differences might rather be ascribed to the following causes:

(i) As explained above, negotiations are conducted bilaterally, dealing with commodity group against commodity group. No price should be looked at in isolation. The price of petroleum depends, int.al., on what goods that are saleable at any time in the West—so called hard goods—can be offered against the crude oil.

(ii) Part of the Soviet petroleum deliveries, but in any case quantities in excess of the quotas promised in the medium term, are charged in dollars at WMPs. Thus Hungary reports that in 1978 the WMP was applicable to 1 million tons of petroleum and petroleum products—that being just under 11 percent of the total quantity of oil imports. Usually such deliveries are paid for in goods, so that Western currencies serve merely as the accounting unit without acting as an instrument of payment.

[9] Világgazdaság, Jan. 24, 1978, p. 1.

TABLE 2.—PRICES OF SOVIET PETROLEUM IN EXPORT TO THE INDIVIDUAL CMEA COUNTRIES

	Rubles per ton						Price increases as against preceding year in percent					Price index 1976 1972 equals 100
	1972	1973	1974	1975	1976	1977	1973	1974	1975	1976	1977	
Bulgaria	14.9	14.6	15.2	34.2	37.5	----	−2.5	4.1	126.0	9.6	----	252
CSSR	16.3	16.4	16.3	30.9	34.1	----	.7	—.8	89.6	10.4	----	209
German Democratic Republic	14.1	14.2	18.8	28.2	32.1	[1] 39.1	.7	32.4	50.0	13.8	[1] 21.9	228
Hungary	17.0	17.9	17.1	41.0	44.7	[2] 53.4	5.3	−4.5	139.8	9.0	[2] 19.5	262
Poland	16.5	17.4	20.6	39.5	42.0	[1] 51.3	5.5	18.4	91.7	6.3	[1] 22.2	254
Cuba	13.1	15.4	17.8	30.8	32.7	----	17.6	15.6	73.0	6.2	----	250
CMEA total [3]	15.5	16.0	18.2	33.5	36.8	[4] 46.9	3.6	13.4	84.1	9.9	[4] 27.8	237

[1] Calculated by crude petroleum import quantities of the countries concerned.
[2] Calculated on the basis of Hungarian statistics.
[3] Including Mongolia.
[4] Estimates.

Source: Statistical annuals of German Democratic Republic, Poland, and Hungary.

(iii) It may be that the smaller CMEA countries are being compensated for their investment participation in joint projects with the USSR by way of cheaper raw materials deliveries. It is possible that such deliveries have already commenced, to one country or another, in consideration of earlier participations.

One CMEA-country contemplated making representations to the USSR, pleading for a uniform Soviet oil export price to apply throughout the CMEA. The plan was dropped for fear that such an initiative might be construed as an attempted "interference in the USSR's internal affairs."

2. The Price Changes in Soviet Foreign Trade

2.1 Some Glaring Inconsistencies in Soviet Statistics on Volume and Price Changes

Annual indices are published on Soviet foreign trade statistics; they report on the real growth of Soviet exports and imports by major groups of countries (total; socialist countries, among them CMEA countries; non-socialist countries; and capitalist and developing countries). There was no reason until 1974 to entertain serious doubts concerning the "truth" of these indices. The supposed reliability of these volumes indices was corroborated rather than put in doubt by E. A. Hewett's price index calculations for the years 1956 to 1970 on the basis of the unit value method.[10]

But grave divergences between official volume indices and those calculated by the unit value method (derived from value and price changes) emerge for 1975.[11] According to official Soviet statements, the real increase of Soviet exports to the CMEA countries was almost 11 percent, but in 1976 exports are said to have declined by 6 percent in real terms. We, however, calculated a decline of Soviet exports in 1975 of 1 percent, and an increase in the following year of just around 3 percent. In imports we find a slightly lower discrepancy (Table 3).

[10] The volume index is given by the quotient of value and price changes.
[11] As to the method of index computation, see section 6.

TABLE 3.—VALUE, PRICE, AND VOLUME CHANGES IN SOVIET FOREIGN TRADE

[Annual growth rates in percent]

	Total				CMEA (8)[1]				Rest of the world[2]			
	Soviet		Own		Soviet		Own		Soviet		Own	
	Exports (1)	Imports (2)	Exports (3)	Imports (4)	Exports (5)	Imports (6)	Exports (7)	Imports (8)	Exports (9)	Imports (10)	Exports (11)	Imports (12)
Values:												
1975	15.9	41.6			34.8	36.6			−1.4	46.6		
1976	16.7	7.7			11.7	7.8			22.9	7.6		
1977	18.7	4.7			16.9	13.7			26.8	−3.7		
Volumes:												
1975	2.9	18.4	−0.7	19.8	10.9	17.3	−1.2	8.1	−4.4	19.5	−6.2	31.5
1976	7.8	6.3	7.3	4.1	−6.3	−5.1	2.9	2.7	25.5	17.6	12.8	5.4
1977	9.2	1.6	(6.3)	(−2.0)	8.2	9.4	[3] 4.7	[3] 8.5	16.3	−6.7		
Prices:												
1975	12.6	19.6	16.7	18.2	21.6	16.5	36.5	26.3	4.3	22.7	−1.4	16.1
1976	8.2	1.3	8.8	3.5	19.2	13.6	8.6	5.0	−5.5	−16.2	9.1	2.1
1977	8.7	3.1	(11.6)	(6.8)	8.0	3.9	[3] 11.9	[3] 4.8	9.5	2.1	(11.2)	(8.7)
Terms of trade:												
1975	−5.9		−1.3		4.4		8.1		−15.6		−16.4	
1976	6.8		+5.0		4.9		3.4		5.2		6.8	
1977	5.5		(4.5)		3.9		6.8		7.2		(2.3)	

[1] CMEA Europe plus Mongolia and Cuba.

[2] Derived from data on overall trade and CMEA trade. Multiplication of volume with price indices does not, in most cases, lead to exactly corresponding value changes.

[3] Estimated; compare table 7, footnotes 1-4.

Note: Data in parentheses are possibly distorted because the number of unit value-positions, particularly in the area of raw materials, was sharply reduced in 1977.

Source: Vneshnyaya torgovlya 1975, 1976, 1977; own calculations.

AUTHOR'S NOTE

After I had completed the foregoing paper, it was pointed out to me by Mr. Jan Vanous of the University of British that the USSR have published revised figures, in the Russian edition of the monthly journal "Vneshnyaya torgovlya", of the volume indices for the year 1975 given in the 1975 and 1976 editions of the Annual Vneshnyaya torgovlya. The development of prices and volumes, as published in the corrected version, are given in table 3a below:

TABLE 3A.—VOLUME AND PRICE CHANGES IN SOVIET FOREIGN TRADE

[Annual growth rates in percent]

	Total		CMEA (8)		Rest of the world	
	Exports	Imports	Exports	Imports	Exports	Imports
Volumes:						
1975	2.9	18.4	1.6	9.0	4.1	27.8
1976	7.8	6.3	2.3	2.1	14.7	10.2
1975 plus 1976	10.9	25.9	3.9	11.3	19.4	40.8
Prices:						
1975	12.6	19.6	32.7	25.3	−5.8	13.9
1976	8.2	1.3	9.2	5.6	6.8	−1.7
1975 plus 1976	21.8	21.2	44.9	32.3	.7	11.9
Terms of trade:						
1975	−5.9		5.9		−17.3	
1976	6.8		3.4		8.7	
1975 plus 1976	.5		9.5		−10.0	

Source: Vneshnyaya torgovlya, various editions. Journal: Vneshnyaya torgovlya 1978.

Since the figures for the two bracketing years, 1974 and 1976, are not affected by the corrections, this means that the revisions imply merely a re-distribution of the price changes that occurred in 1975 and 1976, between these 2 years. The new data point in the direction of my calculations, i.e. that prices in the USSR developed vigorously in 1975, and only on a modest scale in 1976. But as far as the total extent of price changes in the years 1975 and 1976 is concerned—an extent that, in my opinion, is not sufficient to account for the development of export prices in particular—this is maintained by the (new) Soviet statistical data. The reasons given for these corrections are—simple printers' errors.

The special circumstances surrounding these corrections give rise to several questions:

Why were the corrections published in the Russian edition of the Monthly only? How was it possible that the erroneous, obviously contradictory indices could appear in two successive Annuals (1975 and 1976).[11a] And why did these grave errors happen precisely concerning data of trade with the CMEA countries at a time of startling price changes?

Even after adjustment of these data, some inconsistencies remain, albeit on a reduced scale. Indirect calculation of the volume increases in foreign trade with the capitalist and with the developing countries (1976) results in growth rates of 13.9 percent in exports (as against 11.2 percent) and 4.8 percent in imports (as against 10.2 percent) (cf. Table 4).

[11a] Considering the fact that the figures relating to foreign trade with the socialist countries given in the 1976 Annual did provide changes as against those given in the 1975 Annual.

A glance at the prices gives the following mirror image: according to the official version export prices rose by no more than 22 percent in 1975, while we calculate them at 36.5 percent. Part of the unpublished price increases of 1975 were "caught up on" in 1976; we calculated 8.6 percent, but officially prices were said to have risen by 19.2 percent. Similar discrepancies were noted on the import side, but there the index reflects the full extent of price increases—if we sum up the changes reported for 1975 and 1976.

The discrepancies are grave indeed, they demand elucidation. Let us leave our own results aside for the moment. In section 6 we shall also revert to possible flaws due to our methodology. But even if a calculation check based on Soviet data were not possible, the official data are suspect for the following reasons:

In the first place, the Soviet data depart from the price development that would result from application of the modified Bucharest formula on WMPs. (Our unit value calculations, on the other hand, do, to a large degree, correspond to the price model.)

Second, the magnitude of fluctuations in real growth rates as claimed by Soviet foreign trade statistics contradicts the mechanism of intra-CMEA trade, designed to assure stability of relations.

Third, the official data are contradictory in themselves. This becomes apparent, e.g., if the volume changes of Soviet foreign trade with the "capitalist and developing countries" in the year 1976 are calculated from official data in two different ways. For one, changes in volume may be taken directly from the index for that group of countries. Since the "capitalist and the developing countries" are per definition the nonsocialist part of the world, we are able in the alternative computation indirectly to deduce those changes from data on total trade and on the group of "socialist countries". The deviations are considerable as can be seen in table 4; they cannot be ascribed to statistical errors alone.[12])

TABLE 4.—SOVIET FOREIGN TRADE WITH "CAPIALTIST AND DEVELOPING COUNTRIES"

	Changes in volume in percent	
	Exports	Import
Calculated from official indices:		
Directly	16.1	10.2
Indirectly	11.2	4.9

Fourth, according to official data Soviet exports to the socialist countries rose by 5.3 percent in real terms in 1976, while the export volume to the CMEA is alleged to have declined by 6.3 percent during the same time period. These two data would only then be compatible if the exports to the remaining socialist countries had more than doubled in real

[12] If we set the data on volume changes of imports in 1975 from the "rest of the world" (19.5 percent) against the equally official data on changes in imports from capitalist and developing countries (30.9 percent), then this produces deviations that can under no circumstances be explained through the comparatively minor difference in the regional delimitation of the two groupings of countries.

terms during the same time, a development which cannot be supported by any other evidence.[13]

The great discrepancies between the official data and our own computational results cannot be explained by methodological differences. For the Soviet computations are based on a procedure which is very similar to our own (cf. Section 5).[14]

It is difficult to extract any meaning from the Soviet foreign trade indices. A conscious manipulation of the data cannot be fully excluded, but this would contradict Soviet practise. The Central Statistical Offices would be more likely to suppress results which are disadvantageous than they would be to falsify them.

The publication of the suspect index numbers was accompanied in 1976 by a certain paucity of data on individual positions, to be followed by a radical dwindling: in the 1977 edition, the position of value and volume data was nearly halved. Since volume data for petroleum, gas, ores, wheat, etc. are missing, a reliable computation of price and/or volume indices for 1977 is hardly possible. It may be significant that information was curtailed in precisely those commodity groups that have presumably experienced sizeable price increases also in 1977. This fact might lead to the conclusion that the official statistics aimed at concealing the extent of the price changes. Only a little fraction of the gaps can be filled from the statistics of the partner countries. The Hungarian sources alone enable us to obtain a notion of the price changes that did in fact occur in 1977.[15]

2.2 Soviet Trade With the CMEA and With the Rest of the World: Divergent Price Developments

In 1973, Soviet terms of trade with the West improved by about 17 percent while those with the CMEA remained unchanged; already in 1974 the Soviets had to accept a small loss in their terms of trade in consequence of the recession in the West, despite further sizeable price increases for raw materials and the relative predominance of raw materials in her exports.[16] As soon as the exorbitant inflationary tendencies in the raw materials sector subsided in 1975, Soviet export prices vis-à-vis the rest of the world fell by 1.4 percent while import prices rose by 10.1 percent, resulting in a 12 percent decline of the Soviet terms of trade in trading with the countries outside the CMEA.

However, as we could see in table 3, the USSR was able to derive a terms of trade gain of 8.1 percent vis-à-vis the CMEA. This positive development of price relations in Soviet CMEA trade were more than offset by substantial terms of trade losses in the USSR's trade with the rest of the world. This regionally counteracting price development may be ascribed, on the one hand, to the temporal shift in the transmission from world market prices to intra-CMEA trade, and on the other to the international economic recession.

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[13] Vnesnyaya torgovlya 1976, p. 17.

[14] The Soviet indices, based on more finely structured foreign trade data, should give more accurate results. As from 1976, the number of sub-positions is said to have been increased, and the indices were annually linked as was done by us.

[15] Cf. section 3 and 5.

[16] Vneshnyaya torgovlya 1973 and 1974.

TABLE 5.—PRICE CHANGES IN SOVIET TRADE WITH THE WORLD, EASTERN EUROPE, AND NON-CMEA COUNTRIES

	Exports				Imports			
	Shares	Price changes			Shares	Price changes		
	1974	1975	1976	1977	1974	1975	1976	1977
Total trade: [1]								
Machinery	22, 9	7, 8	17, 4	8, 6	34, 4	23, 6	15, 4	10, 7
Fuels	30, 2	30, 4	14, 0	15, 4	3, 7	27, 9	4, 9	.....
Ores, metals	17, 9	23, 5	—1, 8	—3, 7	12, 6	26, 0	—14, 0	.....
Chemicals and building materials	4, 8	15, 5	—2, 0	1, 5	7, 4	1, 8	—0, 8	14, 3
Agriculture and foods	21, 2	2, 7	1, 9	14, 2	26, 5	15, 9	—2, 8	4, 9
Industrial consumer goods	2, 9	5, 9	5, 2	4, 4	15, 4	9, 2	2, 0	—3, 3
Total	100, 0	16, 7	8, 8	11, 6	100, 0	18, 2	3, 5	6, 8
Trade with CMEA (6): [2]								
Machinery	32, 5	8, 0	19, 6	(15, 0)	55, 4	21, 6	9, 2	(2, 5)
Fuels	21, 4	83, 5	10, 3	(16, 9)	2, 5	107, 5	6, 1	.....
Ores, metals	24, 3	45, 3	—0, 1	(5, 1)	2, 4	47, 2	6, 2	(5, 1)
Chemicals and building materials	4, 3	32, 6	3, 7	(7, 3)	4, 4	21, 7	—2, 7	(—3, 1)
Agriculture and foods	14, 4	40, 9	5, 8	(8, 4)	11, 1	32, 2	2, 4	(11, 7)
Industrial consumer goods	3, 1	7, 7	7, 3	(2, 7)	24, 1	22, 6	—0, 4	(3, 3)
Total	100, 0	39, 0	8, 8	(11, 6)	100, 0	25, 9	5, 6	(5, 0)
Trade with all other countries:								
Machinery	13, 4	7, 7	13, 7	.....	21, 5	27, 5	23, 6	.....
Fuels	39, 3	5, 3	17, 1	.....	4, 9	—1, 9	4, 2	.....
Ores, metals	14, 1	—6, 5	—5, 0	.....	21, 2	24, 2	—16, 0	.....
Chemicals and building materials	5, 2	3, 4	—8, 8	.....	10, 1	—4, 7	0, 1	.....
Agriculture and foods	26, 2	—16, 6	—0, 6	.....	32, 3	8, 2	—5, 3	.....
Industrial consumer goods	2, 0	+4, 0	4, 5	.....	10, 0	—14, 7	5, 9	.....
Total	100, 0	—1, 4	9, 1	.....	100, 0	10, 1	2, 1	.....

[1] See classification p. ((37)) footnote ((1)).
[2] CMEA(6)=Bulgaria, CSSR, German Democratic Republic, Hungary, Poland, Romania.

Note: Figures in parentheses estimated from changes in Soviet prices by commodity groups in foreign trade with Hungary (from Hungarian sources). In calculating the CMEA(6) total, export and import shares of Soviet trade were used.

The Soviet terms of trade appear to react very sensitively to the world business cycle.[17] This is due to the particular commodity composition of Soviet trade and to the inflexibility of her foreign trade practice. In addition, the USSR came under pressure through her growing foreign trade deficit vis-a-vis the West: in order to increase export earnings in 1975 in the face of unfavorable market conditions, particularly noticeable in reduced raw materials demand, the USSR was obliged to accept price cuts. Import prices, on the other hand, rose vigorously because after the very poor harvest in 1975 the USSR was forced to import 16 million tons of grain at prices 61 percent above those in the preceding year. In 1975 total imports from the rest of the world rose by 31 percent in real terms. The drastic slowdown in import growth imposed in subsequent years seems to have been well worth while in its effect on prices. In 1976 Soviet terms of trade improved by nearly 7 percent. A further recovery was reported for the year 1977.

Comparison of the columns showing export and import prices in Table 5 reveals the fact that the Soviet terms of trade loss in its foreign

[17] Cf. P. Marer, Postwar Pricing and Price Patterns in Socialist Foreign Trade (1946–71), Indiana University 1972, p. 47.

trade with the rest of the world was due to an extreme decline in the terms of trade in three important commodity groups, viz in machinery and equipment (by 15 percent), in ores and metals (20 percent) and in agricultural products and foods (by as much as 23 percent). The gains in the other commodity groups, at any rate, could not make up for these considerable losses.

A very different picture emerges in trade with East European partners.[18]

In most of the commodity groups on the import side we note a stronger price increase than on the export side.[19] Thus the Soviet terms of trade could only improve because there were over average price increases in those groups where the USSR is a net exporter. 21 percent of Soviet exports to Eastern Europe in 1974 consisted of fuels, at prices that had been increased by 84 percent, while the appropriate import share was only 2.5 percent. Prices of ores and metals rose by 45 percent on average in 1975; these goods accounted for a 24 percent share of Soviet exports, but only a 2 percent share of her imports. The position was similar with chemicals and building materials. The situation is the reverse in the field of machinery but the effect on terms of trade was the same: Prices of machinery rose to a less than average degree in 1975. But the USSR has a considerable excess in imports. Thus: it was only her favourable foreign trade structure that brought the USSR an improvement of her terms of trade in the CMEA in 1975—not any price advantage.

In 1975 the enormous discrepancy between intra-CMEA prices and current world market prices was almost halved in the course of the alignment to the three years' average of world market prices 1972–1974. With the transition to the five years' average 1971–1975 as the standard for alignment—meaning that a "cheap" year, 1971, and an "expensive" year, 1975 were added—there were hardly any impulses left for a further price adjustment to enter into price formation for the year 1976. In so far as the price adjustment process is concerned 1976 is an atypical year.

World market prices of 1971–75 led one to expect a mere 4 percent rise of Soviet export prices in 1976 in trade with the CMEA.[20] Actually they rose by about 9 percent. It is likely that the USSR caught up in 1976 on some of the price rises that would have been possible in 1975 according to the formula.[21] For Soviet export prices in most of the commodity groups rose faster than import prices. In 1976, Soviet terms of trade rose by a further 3 percent, with considerable price increases in Soviet machinery as a main contributory factor.

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[18] From here on, we report only on the development of trade between the U.S.S.R. and Eastern Europe (CMEA (6)). Cuba and Mongolia are special cases as far as price formation is concerned. Price changes vis-à-vis the whole CMEA group (table 3) were calculated only for the purpose of confronting official Soviet data with our results.

[19] The U.S.S.R. would have actually suffered a terms of trade loss of 5 percent had export and import shares been equal in the individual commodity groups. The weights were defined as

$$w_j = a_j + b_j/2, \text{ where } \sum_{i=1}^{\vartheta} = 1$$

and

a_j shares of Soviet exports to CMEA
b_j shares of Soviet imports from CMEA
} in the jth commodity group.

[20] Weighted by structure of Soviet exports to CMEA in 1974 and adjusted to Ruble Dollar parity (cf. comments on figure 1).

[21] Following the price model Soviet export prices for 1975 should have risen by 54 percent. The actual increase was "a mere" 40 percent.

Calculations by E. A. Hewett for the years from 1956 to 1970 show that the Soviet export prices in machinery sales to CMEA(6) did not keep up with import prices.[22] The sudden reversal of these trends in favour of the USSR in 1976 and 1977 surely does not reflect a jump in quality of Soviet machinery; more likely they are an expression of the fact that the Soviet bargaining position has grown stronger in the course of the medium term and long-term prospects of the threatening energy shortage. The structural bilateralism of intra-CEMA trade makes it quite possible to shift price rises from commodity group to commodity group. When, e.g., it seems advisable for reasons of bargaining tactics to exercise restraint in price increases in a particular commodity group, then prices might be increased in a different commodity group where this may elicit less comment. Possibly shifts of this kind may be a further reason for the much discussed fact that the relation between machinery prices and raw materials prices in intra-CEMA trade is well above the world market relation.[23]

As was pointed out earlier, Soviet statistics have considerably reduced the published number of value and quantity data (unit value positions) for 1977. Generally, those positions where unit values had risen above average were omitted. Now if we base the computation of unit value indices for 1977 on published data then a terms of trade loss for the USSR of about 4 percent will result. In contrast to this, official index figures disclose a terms of trade improvement of 3.0 percent for the USSR's position (vis-à-vis the whole CMEA region) (table 3), and it is likely that the latter value understates the true position.

Several circumstances point in that direction: First—the sliding price formula based on world market prices implies a 6.9 percent improvement in the Soviet terms of trade with Eastern Europe in 1977. Next, we calculated export and import price indices for the individual commodity groups—using the Hungarian statistical data which contain very detailed information on Hungarian foreign trade with the Soviet Union—and then weighted the results with the commodity structure of Soviet exports and imports in its intra-CEMA trade. The results of this procedure, to be amplified below, resulted in an estimated value of 6.2 percent. Thus there are some pointers indicating that the Soviet terms of trade with Eastern Europe may have improved in 1977 by between 6 and 7 percent.

Two main components have contributed to this improvement: first, the adjustment process in fuel prices to world market levels continued at a faster rate again since a "cheap" year—1971—was eliminated from the basis of calculation and a "dear" year, 1976, was added (cf. chart). Second, Soviet prices for machinery and equipment rose much faster in 1977 than import prices: a trend that may bear witness much faster in 1977 than import prices: a trend that may bear witness to the strengthened bargaining position of the USSR.[24]

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[22] Hewett's preliminary calculations for 1970–74 show the same tendency. E. A. Hewett, 1978, unpublished manuscript.

[23] Cf. section 4.

[24] In the analysis of price changes in Soviet trade with CMEA(6) we were obliged to take our clues from the Hungarian data concerning that country's foreign trade with the U.S.S.R. The Soviet sample is too small for calculating statistically secured indices from it.

3. Soviet Terms of Trade Vis-à-Vis Eastern Europe to 1980

We have embarked on a prognosis of the Soviet terms of trade vis-à-vis Eastern Europe for 1978 to 1990, since we can assume that the "sliding price formula" gives a fairly accurate picture, over a number of years, of the true price development.

TABLE 6.—SOVIET TERMS OF TRADE VIS-A-VIS EASTERN EUROPE, 1975–80

	1975	1976	1977	1978	1979	1980	1975–80
Terms of trade calculated by:							
Unit value positions	11.4	3.0	[1] 6.2				
Gliding price formula[2]	16.0	1.2	6.9	5.6	4.5	0.3	39.0

[1] Estimated from Hungarian sources, see footnotes in tables 5 and 8.
[2] Estimated from world market prices, weighted by the structure of Soviet exports and imports to CMEA (6), in 1974 and adjusted to ruble/dollar parity (cf. note to chart). As from 1977 we assumed that world market prices grow at an annual rate of 4 percent. This implies that the relative prices of the individual commodity groups do not change—an assumption that may assess the Soviet terms of trade growth rather too low—as it may well turn out in the aftermath of the present Iranian crisis.

Source: Vneshnyaya torgovlya, various years; monthly bulletins of statistics, June 1978; own calculations.

The calculations by price formula seem to give the price range, at the very least. It is possible that the not fully applied price increases that would have been possible according to the formula were caught up on in subsequent years or may still be carried through. The price changes that have occurred between 1970 and 1976 in the world markets in favour of raw materials would lead one to expect terms of trade gains, until 1980, in favour of the USSR as against Eastern Europe, to the extent of 40 percent.

Of course it cannot be ruled out that the USSR may delay the price adjustment in order not to place too onerous a burden on the East European economies. Consequently the prices in bilateral intra-CMEA trade would approximate world market prices at a later stage only.

For the rest, let it be said that there is no evidence of "exploitation" of Eastern Europe through the USSR in the context of pricing. True, it may be noted that there exists a dependence, to the detriment particularly of the more advanced East European countries, inasmuch as the Soviet Union inhibits their potential development by virtue of her sociopolitical preponderance. The USSR, as a super-power, is primarily interested in close political ties. Economic considerations are of less concern to her and it would appear that the USSR may even make certain economic concessions as a price for maintaining those ties.

The extent of the future development of the Soviet terms of trade as against Eastern Europe depends not alone on price movements in the world market but also on the differences in the price relations in East and West. Ausch reports that machinery was over-valued in intra-CMEA trade as against raw materials—compared with the West—to the extent of at least 10 percent despite the generally lower quality of machines in intra-CMEA trade.[25] It is more than doubtful whether the same "distorted" price relation will be restored after completion of the approximation to increased world market prices. There is rather a likelihood that the worldwide (growing) scarcity

[25] S. Ausch, Theory and practice of CMEA cooperation, Budapest 1972, p. 83.

of raw materials in conjunction with the quickly rising costs of extraction and transportation of Soviet raw materials will lead to price relations between industrial goods and raw materials in the East that will parallel the price relations in the West. But following upon such adjustment of price relations in intra-CMEA trade, the Soviet terms of trade would improve to a greater extent than projected by us in the foregoing, on the basis of world market prices.

It can even happen that adjustments in the shape of relative price shifts may be omitted, even if they are economically advantageous because the USSR, precisely because of her political ascendancy, may wish to avoid the opprobrium of obtaining one-sided economic advantages.

4. Does the New Price Formula Impede Intra-Bloc Trade?

The rapid nominal growth of Soviet foreign trade leads to the assumption of a considerable growth in real terms, too. The price indices as calculated show such assumption to be false. The high price increases—very differentiated between various commodity groups and also within some groups—did surely do a disservice to the development of Soviet trade with her CMEA partners. In any case, intra-CMEA trade suffers from the circumstance that the efficiency of foreign trade activities cannot be rendered sufficiently visible. The old Bucharest ruling, providing that all major intra-CMEA price adjustments be carried out in five year intervals only (at the beginning of each new five-year plan period), was fully adapted to the functioning of intra-CMEA trade. It was easier possibly to coordinate the five-year plans, formulated at constant prices, and to regulate intra-CMEA trade in terms of firm quantity quotas. With the advent of the new pricing formula, which provides annual price changes whose extent can be substantiated, at best, at the beginning of each year only, the price scene may have become completely confusing. Not only do the new prices fail as indicators of shortages; advantages and disadvantages arising from foreign trade are even less easily assessed than formerly, and the amount of yearly repeated negotiating required for the fixing of new prices in all bilateral relations must have grown enormously.

TABLE 7.—DEVELOPMENT OF SOVIET TRADE VOLUME VIS-A-VIS EASTERN EUROPE

[Shares growth rates in percent]

	Exports				Imports			
	1974	1975	1976	1975–76	1974	1975	1976	1975–76
Machinery	32,5	−3,1	1,7	−1,5	55,5	1,9	6,2	8,2
Fuels	2,4	7,8	7,9	16,3	2,5	5,1	−9,1	−4,5
Ores, metals	24,3	2,0	−,4	1,6	2,4	3,1	−4,7	−1,7
Chemicals and building materials	4,3	13,6	−4,2	8,8	4,4	17,9	7,2	- 26,4
Agriculture products and foods	14,4	−11,6	−9,7	−20,2	11,1	12,6	−3,6	8,5
Industrial consumer goods	3,1	17,4	3,4	21,4	24,1	4,6	,1	4,7
Total	100,0	,6	1,3	1,9	100,0	4,6	2,8	7,5
Total at current prices	×	36,3	10,5	50,6	×	31,5	8,1	42,2

While Soviet exports stagnated [26] in the first two years after the sliding price formula was introduced, imports from Eastern Europe grew by a modest 7.5 percent. But of course this could only serve to compensate a small part of the trading balance surpluses of the USSR that may be ascribed to the development of the terms of trade. Though the Soviet raw materials exports increased in the preceding years, Soviet machinery exports stagnated. The event that helped reduce the unbalance in foreign trading was the poor harvest in the USSR: Soviet exports of foods and agricultural products were considerably curtailed while agricultural imports rose. Of course it was only countries with agricultural surpluses, viz. Bulgaria, Hungary and Romania, who could participate in the expansion of these Soviet imports.

Even assuming that the sliding price formula may disturb the functioning of the intra-bloc mechanism and could have led to a temporary stagnation of the flows, there can be no doubt that the improvement of the terms of trade position of the USSR will sooner or later bring about Eastern Europe's intensified economic dependence on the Soviet Union. Since the East European countries are dependent on Soviet raw materials, they will react with a certain restraint in trading with the USSR—but not with an actual reduction of their imports—to those foreign trade deficits that have been constantly on the increase since 1974. It follows that the Soviet terms of trade gains can only be compensated by a great export drive of the East European countries. This supposition is underlined by the development in 1978, when the preceding year's Soviet export surplus of 1,414 million Ruble (US $1917 million) was reduced to 169 million Ruble (US $247 million). Soviet exports had increased by 11 percent (nominal), imports from Eastern Europe, however, by 21 percent. Since an improvement of the Soviet terms of trade is to be expected for 1978 too—our estimate puts it at 5.6 percent—the difference in nominal growth rates may indicate an even greater difference in growth in real terms.

The USSR is apparently urging a speedy reduction of the deficits, in fact a reduction of her accumulated transfer balances which, in effect, automatically constitute loan positions of the CMEA countries. This attitude is entirely in keeping with the logic of the system, since possession of transfer rubles—which are, in fact, neither convertible nor transferable—gives the USSR, as the creditor, no economic advantages whatsoever. Thrown back on bilateral clearing, the creditor can acquire such commodities only as the partner country is able and willing to make available for export.

While the sliding price formula protects the CMEA countries that are deficient in raw materials from any too sudden deterioration of the terms of trade, thereby offering them some relief, it is the inflexi-

[26] Annual average growth rates of Soviet trade with CMEA in real terms:

Exports:	
1961–1970	9.5
1971–1974	5.2
1975–1976	0.9
Imports:	
1961–1970	7.8
1971–1974	5.9
1975–1976	3.7

bility of the monetary system within the CMEA that imposes a speedy reduction of the foreign trade imbalances and thereby forces an accelerated adjustment process—for which countries with convertible currencies could normally take their time. It might even be concluded that it is the inflexibility of the monetary system that imposes the necessity for going easy when carrying out the adaption of CMEA—to world prices—especially after the latter have undergone sudden or drastic changes.

5. Price Changes in Soviet Foreign Trade With Individual East European Countries

In foreign trade with the individual East European countries there is considerable variation in the terms of trade changes. This—as will be shown—is due, in the main, to differences in the commodity composition. It is in trade with countries with whom the USSR is engaged in complementary trade—i.e., when delivering raw materials against finished products—that the USSR achieves the greatest terms of trade gains. Thus the terms of trade vis-à-vis the GDR improved by 18 percent in 1975, and by 13 percent in trade with the CSSR (table 8).

TABLE 8.—PRICE INCREASES IN SOVIET FOREIGN TRADE WITH THE EAST EUROPEAN COUNTRIES

[Shares change in percent]

	Exports				Imports				Terms of trade		
	1974	1975	1976	1977	1974	1975	1976	1977 [1]	1975	1976	1977
Bulgaria	17,0	38,2	9,7	13,1	16,6	25,6	2,2	5,7	9,7	7,3	7,0
CSSR	17,4	37,0	9,9	11,9	17,6	21,1	8,6	2,9	13,1	1,1	8,7
German Democratic Republic	24,9	41,0	7,3	11,1	25,0	19,9	1,7	2,5	17,6	5,5	8,4
Hungary	13,0	39,8	7,6	11,9	13,3	25,2	4,2	4,8	11,7	3,2	6,8
Poland	21,1	40,5	8,5	11,7	20,3	36,8	9,7	8,2	2,7	−1,2	3,2
Romania	6,6	32,1	12,9	9,8	7,1	28,5	9,5	7,2	2,8	3,1	2,4
Total	100,0	39,0	8,8	11,6	100,0	25,9	5,6	5,0	10,4	3,0	6,2

[1] Estimated from changes in Soviet prices by commodity groups in foreign trade with Hungary (from Hungarian sources) weighted with the commodity shares in exports and imports of Soviet trade with the respective countries.

Source: Vneshnyaya torgovlya 1975, 1976 and 1977; Kiilkereskedelmi statisztikai evkönyv, 1976 and 1977, own calculations.

The fact that it was mainly price increases for various types of energy that raised the price level of Soviet exports in 1975 may be gathered from the circumstances that Romania—having imported hardly any fuels from the USSR—fared relatively well with a price increase of 32 percent. Soviet export prices rose by around 40 percent for the other East European countries. The uniformity of the price burden is due to the similarity of the commodity composition of Soviet exports to all other East European countries.[27] It is otherwise with imports: here, the differences are greater. Soviet imports from Eastern Europe are concentrated in the fields of machinery and industrial consumer goods, whose prices rose but little. These two groups accounted for more than 90 percent of Soviet imports in 1974 from CSSR and GDR.[28] And accordingly price increases for imports from those coun-

[27] The only outstanding exception is the high share of machinery of Soviet exports to Bulgaria (1974: 50 percent without commodity group 10). As to the structure of Soviet foreign trade with Eastern Europe, see table 5.

[28] Without commodity group 10.

tries were quite modest. Countries with agricultural surpluses, on the other hand, could compensate the Soviet export price increases more successfully. Bulgaria was able to obtain a price increase of 36 percent for its agrarian exports to the USSR (1974: share 32 percent).

Hungary increased prices in these commodity groups by 31 percent.[29] But Poland fared best since that country was able almost completely to compensate for Soviet crude oil price increases through mark-ups on its coal price (114 percent). In consequence, Poland's terms of trade with the USSR deteriorated by only 3 percent in 1975, and for 1976 we computed some improvement for Poland's position.

As in 1975, so in 1976 there was hardly any differentiation in average Soviet export prices by CMEA countries, while there were considerable differences in import prices. The reasons for such differentiation are not easily transparent since the impulses leading to price increases in 1976 are composed of contradictory tendencies (cf. p. 24). In 1976, when Poland obtained slight terms of trade gains, Bulgaria had to contend with a terms of trade loss of 7 percent on the outside.

As pointed out before, the Soviet Foreign Trade Annual data proved totally useless for calculating the 1977 unit value indices since they lead to systematically distorted values.[30] In order to arrive at some conception of the price development in Soviet foreign trade with the individual countries despite this handicap, we have made use of the high degree of determination exercised by the foreign trade shares on the development of the prices. In this we base ourselves on Hungarian sources and have assumed that the price development in foreign trade between the USSR and Hungary in the individual commodity groups is representative of the price changes in Soviet trade with the other East European countries.[31]

The results of the estimates confirm what appears obvious by the sliding price ruling, namely that the USSR's terms of trade have again improved most in 1977 with respect to CSSR and GDR. This is mainly due to the fact that the prices of imports from those countries rose at the slowest rate. Again it was Poland and Romania that fared best; in the case of Poland because that country was an exporter of fuels—again at above average increased prices—to the USSR; and Romania, because it took practically no deliveries from the Soviet Union in that commodity group.

Our estimates could be carried out only after we had ascertained by check calculations the high degree by which the commodity structure determines price changes of Soviet trade with the individual CMEA countries. The astonishingly close connection leads us to the following conclusion: Despite the divergent levels of Soviet oil prices discussed in section 1—and price divergencies for non-homogeneous commodities are much greater still [32]—there are no tangible indications for assuming that the USSR had let political considerations come

[29] On the basis of the gliding price formula, the U.N. price index for foods implies a price rise in the CMEA (region) of 35 percent for 1975.
[30] Cf. p. [1].
[31] Soviet price changes with each individual country are obtained by weighting price changes in Soviet-Hungarian trade with the commodity composition of Soviet trade with each individual country.
[32] S. Ausch, Theory . . . , op. cit., p. 80.

into play in their price increases carried through since 1975. This is borne out by the fact that the actual terms of trade shifts would also contradict such a supposition. Precisely those countries had to contend with considerable terms of trade deteriorations, that are generally considered the most faithful adherents of the USSR.

6. On the Method of Calculating Unit Value Indices

Soviet statistical data reporting on exports to and imports from individual countries are arranged according to a seven digit key, with each first digit (running from one to nine) designating one of nine commodity groups (ETN=Edinaya Torgovlya Nomenclature).[33] We have kept to this classification, apart from two exceptions: First, we split group 2 in two, viz., "fuels" and "mineral raw materials and metals". The split-up of commodity group 2 is justified by its magnitude and by the discrepancy between the two subgroups' contributions to the development of prices: Second, we included one-digit group 6 (livestock)—very nearly a negligible quantity—in group 5 (raw materials of animal and vegetable origin, inedible), and in consequence we too obtain nine commodity groups.[34]

The individual positions dealt with in the Soviet Foreign Trade Yearbook (Vneshnyaya Torgovlya) are more or less narrowly circumscribed product groups, e.g., ships' diesel engines (11018), copper (2700101), or leather and leatherette garments (911). In almost two-thirds of all positions listed, the Soviet Annual gives both values and quantities.[35] Such positions we designate as unit value positions, since it is possible to calculate average prices for them. Value data only are given for the remaining third, either because quantitive data would not make sense—or because information on the latter is deliberately withheld.[36]

The average values that may be calculated from these unit value positions must not be confused with genuine prices. Were we to attempt to compare unit values in foreign trade with different countries,

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[33] The nine commodity groups listed in Soviet foreign trade statistics are:

Number, ETN groups, and designation	*Short designation in tables 5 and 7*
1—100–u. 200: Machinery and equipment	Machinery.
2a—200–u. 240: Fuels	Fuels.
2b—240–u. 300: Ores, metals	Ores, metals.
3—300–u. 400: Chemicals, fertilizers, rubber.	
4—400–u. 500: Building materials and construction parts	Chemicals and building materials.
5—500–u. 600: Raw materials of vegetable and animal origin (not food).	
7—700–u. 800: Raw materials for the production of foodstuffs	Agriculture products and foods.
8—800–u. 900: Foodstuffs.	
9—900–u. 000: Industrial consumer goods	Industrial consumer goods.

[34] A translation of Soviet foreign trade terminology may be found in P. Marer, Soviet and East European Foreign Trade 1946–69, Bloomington and London 1972, p. 311.

[35] If quantities were listed in both pieces and weight the latter were used in our calculations.

[36] Thus we find but one single-value datum in the Soviet sources concerning imports of "ores and metals" from the CSSR—the item constituted close on 10 percent of total Soviet imports from CSSR (ETN 24–27). It may be surmised that this position includes uranium. The GDR too supplies uranium, this being extracted by Wismut AG., a Soviet joint-stock company with German participation (the GDR participating since 1954). The position does not appear at all in the foreign trade statistics of either country. It is not clear whether the uranium deliveries may be counted as German reparations (officially discontinued since 1953), or as compensation for the Soviet costs for her military presence. Although the position does not appear in foreign trade data of the two countries, it cannot be excluded that the uranium deliveries are a further reason for the price reductions of the Soviet crude oil deliveries.

we would encounter great difficulties since both quality of goods and commodity composition may be very different in the individual positions. But since it is price indices over time in one particular country that we aim to calculate, the problem does not arise in its full extent.[37] In general we may rely on it that the quality of goods and commodity composition will hardly change in the course of several years. Major distortions might only be expected if quantitative changes were to take place in regard to products whose prices were above or below the average of prices within the unit value group. It is possible that price indices computed on the basis of unit value groups may overestimate actual prices to some extent, since foreign trade in high quality goods grows faster than the average. In order to exclude errors of this kind as far as possible we have computed the price indices only for each individual successive year thereafter linking them, which means that

$$P_{74,\,77}=P_{74,\,75}\cdot P_{75,\,76}\cdot P_{76,\,77}$$

Though this nearly doubled our figure-work, we then only had to impute the constancy of the use-value structure for one individual period. Besides, we excluded the unit value positions whose prices dropped by more than 40 percent or rose by more than 100 percent within one year (fixing a 200 percent price rise limit for 1975 in ETN-group 2) because it may be assumed that price rises exceeding these parameter are due to substantial structural changes in quantities.

Linking the indices offers a further advantage: A linked index, as has been shown by R.G.D. Allen [38], possesses greatly superior statistical characteristics. It satisfies approximately the circular condition

$$P_{ot}=P_{os}\times P_{st} \text{ for all } s\ (\emptyset<s<t)$$

and will always, be it a Laspeyres index or a Paasche index, lie between the direct Laspeyres and Paasche index.

Below we shall set out the formulae used in the steps of calculating, first, the changes of unit values in the individual positions, through to the average price changes of Soviet exports into the CMEA area. After calculating the import prices—whereby we follow, naturally, the same sequence of stages—we obtain the indices of the terms of trade as quotients of the export and import price indices.

Steps of calculating Soviet foreign trade price indices.

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[37] Genuine foreign trade price indices which are based on established commodity baskets and are thus Laspeyres indices, are calculated only in the FRG, Sweden, Finland, Japan and South Korea. The other countries and international organizations resort partly to an index of average values which is determined by devision of volume changes into value changes, partly to the so-called unit value index which is used, for example, by the United Nations. The unit value index is a "price index" according to Paasche from which the quantum index (volume index) is then derived. Aside from the fact that the genuine price indices and the unit value index are determined according to different index formulae, the following changes, inter alia, enter into the unit value index in addition to pure price changes:

Assortment and quality changes within the unit value positions;

Changes in transportation costs, due to changes in the means of transportation and routes; and

Changes in payment and delivery conditions.

See W. Rostin, Die Indizes der Auszenhandelspreise auf Basis 1970, Wirtschaft und Statistik, 6/1974, p. 393.

[38] R. G. D. Allen, Index Numbers in Theory and Practice, London 1975, p. 177.

Example: Soviet exports.

(1) $$u_{kij} = \frac{v_{kij,t}}{q_{kij,t}}$$

Unit value of position k from commodity group i of exports to country j, where v denotes value and q denotes quantity of such position.

(2) $$p_{ij} = \frac{\sum_k u_{kij,1} q_{kij,1}}{\sum u_{kij,\phi} q_{kij,1}}$$

Unit value (Paasche) index for exports in commodity group i to country j

(3) $$p_j = \frac{1}{\sum_i a_{ij}} \sum_i p_{ij} a_{ij}$$

Unit value index for exports to country j, with a_{ij} being the summed-up export values across all positions of commodity group i (including positions without quantity data) in each preceding year respectively (Remark 2 and 3)

(3a) $$p_i = \frac{1}{\sum_j a_{ij}} \cdot \sum_j p_{ij} a_{ij}$$

Unit value index for exports of commodity group i to CMEA area.

(4) $$p = \frac{1}{\sum_j e_j} \cdot \sum p_j e_j$$

Unit value index for Soviet exports to CMEA, with e_j being the respective total exports to country j in each preceding year.

List of symbols

i=1, 2, ..., 9	unit value positions
k=1, 2, 3, ...	commodity groups
j=1, 2, ..., 6	CMEA(6)=Bulgaria, CSSR, GDR, Hungary, Poland, Romania
=1, 2, ..., 8	CMEA(8)=CMEA(6)+Cuba+Mongolia
$t=\begin{cases}0\\1\end{cases}$	years
v_k	value in unit value position k
q_k	quantities in unit value position k
u_k	unit value (average price) in position k
p	price index of period 1 to basis 0
a_{ij}	summed-up export values in commodity group including positions without quantity data
e_j	total exports from USSR to country j.[39]

Remark 1

We selected the Paasche version for index p_{ij}, for two reasons:

1. As we know, multiplication of the price index of the Paasche type with the quantity index of the Laspeyres type gives the growth factor of the price change. As mentioned before, the Soviet volume index belongs to the Laspeyres type, while the price index that may be deduced from the growth factor of the value change and the Soviet volume index is cast in the form of the Paasche index.

2. The index of terms of trade is defined as the quotient of the export price index and import price index according to Paasche.

[39] Including unpublished export value in commodity group 10.

Remark 2

We always base ourselves on maximal sample values since we have utilized all uv-positions for the caculations of the indices (apart from certain defined exceptions). But it is impossible to control exactly to what extent the samples are random samples, thus guaranteeing optimal statistical quality. We may assume an at least adequate random sample quality for the calculation of price changes in 1975 and 1976, but not necessarily for 1977. This is because the sample size was radically reduced in the Soviet foreign trade annual for 1977 and precisely those uv-positions fell victims to this weeding process wherein a more than average price increase was to be expected.

The unit value-positions have sample characteristics in two respects:

(a) With respect to individual commodity groups, since quantity data are not available for each position; and

(b) With respect to total foreign trade, since unit value indices cannot be calculated at all for a part of foreign trade. Therefore we had to assume that the unit value-positions, adjusted by elimination of the "runaways", represent price changes of the remaining positions.

(*a*) The unit value-position samples' size is very different in the individual commodity groups (table 9). It measures the share of the sample in the population and is a criterion of the statistical quality of the indices.

The sample size (1975) varies greatly from community to commodity group. In the case of raw materials and semi-finished products, samples and basic totality merge in many cases, both in exports and in imports; in exports of machinery and industrial consumer goods the degree to which the sample represents the population (sample size) is still quite fair. Only in imports of the latter group is the statical quality of the price indices somewhat dubious. The average sample size is considerably higher in exports than it is in imports. This is in the main accounted for by the commodity structure: in imports the high share of the more poorly represented commodity groups comes to the fore.

TABLE 9.—UNIT VALUE SAMPLE SIZE FOR THE COMPUTATION OF THE INDEXES P_{ij} IN 1975

ETN [1]	Bulgaria	U.S.S.R.	German Democratic Republic	Hungary	Poland	Romania
Exports:						
1	0.32	0.42	0.29	0.45	0.43	0.28
2a	1.00	1.00	1.00	1.00	1.00	1.00
2b	.97	.93	.98	.98	.98	.90
3	.69	.74	.61	.80	.81	.59
4	1.00	1.00	1.00	1.00	.97	1.00
5	.95	.97	.97	.97	.97	1.00
7	0	.70	.85	1.00	.98	0
8	1.00	.93	1.00	1.00	.60	1.00
9	.59	.48	.43	.61	.55	.76
Total	.63	.80	.77	.81	.79	.65
Imports:						
1	.39	.36	.41	.32	.27	.71
2a					1.00	1.00
2b	.95			.97	.96	.90
3	.79	.50	.54	.45	.87	.79
4	1.00	.83	1.00			1.00
5	1.00	1.00	.34	.68		.74
7	1.00	1.00		1.00		1.00
8	1.00	1.00		1.00	.73	.99
9	.21	.43	.15	.27	.24	.19
Total	.60	.40	.37	.46	.40	.59

[1] See text footnote 33.

(b) We had to assume for the unit value indices p_j that the indices p_{ij} represent the price increases in the total foreign trade, or, in other words, that prices in commodity group 10 rise at the rate of the average of price rises of goods in groups 1 to 9. The share of the tenth commodity group differs from country to country; it fluctuates between 5 percent and 15 percent.

Remark 3

We weighted the values a_{ij} of the respective preceding period (basic period). A weighting with current values would lead to a distortion upwards of the price indices.

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EAST-WEST ECONOMIC RELATIONS AND SOVIET-EAST EUROPEAN ECONOMIC RELATIONS*

(By Morris Bornstein)

CONTENTS

TABLES

This paper is a comprehensive but concise survey of some of the most important developments and outstanding issues in East-West and in Soviet-East European economic relations.

Part I examines factors responsible for the rapid expansion of East-West economic relations in the early 1970s and its extent and forms. Part II then considers reasons for the subsequent loss of momentum in the mid-1970s in the further development of East-West relations. Part III analyzes some implications for Soviet-East European economic relations. Part IV discusses the nature, problems, and prospects of Soviet-East European "economic integration" in the Council for Mutual Economic Assistance (CMEA). Part V concludes by identifying ways in which East-West economic relations are complementary or competitive with Soviet-East European economic relations.

In this paper, the "East" comprises the USSR and Eastern Europe, with the latter including Bulgaria, Czechoslovakia, the German Democratic Republic (GDR), Hungary, Poland, and Romania. In turn, the "West" comprehends the developed market economies of Western Europe, the United States, Canada, and Japan. However, space limitations preclude separate discussion of the involvement of each of these Eastern and Western countries in East-West relations.

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I. Expansion of East-West Economic Relations in the Early 1970's

For political reasons on both sides, East-West economic relations were severely limited during the "Cold War" which soon followed the military cooperation of the USSR with the United States, Canada, and Great Britain during World War II. From 1948 to the mid-1950's the United States and its allies sought to restrain the growth of Soviet (and East European) economic and military potential by controls on the exports of "strategic" goods, restrictions on credits, and other obstacles to economic relations (Adler-Karlsson). In turn, the USSR undertook to form an economic bloc by linking the East European economies to it through a network of bilateral trade agreements. Although the CMEA was formally established in 1949, it was not a vehicle for either multilateralism or region-wide integration (Kaser).

However, already by the mid-1950's a gradual "thaw" in this "Cold War" situation started, and East-West trade continued to grow steadily, if quietly, during the 1960's as a result of new attitudes on each side.

In the East, by the late 1950's or early 1960's (depending upon the country), rates of growth of industrial production, national product, and labor and capital productivity had begun to fall from the impressive figures achieved during the preceding decade. A common (and politically acceptable) diagnosis of economists and policymakers was that these economies were moving from the "extensive" to the "intensive" phase of economic development.

In the former phase, according to this analysis, it had been necessary to alter the structure of the economy drastically and rapidly, through industrialization, urbanization, and changes in the content and geographical orientation of foreign trade. The methods chosen for these tasks were socialization of the means of production, comprehensive and detailed central planning, rapid expansion of the industrial labor force (through increased participation of women and transfers from agriculture), and a sharp increase in the rate of investment.

In contrast, in the new "intensive" phase the emphasis of economic policy was no longer primarily on politically determined rapid structural change, as much as on smaller, more economically based changes in the composition of output and methods of producing it. Because neither the labor force nor the capital stock could be increased at the former high rates, greater efficiency in the use of limited inputs was essential. Furthermore, in the consumer sector, for certain goods (including some clothing, footwear, and simpler consumer durables), a shift was occurring from a sellers' to a buyers' market, as a result of the rise in living standards and the availability of stocks.

This diagnosis led initially to the prescription that "reform" of the domestic economic system could improve economic performance from available resources—through one or both of two kinds of "decentralization" (Bornstein 1977).

On the one hand, the "administrative decentralization" approach involved partial devolution of authority over selected decisions from higher to lower tiers within the administrative hierarchy—for instance, from the ministry to an intermediate "association" level supervising the producing enterprise. The idea was that lower administrative agencies could make more sensible and more timely decisions on some aspects of the composition of output and production meth-

ods—though subject to constraints in the form of centrally set global output assignments and input authorizations.

In contrast, the "economic decentralization" approach envisioned a greater role for domestic and foreign market forces in determining the composition of output, the allocation of resources, and even the distribution of income. Enterprise activities would be co-ordinated through "horizontal" market links rather than a "vertical" administrative command chain. Supply and demand forces, expressed through more flexible domestic prices (in turn related to world market prices), would guide decisions on outputs and inputs by profit-seeking firms.

However, fearing a loss of control over the economy and society, most CMEA regimes proved in practice unwilling to accept much of either type of decentralization. Thus, economic reforms either were not undertaken or did not survive long—except in Hugary, where a reform of the economic decentralization type (the "New Economic Mechanism") was implemented to a significant, though incomplete, extent.

With genuine systemic reform widely rejected as too risky, Eastern regimes paid greater attention to the potential contribution of more extensive trade and investment relations with Western developed capitalist market economies to solving the Eastern countries' problems of sagging growth rates and popular dissatisfaction with the rate of improvement in living standards. East-West economic relations offer Eastern countries three means of enhancing economic performance. One is sophisticated up-to-date machinery and equipment not available in the CMEA region. The second is advanced technology, including not only production processes covered by licenses but also entire turnkey plants constructed by foreign firms. The third is credit to cover two types of "gaps." One type is a "foreign exchange gap" in the form of a shortage of hard currency to pay for such imports from the West. The other type is a "domestic saving gap" which exists because the strained Eastern countries lack the capital and labor resources for these additional investment projects (even if they had the technical know-how to carry them out).

All the Eastern countries found that the benefits just mentioned justified an expansion of their economic relations with the West. However, only Poland went so far as to adopt an "economic strategy" based primarily on modernizing the economy with massive imports of Western technology, equipment, and industrial materials, financed by large credits—which it hoped to repay by future exports to the West of competitive industrial goods produced in the new plants (Fallenbuchl 1977b). Other Eastern countries assigned East-West economic relations a more modest, though important, role in their development plans.

A further impetus for Soviet interest in expanding its own and Eastern Europe's economic relations with the West was the USSR's recognition that during the 1960s its trade with Eastern Europe had become economically less advantageous for the USSR. Because changes in world market prices were reflected incompletely and with a lag in intra-CMEA trade, the USSR was supplying Eastern Europe raw materials and fuels in return for outdated machinery and poor quality manufactures. Instead, the USSR could sell its primary products to the West for higher prices and payment in convertible currency which

could be used to buy advanced Western machinery and technology and, in bad harvest years, grain.

On the Western side, business firms and banks responded to the further opening of the "Eastern market" with lively competition in goods, technology, and credit. The active participation of U.S. firms and financial institutions in East-West trade received a political imprimatur and stimulus in Soviet-U.S. efforts at rapprochment and détente culminating in SALT I and other agreements reached at a "summit" meeting in Moscow in May 1972 and subsequent U.S.-Soviet agreements in October 1972 about trade, shipping, and credit (Wilson and others). The implementation of these agreements was subsequently curtailed by disputes over Soviet emigration policies and other issues, but U.S. trade with the USSR continued to grow, financed by private credits and Soviet hard-currency earnings.

Thus, during the early 1970s Eastern imports from the West increased much faster than Eastern exports to the West, leading to large trade deficits which (in the absence of significant surpluses on other current account transactions) were financed by substantial Western credits and the accumulation of significant net indebtedness to the West. For example, from 1970 to 1973 Soviet imports from the West rose from $2.8 billion to $6.2 billion, and Soviet exports to the West from $2.4 billion to $5.1 billion. The cumulative deficit for the three years 1971–73 was $2.3 billion. East European imports from the West climbed from $5.1 billion in 1970 to $11.1 billion in 1973, while exports to the West increased from $4.4 billion to $8.5 billion, and the cumulative deficit during 1971–73 totaled $4.6 billion. As a result, according to representative estimates,[1] the net hard currency debt of the six East European countries grew from $4.6 billion at the end of 1970 to $8.5 billion at the end of 1973 (Zoeter, p. 1352), and for the USSR the corresponding increase was from $1.9 billion to about $4.0 billion (Marer 1978, p. 100, and Marer 1974, p. 129).

Another noteworthy development in East-West economic relations in the early 1970s was a rapid increase in the number of industrial cooperation agreements (ICAs) from about 350 in 1970 to over 600 in 1973.[2] ICAs cover one or more of such activities as licensing of technology, training and technical assistance, plant construction, joint production (including subcontracting and exchange of components), and cooperative marketing. About three-fourths of ICAs concern producer goods (especially machine building and chemicals), and only one-fourth consumer goods. The most active countries have been Hungary, Poland, and Romania on the Eastern side, and the Federal Republic of Germany, France, the United Kingdom, and (more recently) the United States on the Western side.

To the Eastern partner, ICAs offer a way to obtain equipment, technology, know-how, and/or sales outlets on the world market. Often it

[1] Estimates of Eastern indebtedness to the West are difficult because of the lack of published information from Eastern sources, the variety of types of private and official credit extended by the West to the East, and the need to distinguish net from gross debt. Hence, published Western estimates vary for one or more of these reasons. Sources and methods for debt estimates are discussed in detail in Zoeter and in Melson and Snell.

[2] Estimates of the number of ICAs, their value, their distribution by Eastern and Western countries, and the activities involved vary because of differences in (a) the types of activities included in the definition of "industrial cooperation," (b) the country coverage of different surveys, and (c) the extent to which signed but unimplemented agreements are counted. These problems are reviewed in recent studies by McMillan 1977, Marer and Miller, and Savyolova.

can save scarce hard currency by paying the Western partner in the future output of the project. To the Western partner, ICAs offer access to CMEA markets and a source of low-cost production for sale on the world market.

However, the problems involved in reaching and subsequently implementing ICAs have proved formidable. (1) In regard to the choice of technology, the East seeks to obtain the latest technology in capital-intensive industries, while the West prefers to transfer more labor-intensive processes based on standard (or even aging) technology. (2) The two sides often disagree on the specific varieties and models to be made and the standards and supervision of quality control. (3) The insulation of domestic price systems in the East from the world market makes it difficult to reach agreement on pricing inputs and outputs. (4) In turn, there are important issues about the calculation, sharing, and taxation of profit, and its remittance to the West. (5) Finally, the marketing of Eastern products in the West has fallen below expectations because of depressed demand conditions and trade restrictions in the West.

Thus, although by 1976 the number of East-West ICAs exceeded 1,200, the goods shipped under them amounted to only 4–5 percent of total East-West trade turnover.

II. Slowdown in Development of East-West Economic Relations in the Mid-1970's

In the mid-1970s the development of East-West economic relations was interrupted by OPEC-led increases in world oil prices and subsequent inflation and recession in industrialized market economies.

According to estimates of the United Nations Economic Commission for Europe (U.N.E.C.E.), presented in Table 1, although the value of Soviet and East European imports from the West grew by 40 percent in 1974 compared with 1973, price changes were largely responsible, as Eastern import prices rose by 30 percent and real volume by 8 percent, while Eastern export prices rose by 62 percent (68 percent for the USSR) and volume fell by 12 percent. In 1975, the 31 percent increase in Eastern imports was due primarily to a big volume increase (63 percent for the USSR, reflecting big purchases of food products). In contrast, the value of Eastern exports rose by only 6 percent, entirely due to greater volume at the same prices. In 1976, as business conditions in the West improved, Eastern exports to the West rose by 7.4 percent in real terms and prices increased 8.9 percent, yielding an increase of 17 percent in value. With this growth in export earnings, and a 4.7 percent decline in import prices, the East was able to achieve a 10 percent increase in the volume of imports from the West, although the corresponding value increment was only 5 percent. However, in 1977 the growth of imports into the Western market economies fell sharply, and Eastern exports to the West rose by only 1 percent in volume though, thanks to a 10.9 percent increase in prices, by 12 percent in value. In turn, Eastern imports from the West fell 8 percent in volume but rose 1 percent in value as a result of a 9.7 percent increase in prices. In the first nine months of 1978, the value of Eastern imports from the West climbed 16 percent, because of equal increases in volume and prices, but the value of Eastern exports to the West grew

11 percent, chiefly because of a 9 percent rise in prices. Thus the Eastern trade deficit, which had been reduced in 1976 and 1977, grew in 1978.

TABLE 1.—TRENDS IN EAST-WEST TRADE, 1974–78

[Percentage change over same period of preceding year]

Period	Eastern imports from West			Eastern exports to West		
	Value	Prices	Volume	Value	Prices	Volume
1974	40.0	30.0	8.0	42.0	62.0	−12.0
1975	31.0	8.0	21.0	6.0	0	6.0
1976	5.0	−4.7	10.0	17.0	8.9	7.4
1977	1.0	9.7	−8.0	12.0	10.9	1.0
January–September 1978	16.0	8.0	8.0	11.0	9.0	2.0

Source: UNECE, sec. 6, table 6.5.

However, the USSR, was more successful than Eastern Europe in reducing the trade deficit with the West by expanding exports and curtailing imports. Soviet exports to the West rose from $8.4 billion in 1975 to $10.3 billion in 1976 and $12.1 billion in 1977, while imports grew only modestly from $13.5 billion in 1975 to $14.4 billion in 1976 and then were cut back in 1977 to $13.6 billion, approximately the 1975 level. Thus, the Soviet trade deficit with the West fell from $5.1 billion in 1975 to $1.5 billion in 1977.

In contrast, the six East European countries as a group boosted exports from $11.3 billion in 1975 to $12.8 billion in 1976 and $14.1 billion in 1977, but also increased imports from the West from $17.7 billion in 1975 to $19.2 billion in 1976 and then approximately stabilized them at $19.3 billion in 1977. As a result, Eastern Europe's combined trade deficit with the West was cut by only a fifth, from $6.4 billion in 1975 to $5.2 billion in 1977.

Further progress in reducing Eastern—especially East European—trade deficits with the West will be difficult. A recent econometric study by Vanous (1978b) yields activity elasticities for CMEA imports from the West well above unity, indicating rising shares for these imports in CMEA countries' domestic supplies of machinery and equipment, fuels and non-food raw materials, food and raw materials for food, and industrial consumer goods. The relation of import prices from the West to CMEA contract prices does play some role in determining imports of manufactured goods from the West, but it is not significant for primary products, which must be imported from the West when they are not available inside CMEA. On the other hand, for CMEA exports to the West, Vanous (1978c) finds that activity elasticities are generally close to unity, indicating relatively constant shares for CMEA countries in Western imports of different commodities from all regions of the world. However, price elasticities for CMEA exports to the West tend to be rather high, especially for machinery and equipment. Thus, price-cutting may be the only effective way of increasing sales of manufactured goods to Western markets.

Substantial trade deficits were responsible for the steady climb in Eastern net debt to the West, some recent estimates for which are presented in Table 2. For the East European countries as a group, it rose from $13.1 billion at the end of 1974 to $31.7 billion at the end

of 1977. For Bulgaria, Czechoslovakia, the GDR, and Hungary, the estimated net debt slightly more than doubled over the period, but it more than tripled for Poland, while increasing only by half for Romania. The USSR's estimated year-end net debt also grew rapidly, from $5.0 billion in 1974 to $16.0 billion in 1977. In addition, as a result of their Eurocurrency borrowings, the net year-end debt to the West of the two CMEA banks rose from $0.1 billion in 1974 to $1.7 billion in 1977. Thus, total Eastern net debt to the West at the end of 1977 was estimated at $49.4 billion.

TABLE 2.—ESTIMATED NET HARD-CURRENCY DEBT OF EASTERN EUROPE, U.S.S.R., AND CMEA BANKS, END OF YEAR, 1970, 1974–77

[Billion U.S. dollars]

	1970	1974	1975	1976	1977
Bulgaria	0.7	1.2	1.8	2.3	2.7
Czechoslovakia	.3	1.1	1.5	2.1	2.7
German Democratic Republic	1.0	2.8	3.8	6.0	5.9
Hungary	.6	1.5	2.1	2.8	3.4
Poland	.8	3.9	6.9	10.2	13.0
Romania	1.2	2.6	3.0	.3	4.0
Total, Eastern Europe	4.6	13.1	19.1	25.7	31.7
U.S.S.R.	1.9	5.0	10.0	14.0	16.0
CMEA banks	0	.1	.5	1.1	1.7
Total	6.5	18.2	29.6	40.8	49.4

Source: Marer 1978, p. 100.

Because full information is lacking on the maturity structure and interest rates for much of this debt, it is difficult to reach a reliable appraisal of Eastern countries' ability to service it by making scheduled payments of interest and repayments of principal, and the risk of default or need for refinancing to avoid it. Studies (for example, Askanas and others, and Vanous 1978a) analyzing the ratio of indebtedness (a stock concept) to exports (a flow concept) offer some cross-country comparisons which may be of interest. But they do not address directly the pressure on borrower countries to meet debt service obligations by reducing imports from the West and/or by increasing exports to the West (at the expense of domestic absorption and/or intra-CMEA sales). This pressure can better be evaluated by more direct estimates of the "debt service ratio" obtained by taking (a) annual interest on all debt and repayments of principal on medium- and long-term debt as a percentage of (b) annual merchandise exports to the West. For 1977, the U.S. Department of Commerce estimated this percentage ratio for Bulgaria at 85; Czechoslovakia, 31; GDR, 40; Hungary, 44; Poland, 60; Romania, 42; and the USSR, 28 (figures cited in Economic Relations . . ., p. 23). However, unlike the other CMEA countries, the USSR has substantial hard-currency earnings from sales of gold and arms which offset most of its deficit on ordinary merchandise trade with the West. Also, the denominator used in calculating these ratios excludes earnings from services, which are important for Bulgaria and Poland.

The Eastern countries—with varying difficulty—should find it possible to finance their trade deficits with the West and refinance their

debt. On the one hand, Eastern countries have shown their willingness to restrain imports in order to cut the size of their deficits. On the other, as in the past the liquidity of Western banks, due to OPEC deposits and weak business conditions in the West, makes them willing to grant what they consider sound loans to Eastern borrowers.

Their balance of payments problems have intensified Eastern countries' interest in "countertrade" by which imports are financed through paired current or future exports (Matheson). Two forms of countertrade are often distinguished. "Compensation agreements" involve long-term (3–4 and often 10–20 years) deals of relatively large value (hundreds of millions of dollars) providing for Eastern imports of equipment and technology from the West with subsequent repayment in "resultant" products. In contrast, "counterpurchase agreements" are shorter-term (1–3 years) deals of smaller value in which technology transfer is not a principal element and the Eastern exports have no intrinsic links to the Western exports. In both cases, one may calculate a "counterdelivery ratio" comparing the value of Western purchases as a percentage of the value of Eastern purchases. This ratio is usually the subject of intensive negotiations and ranges from 40 to 100 percent and sometimes even higher.

There is more, though still rather incomplete, published information on compensation agreements than on counterpurchase deals, because the large size of the former usually requires some political and financial support by Western governments. On the Eastern side, the USSR accounts for two-thirds of the estimated total value of East-West compensation agreements, chiefly in natural gas, chemicals, and semifinished products. Poland—in raw materials, metals, and manufactures—is responsible for about one-fourth of the Eastern total. The other East European countries' agreements are relatively small and concentrated in manufacturing. On the Western side, Italy, France, and the Federal Republic of Germany each account for about one-fourth of the estimated total value of compensation agreements.

Although the USSR has been successful in negotiating some large agreements with high counterdelivery ratios—for example, covering the import of pipe, machinery, and equipment for a trans-European gas pipeline, to be repaid by natural gas deliveries to Western Europe—it is questionable to what extent countertrade can ease the East's hard-currency balance of payments problems.

First, the raw materials deals of greatest interest to Western partners are relevant for only a few Eastern countries and, in the case of the USSR, are typically of a magnitude requiring extensive negotiation, considerable Western official credit support, and long construction times.

Second, the manufactures which the East offers for counterpurchase are often hard to sell in the West. Their deficiencies in style, quality, and availability of spare parts and service are long-standing and well known and have proved hard to overcome. In addition, it is difficult for the East to break into Western markets when business conditions are sluggish, competition from aggressive and experienced Asian rivals like Taiwan and South Korea is severe, and there is growing protectionism in Western developed countries affecting such current and

potential Eastern exports as clothing, footwear, electronics, chemicals, pharmaceuticals, steel, and metal products. Although Eastern countries press for wider use of counterpurchases, and higher counterdelivery ratios, countertrade can do little to overcome the shortcomings of Eastern products and weak domestic demand conditions and trade restrictions in Western markets.

Thus, the momentum for expanding East-West economic relations has declined markedly in the last five years because of difficulties in increasing Eastern exports to the West and because of the commitment of a large share of hard-currency earnings to servicing debt obligations incurred to cover past trade deficits. This in turn must lead the East to examine again how, and how far, its problems of economic growth and trade can be met through intra-CMEA economic relations (and, to a much smaller extent, relations with the less developed countries—a subject outside the scope of this essay).

III. Soviet-East European Economic Relations

Despite their efforts in the 1970s to expand trade with the West, virtually all of the European CMEA countries continued, for economic as well as political reasons, to concentrate the bulk of their trade inside the CMEA region. Thus, the intra-CMEA share in total trade is about three-fourths for Bulgaria; two-thirds for Czechoslovakia and the GDR; and half for the USSR, Hungary, and Poland. Only Romania now conducts a minority share (about a third) of its total trade within CMEA.[3]

Among the European CMEA countries, the commodity composition of trade is along fairly well defined lines. The East European countries import chiefly fuels and nonfood raw materials from the USSR, exporting in return machinery and equipment, industrial consumer goods, and selected food products. Among themselves, the six East European countries trade mostly manufactured products—semifabricates, machinery and equipment, and industrial consumer goods.

In Soviet-East European trade relations, the USSR plays a dominant role for purely economic (as well as also political-military) reasons. One factor is the enormous difference in size of the Soviet economy compared with the economies of the East European six (individually and collectively). Thus, in the "radial" pattern of trade prevailing in CMEA, bilateral trade between the USSR and each of the East European countries is much more important than trade among East European countries (Fallenbuchl 1977a, pp. 104–05). Another factor is that to a considerable extent Soviet exports to Eastern Europe consist of "hard" goods, such as fuels and raw materials, which, for lack of convertible currency, Eastern Europe cannot purchase on the world market, while the USSR takes from Eastern Europe "soft" goods, such as outdated machinery and poor quality consumer goods,

[3] These shares are calculated from official statistics in national and CMEA statistical yearbooks. Intra-CMEA prices are supposed to be set on the basis of average world market prices in an earlier period. and thus changes in prices for intra-CMEA trade lag changes in world market prices. In a period of sustained inflation on the world market, intra-CMEA trade takes place at lower prices than trade with the West, and therefore intra-CMEA shares in total trade are understated in official statistics.

which Eastern Europe cannot easily sell to the West. Thus, while intra-CMEA trade does not play a decisive role in Soviet economic growth, the level, composition, and terms of trade with the USSR are critical for Eastern Europe's economic development (Lavigne 1978).

In the first decade after World War II the USSR exploited the East European countries through reparations, deliveries by Soviet-controlled joint enterprises, and adverse terms of trade. However, the consensus view of Western specialists is that by the mid-1950s the situation began to change, and that in the 1960s and 1970s the East European countries turned into an economic "liability" to the USSR for two reasons. First, the terms of Soviet-East European trade became unfavorable to the USSR. Second, Moscow found it necessary at various times to grant credits to client states in economic and/or political difficulties, notably Poland and the GDR but also most of the other East European countries as well (Marer 1976).

One of the most commonly cited forms of East European dependence on the USSR is reliance, by all of the countries except Romania, on Soviet supplies of oil and natural gas. For example, in 1975, Soviet oil deliveries to the other five East European countries (Bulgaria, Czechoslovakia, the GDR, Hungary, and Poland) accounted for 86 percent of their total crude oil supply (Haberstroh, p. 383). Since 1965, Soviet oil deliveries to Eastern Europe had been growing faster than Soviet oil production, leaving a smaller part of total Soviet output for domestic consumption and hard-currency exports. In response, in the early 1970s the USSR told the East European countries that future increases in oil deliveries would be severely limited and that they would be linked to East European countries' investments in Soviet energy and raw material projects. These include the $5 billion (initial cost estimate) Orenburg natural gas pipeline from Soviet fields to Eastern Europe, and smaller cellulose, asbestos, copper and nickel, and electric power projects. Typically, East European participants provide equipment (sometimes purchased by them in the West for hard currency, directly or through CMEA banks) and are to be repaid in output from the project over a 10–20 year period. However, in most, if not all, of these projects the price at which the commodity payback will be valued is not specified in the joint investment agreement but instead will be set at the time of delivery. Thus, the USSR is protected for likely future increases in world fuel and raw material prices.

When the USSR warned Eastern Europe that future increments in Soviet oil deliveries would be limited, it advised them to expand their imports from Middle Eastern and other sources. But such a shift became impossible after the quadrupling of Middle East oil prices in 1973–74, and the subsequent recession in Western developed countries, which hurt Eastern Europe's ability to increase hard-currency earnings to pay for Middle Eastern oil.

The impact on Eastern Europe of the changes in world prices for oil and raw materials was reinforced by a modification late in 1974 in the method of relating intra-CMEA foreign trade prices to world market prices. Previously, intra-CMEA foreign trade prices for a five-year period were supposed to be based on average world market prices for a preceding five-year period; for example, intra-CMEA prices in

1971–75 were to be related to average world market prices in 1965–69. The new formula, imposed by the USSR, provided instead for annual adjustments on the basis of moving averages. In principle, 1975 intra-CMEA prices were to be based on average 1970–74 world prices, 1976 intra-CMEA prices on average 1971–75 world prices, and so on. However, for oil and some other commodities, 1975 prices were supposed to be based on average 1972–74 world prices, which for oil were about 8 percent less than average 1971–75 prices (Kohn and Lang).

According to recent calculations by Vaňous (1978a, p. 9), the application of this new formula led to the following approximate percentage increases in intra-CMEA prices in 1975 relative to 1974: fuels, 100; raw materials, 8–50; food, 15; machinery and equipment, 11; and industrial consumer goods, 13. The result was a sharp improvement in the USSR's terms of trade with Eastern Europe, estimated (by Kohn and Lang) at about 12 percent for trade with the six East European countries as a group, and vis-à-vis individual countries as follows (in percent): Bulgaria, 9; Czechoslovakia, 17; GDR, 23; Hungary, 13; Poland, 3; and Romania, 3.[4] Thus, the impact was greatest on the heavy raw material importers (Bulgaria, Czechoslovakia, the GDR, and Hungary) and much more modest for the countries more generously endowed with raw materials and/or fuels (Poland and Romania). Other calculations by Vaňous (1978a, p. 38) show that these trends persisted in 1976, when the terms of trade with "socialist" countries continued to decline for Bulgaria, Czechoslovakia, the GDR, and Hungary, but improved for Poland, Romania, and the USSR.

Table 3 presents recent calculations by N. Mitrofanova, a leading Soviet specialist on intra-CMEA contract prices. For fuels, raw materials, and metals, she finds that Soviet export prices to CMEA kept pace with world market price increases from 1970 to 1972, fell far behind in 1973 and 1974, rose sharply in 1975, but then leveled off in 1976. For unprocessed and processed agricultural products, world market prices climbed sharply in 1973 and 1974 and then declined in 1975 and approximately stabilized in 1976, while Soviet export prices to CMEA rose less rapidly but more steadily. For machinery and equipment, the increase in Soviet export prices to CMEA was much closer to world market price movements, with approximately the same change from 1970 to 1976. These figures support the Soviet argument that within CMEA since the early 1970s the exporters of fuels, raw materials, and agricultural products, (the "hard" goods) have failed to get price increases justified by world market price movements, whereas export prices of machinery and equipment ("soft" goods) have on balance kept up with world market trends. Finally, the isolation of Soviet domestic wholesale prices from both world market prices and CMEA contract prices is strikingly confirmed by these calculations.[5]

[4] These figures are geometric averages of the results of Kohn and Lang (p. 141) with 1974 and 1975 weights.

[5] It should be noted, moreover, that Mitrofanova's indexes for Soviet domestic wholesale prices differ substantially from the official statistics. For example, Mitrofanova shows domestic wholesale prices for machinery and equipment rising steadily, while the official series report them to be falling. On the shortcomings of the official series, see, for instance, Bornstein 1976, pp. 20–26, Becker, and Borozdin and others.

TABLE 3.—INDEXES OF WORLD MARKET PRICES, SOVIET EXPORT PRICES TO CMEA, AND SOVIET DOMESTIC WHOLESALE PRICES, BY COMMODITY GROUPS, 1960, 1966, AND 1971–76

[1970=100]

Year	Fuels, raw materials, and metals			Unprocessed and processed agricultural products			Machinery and equipment		
	World market prices	Soviet export prices to CMEA	Soviet domestic wholesale prices	World market prices	Soviet export prices to CMEA	Soviet domestic wholesale prices	World market prices	Soviet export prices to CMEA	Soviet domestic wholesale prices
1960	94	131	58	89	97	86	78	85	74
1966	94	101	60	101	100	93	89	100	76
1971	108	105	99	103	96	103	103	101	97
1972	111	110	99	121	107	104	112	108	106
1973	168	113	99	176	108	106	117	105	105
1974	243	119	96	216	111	107	128	116	117
1975	247	175	96	201	135	111	141	127	119
1976	258	177	96	203	148	109	148	145	122

Source: Mitrofanova 1978, p. 103.

These changes in CMEA prices were reflected in rising trade deficits of the East European countries with the USSR. In 1973, the six East European nations together ran a surplus of almost $1 billion with the USSR, but in 1974 their combined trade balance with the USSR showed a deficit of $0.1 billion, which climbed to $0.8 billion in 1975, $1.2 billion in 1976, and $1.9 billion in 1977. Thus, the USSR found it necessary to extend substantial new credits to Eastern Europe, particularly the GDR and Poland. Romania is again an exception, the only one of the East European six which continued to run a trade surplus with the USSR.

Thus, as the CMEA countries prepare their new five-year plans for 1981–85, they face serious problems arising from the reduced possibilities for further expansion of East-West economic relations (discussed in Part II) and, partly as a result, the dependence of Eastern Europe on the USSR for fuels and raw materials. These factors must lead to a reappraisal of the conduct, extent, and speed of efforts at "economic integration" in CMEA.

IV. Economic Integration in CMEA

The conception of "economic integration" in CMEA is much narrower than, for example, in the European Community (Kirschen). In the latter, integration involves the elimination of tariffs, quotas, and other restrictions on trade among member countries; the establishment of common trade restrictions against nonmember countries; the liberalization of factor movements among member countries; and the harmonization of national economic policies. In contrast, in CMEA, integration is to be accomplished by greater coordination of member countries' national economic plans.

However, CMEA's coordination of national plans is evolving slowly in various dimensions. For two decades, it occurred chiefly through bilateral trade agreements covering planned exports and imports. Then in 1971 CMEA approved a Comprehensive Program for the Further Intensification and Improvement of Collaboration and the Development of Socialist Economic Integration of CMEA Countries. This

Comprehensive Program proposed to achieve closer economic integration, over a 20-year period, through (1) joint efforts at forecasting economic trends and scientific developments; (2) joint scientific and technical research in selected economic branches; (3) more ex ante coordination of medium-term (5-year) and long-term (15–20 year) plans; and (4) joint planning of research and development, investment, production, and trade for selected products, such as metal-cutting lathes and transport containers.[6]

The Comprehensive Program also promised to improve the mechanism for setting intra-CMEA prices, to establish more realistic exchange rates, and to increase convertibility and multilateral settlements. But subsequent efforts to implement the Comprehensive Program have stressed "production integration" through closer plan coordination, rather than "turnover integration" through improved pricing and payments arrangements (Pécsi, p. 14).

Thus, in accordance with a decision at the 27th Session of CMEA in 1973, each member country established a special department in its national planning agency to coordinate with other CMEA countries important aspects of five-year plans for 1976–80. The results of this joint work were approved at the 29th Session in 1975, as a Coordinated Plan of Multilateral Integration Measures (soglasovannyi plan mnogostoronnikh integratsionnykh meropriatii) for 1976–80. It included (1) joint investment projects, primarily in fuels, raw materials, and electric power, located, or originating, in the USSR; (2) specialization and cooperation assignments in machinery and chemicals; (3) various science and technology projects; and (4) cooperation in the development of the Mongolian People's Republic.

The 30th CMEA Session in 1976 extended the time horizon for plan coordination to 1990 and focused it on five "leading" sectors for which Long-Term Target (or Special-Purpose) Programs of Cooperation (dolgosrochnye tselevye programmy sotrudnichestva; hereafter, LTTPs) were to be elaborated: (1) fuel, energy, and raw materials; (2) machine building; (3) agriculture and food industry; (4) consumer goods of industrial origin; and (5) transportation. For these sectors, the member countries were to make bilateral and multilateral agreements covering production, consumption, exports and imports, and investment projects for specific product groups.

However, the number of high-priority output categories—about 90—was too large to be meaningful. According to a leading Hungarian specialist on CMEA, Kálmán Pécsi:

> . . . the individual countries . . . wanted to be members of as many organizations as possible or to recommend the joint implementation of as many special-purpose programs as possible. The danger of being left out and the knowledge that they will not share in the subsequent results and distribution of the market act as a strong incentive to participate and to locate more and more possibilities. However, once they are members, they have difficulty in coordinating the development investment requirements and objectives with the possibilities and tasks of their national plans, and their behavior becomes cautious and uncertain when giving concrete form to their ideas for the development of production integration and making resources available. (Pécsi, p. 38)
>
> . . . we can see that we are trying to solve almost all of the problems of the CMEA within the framework of the special-purpose programs. The realistic nature of this is obviously in contradiction with experience to date. (Pécsi, p. 40)

[6] Administrative procedures for "plan coordination" and "joint planning" are described by Petrosian.

If the special-purpose programs are clearly defined and directed at the solution of one or two major tasks on the basis of the decisive link principle, they make it possible to combine resources to attain the goal set . . . Obviously, if all tasks become top-priority ones, then we are giving priority to none. (Pécsi, p. 60)

Thus, the 31st CMEA Session in 1977 narrowed the work on LTTPs to only the first three sectors, downgrading industrial consumer goods and transportation. Then the 32nd Session in 1978 effectively further reduced the focus to only the first LTTP—essentially the development of fuel, energy, and raw material resources in the USSR. The LTTP for machine building will apparently be pursued largely to support the LTTP for fuel, energy, and raw materials, rather than as an independent and equal effort.[7]

Thirty years of experience show that the obstacles to economic integration in CMEA are serious and very difficult to overcome.

First, national interests of the CMEA member countries conflict. The less developed countries oppose "integration" which would retard their industrialization by assigning them relative specialization in primary production of foodstuffs and raw materials. Romania has been the most prominent and most successful exponent of this view. More developed countries, such as Czechoslovakia and Hungary, desire to produce modern machinery and equipment that can be sold for hard currency in the West and at the same time to sell inside CMEA lower-quality producer and consumer manufactures. The GDR wishes to exploit its special relationship with West Germany, through which it gains access to the markets of the European Community. And the USSR wants to allocate its fuels and raw materials to domestic use and to hard-currency exports, through which it can import better machinery and equipment and more food than Eastern Europe can supply. In the face of the overwhelming economic, political, and military power of the USSR, the East European members of CMEA have opposed the creation of supranational CMEA agencies and have insisted upon a rule of unanimity on the part of countries involved in CMEA decisions.[8]

Second, there are serious technical problems in determining an economically sound pattern of specialization in production and trade in CMEA. Calculations of (static or dynamic) comparative advantage involve comparisons of relative costs at home and abroad. But the internal price systems of the CMEA countries cannot provide the necessary information on domestic costs, because administratively set producer prices do not incorporate all relevant costs or measure relative scarcities of inputs and outputs.

Third, in turn arbitrary official exchange rates imperfectly reflect relative price (and cost) levels among CMEA countries.

Fourth, as a result, intra-CMEA trade must be conducted on the basis of world market prices. Various CMEA economists have proposed basing intra-CMEA "contract" prices on "regional socially necessary labor costs" (for recent Soviet suggestions, see Mitrofanova

[7] "It is hardly probable that, with the attempts to solve much more pressing materials supply problems, sufficient energy will remain for independent attention to the idea of specialization and cooperation [in engineering industries]." (Pécsi, p. 37). See also Pekshev, p. 89.

[8] On the failure of the U.S.S.R.'s effort in 1962–63 to establish supranational planning in CMEA, see Jaster.

1977 and Pekshev), but this approach is hardly feasible. As Pécsi (p. 68) has pointed out:

> . . . socially necessary inputs should be correctly reflected in the internal prices of the different countries and the establishment of economically sound and mutually agreed national exchange rates and currency factors for transfer of the national currencies from one to another and to the collective currency and for determining economically sound foreign trade prices . . .

Thus, most CMEA economists accept the need to base CMEA contract prices on world market prices. However, controversy continues on how to adjust world market prices to obtain fair "purified" CMEA prices. The discussion currently focuses on four problems (Shamrai):

(1) How long a base period should be used to obtain an "average" world market price? A five-year period is convenient because it corresponds to the length of national medium-term plans and trade agreements based on them. But a shorter period may be preferable for fuels and raw materials, whose world market prices have increased markedly in the 1970s, as well as for machinery and equipment, whose changing product characteristics make it difficult to obtain a comparable price series for the "same" item for more than two or three years.

(2) Should base periods of different length therefore be used for different product groups?

(3) Should "extreme price intervals"—of abnormally high or rapidly rising prices—be omitted in calculating the average for the base period chosen?

(4) How can a "representative world price" be identified, particularly for manufactured products, in view of the multiplicity of prices arising from differences in quality, quantities sold, export taxes and subsidies and import duties, terms of payment and delivery, etc.?

Finally, inconvertibility and bilateralism predominate in intra-CMEA trade, despite the establishment of the "transferable ruble" (TR) in 1964 as an "international socialist collective currency" (van Brabant, pp. 108–16 and 312–42, and Levcik 1978). Intra-CMEA trade transactions are denominated in TRs after world market prices (expressed in internationally traded currencies) are converted into TRs on the basis of the official ruble-dollar exchange rate specified by the USSR. CMEA countries make a great effort to balance trade bilaterally and avoid surpluses, because a credit balance in TRs in CMEA's International Bank for Economic Cooperation is in fact not usually transferable. Instead, the creditor country must hold the balance until it can arrange to run an offsetting deficit with the original debtor country.

Thus, TRs do not have "currency convertibility" into convertible currencies, gold, or even national CMEA currencies (such as the Soviet domestic ruble). Nor do TRs have "commodity convertibility" at the holder's option into goods of its free choice from other CMEA countries. Hence, multilateral settlements through TRs have accounted in recent years for no more than 2 percent of total CMEA trade turnover accounted in TRs.

Instead, bilateralism is still the rule inside CMEA. Bilateral balancing in intra-CMEA trade is pursued not only globally for the total exports and total imports of one country with another. It is

also done by individual commodity groups (different "hard" goods for each other and different "soft" goods for each other), because CMEA contract prices do not reflect to the same degree the scarcities inside CMEA for different categories of goods. In this balancing process, bilateral bargaining leads to many deviations of CMEA contract prices from the world market prices upon which they are supposedly based. The price for the same commodity often varies by trading partner, because of the commodity against which it has been traded (Lemoine).

To a small extent, estimated at 5–10 percent of total intra-CMEA trade turnover, bilateral balances are settled outside the TR system by payments in convertible Western currencies. This occurs primarily in two cases: (1) when above-plan deliveries of "hard" goods are made; and (2) when an export to CMEA contains inputs purchased for convertible currency, or when an import from CMEA will be incorporated by the buyer in a subsequent export for convertible currency (Pécsi, p. 94).

Little change should be expected in the CMEA settlements system, because it reflects the arrangements for planning, pricing, and exchange rates in CMEA. In Pécsi's opinion:

> . . . plan coordination and the order of signing agreements on mutual deliveries in themselves limit the use of the transferable ruble. (Pécsi, p. 49)
>
> Little progress has been made in the question of the usability of the transferable ruble and particularly in its transferability. In view of the predominant concept of the form of integration, transferability is only of limited, secondary importance, and no change should be expected for a long while yet. (Pécsi, p. 11)
>
> . . . we can expect the system of payments within the CMEA to remain unchanged in the coming years . . . I consider the establishment of a mutual settlements system based on some form of combination of the national currencies and the common currency to be practically out of the question for the period under consideration [to 1990]. (Pécsi, p. 52)

Some of the difficulties involved in securing greater economic integration in CMEA are illustrated by experience in machine building, in which production does not depend primarily on natural resource endowment, unlike fuel and raw material industries.

> Between 1956 and 1973 the CMEA standing committees formulated and adopted 5,300 recommendations for engineering industry specialization. It is also known that the CMEA production specialization recommendations have not exercised any significant influence on the development of the engineering industry in the member countries. (Pécsi, p. 21)

CMEA has made little progress in "specialization and cooperation" in machine building for a number of reasons.

First, the committees preparing specialization recommendations did not take into account their effects on the domestic production and supply plans of the affected countries and on their determination to achieve a bilateral balance in machinery trade.

> . . . all such recommendations [for specialization and cooperation in machinery production] come up against the "quota approach" arising from . . . the fact that in the structure of foreign trade the countries strive for equilibrium in the volume of their two-way machinery deliveries. This makes production specialization possible only within given limits. When they come up against this limitation, the recommendations taper off, since they are practically impossible to apply. (Pécsi, p. 19)

Second, one CMEA country is reluctant to become dependent on another for components and parts, for fear that foreign suppliers will not meet their commitments, thus imperiling the fulfillment of national plan assignments for end products. Hence, a Soviet specialist reports:

> For the USSR's industrial ministries and departments that plan the development of international specialization and cooperation, the chief criterion in selecting an object of international specialization or cooperation is a current shortage of a particular product. Given this approach, questions of economic efficiency either are not considered at all or are worked in as "afterthoughts" to already developed proposals. (Leznik, p. 114)

Third, according to another Soviet expert (Pekshev, p. 88), when planning commissions, branch ministries, and foreign trade agencies decide to import machines, prospective user enterprises often are not anxious to buy them because they are priced much higher than comparable domestic products.

Finally, under the "foreign trade monopoly" system prevailing in CMEA countries, there is a lack of direct contacts between domestic producer enterprises and foreign customers, and between domestic user enterprises and foreign suppliers. This is especially disadvantageous to specialization and trade in machine building, where product specifications are complex and individualized.

Another example of the problems of integration is provided by the experience of the international economic organizations (IEOs) assigned a prominent role in the Comprehensive Program. Although some types of IEOs—for example, "international economic associations" and "international economic unions"—exchange technical information and coordinate production assignments to promote specialization, there are very few genuine "joint enterprises" involving joint investments, production, and marketing by enterprises and industrial associations in different CMEA countries. There is no common CMEA-wide legislation covering joint enterprises, and each such venture must be worked out individually by the (usually only two) participating countries.

No participant accepts the internal prices of the others as appropriate for calculating costs, revenues, profits, and profit shares in a joint venture. Therefore, initial contributions of capital and subsequent inputs, outputs, and deliveries must be valued both in the currency and prices of the supplier country and also in transferable rubles at corresponding intra-CMEA trade prices based (with a lag) on world market prices. However, this principle cannot be easily applied in practice, because there is no such intra-CMEA trade price for some inputs (such as labor and land), and because there is no single intra-CMEA trade price for a particular good but rather various prices reached in different bilateral negotiations between different countries over different bundles of goods. Hence, for each joint enterprise it is necessary to negotiate a separate and extremely complicated set of coefficients to convert prices of goods and services in national currencies into mutually acceptable prices in TRs.[9] As a result, the number of joint enterprises in operation is estimated, on the basis of

[9] "Thus, in one of the enterprises, capital investments and current expenses are calculated with the aid of 14 basic and more than 30 supplementary coefficients. That circumstance complicates joint activity." (Zubkov, p. 79)

fragmentary information, at only between 5 and 10 (Lavigne 1975, Machowski, Ivanov and Markicheva, and Zubkov).

On balance, it appears that CMEA "integration" efforts are more likely to produce results in two rather different dimensions: (1) joint investments in Soviet fuel and raw material resources, and (2) narrow technical questions, such as coordination of selected research projects (Gvishiani) and agreements on product standards (Joseph and Stepanenko). On the other hand, the prospects are much weaker for (3) effective coordination of industrial or agricultural [10] production; (4) greater convertibility and multilateralism in trade and payments; or (5) more mobility of labor across national boundaries (Levcik 1977, pp. 473–74).

V. Conclusion

The USSR and Eastern Europe face serious problems in the 1980s, when domestic economic growth will be retarded by inadequate supplies of labor, capital, fuels, and raw materials. These countries can expect only limited help in overcoming their problems either from the expansion of East-West economic relations or from successful regional integration in CMEA.

However, insofar as the development of East-West economic relations and CMEA regional integration are complementary in some ways, progress on one front will also benefit the other (McMillan 1978).

(1) Some large-scale CMEA joint investment projects—for example, the Kursk metallurgical complex, the Ust-Ilim pulp and paper complex, and the Orenburg gas fields and pipeline project—involve both East European and Western participation in Soviet natural resource development. Without Western equipment, licensing of technology, technical assistance, and financing, these "CMEA joint investments" would be impossible. Thus, Western participation has contributed decisively to one of the most prominently cited examples of CMEA "integration."

(2) Western capital and technology can also promote product specialization in manufacturing in CMEA. CMEA countries are more willing to buy a product from a CMEA source if it is produced with Western technology, Western components, and the assistance of Western partners.

> There have in fact been not infrequent instances of East European countries' vying to acquire, and to prove their ability to apply, Western technology in order to obtain official designation as the regional source of a product (i.e., to "capture" the regional "market"). (McMillan 1978, p. 192)

At the same time, industrial cooperation is more attractive to a Western partner if it brings access to the CMEA market as a whole because the Eastern partner obtains a regional specialization assignment.

(3) The greater the opportunities for trade with the West, the stronger will be the pressures in CMEA to adjust the level and structure of CMEA contract prices closer to world market prices, to in-

[10] In agriculture, some specialization has been achieved on the input side—in research and in the production of certain kinds of agricultural machinery and fertilizer—but not on the output side, where a strictly national approach continues (Beaucourt, pp. 59–60).

crease convertibility and multilateralism, and to rationalize other CMEA practices [11]—thereby providing a sounder economic basis for intra-CMEA trade, production, and investment.

(4) The East European countries and the USSR have some common interests in seeking reductions in the EEC's restrictions on imports from the East.

On the other hand, East-West economic relations and Soviet-East European economic relations continue to compete in important respects.

(1) CMEA countries generally prefer Western machinery and equipment and technology—both "embodied" and licensed separately—over what is available from CMEA sources.

(2) However, insofar as Western markets appear difficult to penetrate because of recessions or slow growth, and increasing protectionism, East European interest in the stabler and more accessible Soviet market is strengthened.

(3) But as world oil prices climb, while the growth of Soviet oil production tapers off, the USSR experiences a rising opportunity cost in supplying oil to Eastern Europe on a barter basis at below-world-market prices, instead of exporting it to the West for convertible currencies.

Thus, success in expanding East-West economic relations weakens interest in CMEA integration by providing an economically—and, for Eastern Europe at least, also politically—more appealing alternative.

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[11] For example, the need to pay for technology imported from the West—and also to a lesser extent the possibility of selling technology to the West—was an important factor in the 1971 Comprehensive Program's acceptance of the principle that technology transfers among CMEA countries should be paid for, in place of the previous principle that they should be made free of charge as a form of "fraternal cooperation."

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THE SOVIET ECONOMY ON A TREADMILL OF "REFORMS" [1]

(By Gertrude E. Schroeder*)

CONTENTS

Summary

Over the past dozen years, the Soviet government has undertaken a series of measures unprecedented in scope and intensity, in an effort to improve efficiency in the economy's use of resources and the quality of its products. These measures have entailed: restoration of the ministerial system of managing industry; establishment of new agencies to administer prices and centralized rationing of producer goods and to oversee the mammoth research and development effort; the merger of enterprises into large associations; revisions of prices; increased use of financial variables; alterations in planning techniques; contracts and pecuniary sanctions; and numerous revisions in incentive arrangements, emphasizing profits, sales and other indicators of efficiency. This plan of attack on the USSR's perennial problems was outlined in 1965 by Premier Kosygin in his much-touted program of economic reform. Since the problems stubbornly refused to go away, the period since 1970 has witnessed a continuous process of reforming these initial reforms. The reformed "reforms" and the "improved" plans also have not made matters much better. Throughout the decade, the growth of productivity has been declining, and Soviet products continue to meet

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[1] This paper builds on and brings up to date the research findings and analysis presented in the author's most recent published studies on this subject. See: Gertrude E. Schroeder, "Recent Developments in Soviet Planning and Incentives," JEC. Soviet Economic Prospects for the Seventies, Washington, 1973, pp. 11–38; and Organization and Management in the Soviet Economy: the Ceaseless Search for Panaceas, National Foreign Assessment Center, ER 77–10769, December 1977.

sales resistance both at home and abroad. Yet another round of reforming the reforms is now on the drawing board. It seems to involve more administrative centralization and coordination, perhaps with new intermediate organs of some kind, and still another revision in plan indicators and incentive arrangements.[1a] If, as in the past, these new reforms leave the essentials of the system unaltered, they, too, will not alleviate the system-based malaise. A severe economic crisis—administrative paralysis, declining production or popular uprising—might persuade the political leadership to embark on a system-shattering reform, as did Lenin in a period of crisis nearly six decades ago. If the economy continues to inch forward, the decade of the 1980's will probably witness still more "reforms" of planning procedures, organizational arrangements and incentive schemes, along with persistence of the familiar problems. After 60 years of experience with a Socialist economy run by government agencies, however, nearly everyone seems to have found ways to turn its shortcomings to individual advantage.

I. Introduction

Nearly fifteen years ago the Soviet government launched a series of so-called "economics reforms" designed to solve the economy's most critical problems—widespread inefficiency in the use of labor and capital resources and poor quality and design of products, which hampered their sale at home and abroad. The reforms, with their stress on profit and economic "levers," produced initial excitement in the West, eliciting assertions that Capitalist "tricks" were being used to solve Socialism's problems. When the reforms took a different turn and, in any event, seemed to be ineffective, Western critics became bored, labelling the reforms "dead." The Soviets, in contrast, began to describe the reforms as a long-term, continuing process of change, designed to suit the needs of the economy, as it journeyed through the period of "developed" or "mature" Socialism. The initial set of innovations, as spelled out by Premier Kosygin in 1965, were essentially completed in industry and some other sectors by 1970. Since then, numerous changes in economic organization and working arrangements have been made, in pursuit of the still elusive solutions to the persisting problems. Far from being dead, the reforms have been continuously reformed. The net impact of the changes through 1975 may be gauged by the fact that the Soviet leadership has labelled the Tenth 5-year Plan (1976–80) the "plan of efficiency and quality" and sanctioned further modifications in the reforms. Judging by the results of the first three years of that Plan, the same label also will be appropriate to characterize the aims of the Eleventh Five-year Plan. The reformations of the reforms have introduced changes in economic working arrangements of unprecedented scope and complexity. So ceaseless has been the search for new panaceas and so numerous have been the changes in the rules that one may advance the hypothesis that perennial administrative change is becoming a part of the problem, rather than contributing to its solution.

This paper attempts to provide a road map through the labyrinthian maze that has been created by the reformed and reforming reforms of organizational arrangements and incentive rules. In the first three sections, the paper describes what has been produced in three areas: eco-

[1a] A new round of revisions in planning and incentive arrangements was announced on July 29, 1979. See p. 340, last footnote for more detail.

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nomic organization, economic planning, and incentives. The fourth and fifth sections assess the impact of the innovations and consider the question "What is to be done?" The question is urgent, especially in view of the serious economic problems that the Soviet Union will face in the 1980's.

II. Economic Organization

A. The Administrative Bureaucracy

The most speedily implemented of the Kosygin reforms restored the ministerial system for administering the economy, replacing Khrushchev's little-lamented system of regional economic councils. Three new State Committees were also set up to centralize the administration of key functions—price-fixing and monitoring (State Committee for Prices *Gostsen*), rationing of materials and equipment to producers (State Committee for Material-technical Supply *Gossnab*) and overall management of the research and development effort (State Committee for New Technology, *Gostekhnika*). The relatively few changes since 1965 have contributed to some further centralization—a few new ministries, some conversions from union-republic to all-union status and some splitting up of ministries. A noteworthy development is the broadening of authority over questions dealing with labor accorded the State Committee for Labor and Wages (re-named State Committee for Labor and Social Questions).[2] A new Law on the USSR Council of Ministers, adopted in July 1978, lists 32 all-union ministries, all but one of them economic, and 30 union-republic ministries, 23 of them economic.[3] Centralization and proliferation of the bureaucracy (Apparat) was accompanied by a 57-percent increase in its size during 1966–77 compared with 38 percent for state employment as a whole.[4] To combat the persistent rise of administrative-management expenditures throughout the economy, annual plans now specify quotas for reduction in these outlays and the automatic confiscation of the planned "savings" into the state budget.

Another facet of the reform package was to be the transfer of the economic ministries to full khozraschet, i.e. self-financing of all activities, including investment. Progress toward this goal has been miniscule. At the end of 1978, only 4 national ministries—all machinery ministries—were operating under such conditions. They are: Ministry of Instrument-Making: Automation Equipment and Control Systems; Ministry of Heavy and Transport Machinery; Ministry of Tractor and Agricultural Machinery; and Ministry of Power Machinery. In respect to the last three, the transition took place in 1977 or 1978 and is not complete, since they still receive budget financing for investment in new facilities. Some 10 lower level agencies are also operating on the principle of khozraschet. A considerable volume of press reporting exists on the experience of these ministries and agencies.[5] While the usual claims are made about positive results, the problems are

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[2] The Statute on the Committee is published in Sobraniye postanovlenniy pravitel'stva Soyuza Sovetskikh Sotsialisticheskikh Respublik, No. 26, 1977, pp. 543–555.
[3] Pravda, July 6, 1978.
[4] Narodnoe Khoziaistvo SSSR v 1977 godu, p. 378.
[5] For recent discussion, see: Khoziaistvo i pravo, No. 3, 1978, pp. 3–10. Ekonomika i organizatsiya promyshlennogo proizvodstva, No. 3, 1978, pp. 172–74; No. 8, 1978, pp. 175–192. Ekonomicheskaia gazeta, No. 45, November 1978, p. 16. Ibid, No. 23, 1978, p. 13. Planovoe Khoziaistvo, No. 10, 1978, pp. 94–101. Voprosy ekonomiki, No. 10, 1978, pp. 53–57.

many and difficult. The most vexatious ones seem to concern the planners' penchant for changing prices and output plans and revising the rules of the game. When various authorities observe "excess" accumulation of profits, they siphon them off for the state budget, they change product prices in mid-plan, or they impose restrictions on incentive funds, which reduces the ability of managers to reap the benefits of efficiency gains that may accrue. Besides such operating problems, the extension of khozraschet to other ministries is hampered by the fact that many of them have insufficient profits; widespread price revisions would be needed to permit internal financing of current expenses and investment. To complicate the problem further, extension of self-finance is being accompanied by other experiments in the same units,—such as the use of net output, rather than sales or gross output, as a basis for planning and incentive fund formation, and a new scheme for centralized financing of research and development. Such complexity in approach makes it difficult to sort out the costs and benefits.

The political leadership, along with planners and economists, clearly is dissatisfied with the management of horizontal connections in the economy. Chronic deficiencies in this area have been highlighted by coordination failures characteristic of planning and implementation of the many large regional development projects, such as those in Tyumen' Oblast in West Siberia. At the 25th Party Congress, Brezhnev called for "resolving" the "question of the creation of systems for the management of groups of similar branches (for instance, the fuel and power branch, transportation, and the production and processing of agricultural products)." [6] Although no concrete measures had been announced as of early 1979, advocates of one scheme or another continue to speak out.[7] For example, there are proposals to create special agencies to coordinate large regional development projects; to create an agency, perhaps under Gosplan, to coordinate the production of consumer goods with their sale; to set up a ministry for inter-sector machinery production; to establish an agency to coordinate all inter-sector production; to create a super-organ to manage all aspects of agriculture, including inputs and outputs. Meanwhile, Brezhnev stated in his speech to the CPSU Plenum in November 1978 that the Politburo had recently approved a Resolution concerning Gosplan, broadening its rights and increasing its coordinating role.[8] He also reported that the Council of Ministers was preparing a set of recommendations to improve the entire economic mechanism.

B. The Associations

A provision of the original Kosygin program called for merging industrial enterprises into large associations, in order to reap gains from specialization, obtain economies of scale and save on administrative costs. Little progress in this direction was made during 1965–72. In April 1973, a Party-Government decree required the industrial ministries to come up with specific plans and time-tables for merging subor-

[6] Pravda, February 25, 1976.

[7] Discussions are contained in the following: Sovetskoe gosadarstvo i pravo, No. 6, 1978, pp. 32–40. Iavestia Akademii Nauk, Seria ekonomicheskaia. No. 3, 1978, pp. 55–65. Ibid., No. 5, 1978, pp. 14–28. Voprosy ekonomiki, No. 7, 1977, pp. 35–46. Pravda, December 4, 1978.

[8] Pravda, November 28, 1978. The first fruits of their labor are embodied in a decree published in *Izvestia*, July 29, 1979, entitled "On Improving Planning and Strengthening the Influence of the Economic Mechanism in Raising the Efficiency of Production and Quality of Work."

dinate enterprises into "production" associations, for combining some of them with branch research institutes to form "science-production" associations, and for transforming some ministerial glavki (main administrations) into industrial associations. The decree permitted a wide variety of forms—along product or geographical lines or vertical forms combining products and their required material inputs. By the end of 1980, production associations are supposed to account for about three-fourths of total industrial output.[9] The reorganization is scheduled for completion in industry by the end of 1980 and for initial extension to construction. The number of production and science-production associations in industry rose from 1101 at the beginning of 1973 to 3,670 at the end of 1977, when they accounted for 44.3 percent of sales and 45 percent of employment.[10] The average association then contained 4.5 units, some 43 percent of which were as yet unmerged enterprises. In 1978, over 150 science-production associations,[11] and more than 500 industrial associations were in operation. Also, in 1978, general schemes were approved for reorganizing geological prospecting activities [12] construction [13] and foreign trade [14] and plans were being formulated for an extensive reorganization of domestic trade.[15] The establishment of associations of one kind or another is a key element in all of these reorganizations.

The early experience with this latest reform by reorganization has been well described elsewhere.[16] In the past two years, press reporting on the assorted associations has been less extensive than in earlier years. Although some successes continue to be claimed and figures cited on the number of administrative jobs abolished and rubles saved, the early euphoria is no longer in evidence.[17] Instead, complaints abound. In respect to production associations: there are too many still unmerged enterprises in them (43 percent of all units at start of 1978); some are too small (under 500 workers), and some too large (over 100,000 workers); associations commit the same sins as did their previously independent constituents, they have failed to specialize, too many funds are centralized in the association, weakening incentives in the constituent units. In respect to science-production associations; numerous things are amiss with the rules governing their operations; the research components are managed separately as before; experimental plants are used to meet production plans; ministries continue to intervene in the management of both research institutes and production components, planning "from the achieved", and setting targets

[9] Planovoe Khoziaistvo, No. 8, 1977, p. 24.
[10] Narodnoe Khoziaistvo SSSR v 1972 godu, p. 159. Narodnoe Khoziaistvo SSSR v 1977 godu, p. 119.
[11] Ekonomicheskaia gazeta, No. 43, October 1978, p. 13.
[12] Ibid., No. 35, August 1978, p. 7.
[13] Ibid., No. 47, November 1978, p. 14.
[14] Sobranie postanovlenniy pravitel'stva Soyuza Sovetskivh Sotsialisticheskikh Respublik, No. 13, 1978, pp. 259–78.
[15] Sovetskaia torgovlia, June 29, 1978.
[16] Alice C. Gorlin, "Industrial Reorganization—the Associations", JEC, Soviet Economy in a New Perspective, Washington, 1976, pp. 162–188.
[17] The following are typical of press accounts of the associations during 1977–78: Pravda, March 14, 1977; May 28, 1977; June 11, 1977; January 12, 1978; March 26, 1978; May 11, 1978; November 23, 1978; November 27, 1978. Planovoe Khoziaistvo, No. 11, 1977, pp. 821; No. 3, 1978, pp. 90–100; No. 5, 1978, pp. 55–63. Voprosy ekonomiki, No. 2, 1977, pp. 47–55; No. 7, 1977, pp. 25–34; No. 10, 1977, pp. 82–92; No. 4, 1978, pp. 77–86; Ekonomicheskaia gazeta, No. 25, 1977, pp. 1–8 (insert); No. 52, December 1977, p. 7; No. 43, October 1978, p. 13. Sotsialisticheckaia industria, May 21, 1978. Ekonomika i organizatsiia promyshlennogo proizvodstva, No. 4, 1978, pp. 97–108. Pravda vostoka, December 24, 1977. K. I. Taksoir, Nauchno-proizvodstnyennye ob'edinenlia, Moscow, Nauka, 1977.

for them in violation of the rights of the association's director. Claims are also made, however, that the research-production cycle has been considerably reduced in some cases.

Even more criticism is addressed to the industial association: in many cases, their formation merely amounts once again to "changing the names on doors"; most of them seem still to be located in Moscow, and even in the same buildings; (for example, 8 of the 9 industrial associations created in the Ministry of Tractor and Agricultural Machinery are located in Moscow, where there are no tractor plants); many of them manage the same enterprises as before, now amalgamated into associations, and their behavior continues as of old. The industrial associations are supposed to operate on full khozraschet and to have incentive arrangements like those for their constituents. Apparently, these steps have yet to be taken in most cases. Moreover, there seems to have been little, if any, transfer of enterprises among either industrial associations or ministries, in order to achieve the specialization that was a major objective of the reorganzations. Meanwhile, the new industrial associations have to contend with the ways of their superiors, the ministries, whose position has actually been strengthened in the course of the reforms. The ministries have centralized funds of various kinds which they can use to aid or punish subordinate entities. Moreover, the ministries are the fund-holders for centrally allocated materials and equipment, they make the rules and regulations, on all kinds of matters and, most important of all, perhaps, they directly administer the system of incentives for managers of industrial associations and indirectly, also, in respect to other units. According to report, the ministries, themselves responsible for meeting production plans for the sector, are prone to bypass intermediate units, dealing directly with production associations and enterprises. Although formal statutes have been issued delineating the rights and responsibilities of the three types of associations, proposals abound for amending them. Finally, some critics argue that big is not necessarily good, that small plants have an important role to play and that they should be fostered instead of being discouraged.[18]

Besides going in for giantism and mergers, the USSR in recent years has greatly expanded its programs for training managers in modern skills, along with a brush-up on Marxist-Leninist economic theories. In November 1977, the Central Committee of the Communist Party and the Council of Ministers adopted a resolution "On Further Improving the System of Advanced Training for Managers and Specialists.[19] Ministries and lower-level bodies are to develop annual and 5-year plans for re-training managers at least once every six years. Earlier, Institutes of Management had been set up in Moscow in 1971 and in Kiev in 1975; these institutes provide short-term, intensive courses designed to upgrade managerial skills and competence. In May 1978 the Academy of the National Economy of the USSR was established, primarily to provide longer-term, high level management training for senior executives, mainly officials of associations and large enterprises; its rector is N. V. Melnikov.[20] The Academy has a Scien-

[18] Pravda, July 20, 1978.
[19] Izvestia, November 22, 1977.
[20] Pravda, June 2, 1978.

tific Research Institute for the Study of Economic Management. A similar organization, representing all CEMA countries—the International Scientific Research Institute on Management—was opened in Moscow in 1977.[21] What payoff there will be from this assiduous study of Western management methods, to be practiced in an environment of centrally planned Socialism, remains to be seen.

III. Economic Planning

Scarcely any subject occupies as much space in the Soviet economic press as does economic planning and how to improve it. Poor planning is considered the source of most of the undesired results that occur in the process of plan implementation, and "improving planning" is commonly viewed as the solution to most of these ills. The 1965 reforms were intended to produce a radical breakthrough in this area by (1) extending the time horizons for plans (2) raising their "scientific" basis through extensive use of computers and mathematical optimizing and forecasting techniques and (3) concentrating on planning for major development projects or for solutions to major problems, carefully integrating these plans into the overall plans for development of the economy; this latter aspect is termed "complex planning" or the "program-goals" approach to planning. In the past dozen years the efforts of planners and academics to improve planning along these lines have generated much bureaucratic activity, i.e. many conferences, discussions, decrees and official documents. Despite all this, the goal remains elusive, and the perennial discussions continue on how to improve the improved plans.

A. Extended Planning Horizons

According to Kosygin, the quality of plans would be fundamentally improved by extending their time horizon. To this end, the Five-year Plan was made directive and legally binding on enterprises. Gosplan promulgated detailed instructions for drafting the plan for 1971–75, and another set was issued to apply to the plan for 1976–80. Annual plans (based on a revised methodology and 56 standard forms)[22] are to be drafted within the framework of these plans, and incentives are geared to take account of the degree of progress toward their fulfillment. To provide a stable long-term framework for enterprise operations and evaluation, the Five-Year Plan was supposed to become the basic operating plan, and frequent changes in plans were to be eschewed. There is abundant testimony that neither of these developments has occurred. Originally, also, enterprises were given wider decision-making authority by reducing the number of plan targets that were set centrally. Subsequently, much of this authority was retracted formally by adding to the number of directive targets, and in practice the ministries added others in respect to subordinate enterprises. Consequently, both enterprises and associations are now bound by centrally set parameters for all important aspects of the plan. Proposals are being made in influencial circles to restrict managerial freedom even further by fixing directive quotas for total employment,

[21] Obshchestvennyye Nauki, No. 2, 1978, pp. 155–159.
[22] Ekonomicheskaia gazeta, No. 50, December 1977, pp. 13–14.

thus curtailing freedom of action in respect to labor given by the original reforms.[23] The other important extension of decision-making authority—in the field of investment—has been effectively retracted by the recent decision to include all investment in the plan for "state" investment, thereby doing away with the concept of decentralized investment and the relative degree of freedom that had attached to planning it. [23a] From these actions, it is clear that the idea of improving planning by additional delegation of authority to executants has been abandoned.

The Five-year Plans were to be formulated within the framework of longer-term plans. Work was done on a plan for the location of production facilities in 1971–80. During 1970–72 many projects were set in motion to draft a 15-year plan for 1976–90, but its completion was delayed by bureaucratic conflict over planning methodologies and assumptions and also, no doubt, by the sheer magnitude of the task. Subsequently, perhaps in 1977, a Party-Government decree dealt with formulation of the plan, which was supposed to be completed in mid-1978 and used in drafting the Eleventh Five-year Plan (1981–85). Completion of the 15-year Plan has yet to be announced. In the interim, the Academy of Sciences and the State Committee for New Technology have drafted a "Comprehensive Program of Scientific-technical Development and Socio-economic Consequences, 1976–90" with some 200 targets; this doument was used in drafting the Tenth Five-year Plan (1976–80). Judging from a long article discussing the formulation of this plan, conflicts are continuing over methodologies and approaches, as well as what kind of a final document should be produced.[24] Ironically, the drafters have found two key published statistics—"national income used for consumption and accumulation" and "real per capita income of the population" unsuitable for use in projecting, because they give "misleading results." As a result, Gosplan has devised a list of substitute plan indicators.

B. Computers and Mathematical Methods

The modern, high speed computer has sometimes been viewed as the potential salvation of the modern, centrally-planned economy, which otherwise might "drown in a bureaucratic swamp," as Lenin feared. Even if this dubious hypothesis is correct, salvation is a long way off. Instead of having a comparative advantage in the gains obtainable from computers, the Soviet economy may well have a large comparative disadvantage. Over the past dozen years, much effort has been made to establish computer-based "automated management systems" (ASU's) throughout the bureaucracy—from enterprise to Gosplan. At the same time, computer production has expanded rapidly, from about 700 in 1970 to about 2,000 in 1977, when the total stock of computers, mainly primitive second generation models, was roughly 20,000. The Soviets report the creation of 3,804 ASU's during 1966–78.[25] Somewhat over one third of them are management systems in

[23] Sotsialisticheskiy trud, No. 9, 1978, pp. 2–7.
[23a] Finansy SSSR, No. 12, 1976, p. 13.
[24] Planovoe Khoziaistvo, No. 1, 1978, pp. 24–34.
[25] Narodnoe Khoziastvo SSSR v. 1977 godu, p. 100. Pravda, January 20, 1979. At the Second All-Union Conference on the Use of Computers in the Economy in May 1978, it was reported that there are now about 3,000 Computer centers, about 2,000 ASUP's in enterprises and associations, and some 220 branch systems (OASU's). See Vestnik Statistiki, No. 1, 1979, p. 40.

enterprises, another third are used in technological processes, and the rest are located at various levels of the administrative bureaucracy. During the Tenth Five-year Plan the production of computers is scheduled to rise by 80 percent and to consist primarily of simple third generation models of the Ryad type. The designers and managers of ASU's are busily engaged in redesigning their systems to accommodate the new machines.

During 1968–72, the Soviets launched a grandiose project to design and install a nationwide system of computer centers and information storage and transmission systems. The scheme (labelled OGAS) has several key subsystems, each of which is being set up independently, but ultimately is to be linked into the nationwide system. They are: ASPR (planning), ASGS (statistics), ASMTS (material-technical supply), ASTsen (prices), and ASGNT (scientific and technological information). The scheme also includes a data bank for storage and revision of technical norms (ASN), but it now appears that this data bank has been integrated into ASPR. Although the unified nationwide OGAS remains a cyberneticist's dream, the designers of the several subsystems are forging ahead slowly against enormous difficulties. The "first stage" of ASPR was put into operation in 1977.[26] This step seems to mean that computers have been installed in the Gosplan system and are being extensively used in making plan calculations. A soviet source reports, for example, that the first stage involved computerization of 3300 "planning problems.[27] Centralized calculation of demand for 9,000 types of machines can now be made, compared with only 600 before, and 270,000 material consumption norms have been stored in computers and can be periodically revised. About half of the calculations involved in the 1978 national economic plan were made with the aid of computers. Assignments have been parcelled out to design the second stage, which is to be introduced gradually during 1978–85. It is reported that over 140 research institutes are working on the scheme, with Gosplan's Institute of Economics serving as the coordinator; the Lithuanian and Ukrainian Gosplans are the coordinators for the design and installation of the regional systems. In the second stage, ASPR is to be coordinated with and made compatible with ASGS and ASMTS. The first stage of the former has been completed.[28] It has involved standardization of forms, linking of regional and national computers and computerization of reporting data. Some 54 percent of statistical data is now processed on computers at the all-union level and 40 percent at the republic level. ASMTS seems still to be in the design stage, although Gossnab's computers are being used extensively to monitor inventories and to calculate optimal distribution plans for various kinds of rationed materials.[29] The state bank (Gosbank), too, has acquired some computers; it is reported, however, that in 1977 only 20 percent of its information data had been computerized.[30]

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[26] Planovoe Khoziaistvo. No. 11, 1977, pp. 156.
[27] Ekonomicheskai a gazeta, No. 29, July 1978, p. 17. For additional details about ASPR, see: Ibid., No. 23, June 1978, p. 14. Planovoe Khoziaistvo, No. 10, 1978, pp. 27–41; and Voprosy ekonomiki, No. 5, 1978, pp. 57–63. L. I. Istomin, Upravlenia razrabotkoy pianov v ASPR, Moscow, 1977.
[28] Ekonomicheskaia gazeta, No. 26, June 1978, p. 5.
[29] Material no-tekhnicheskoe snabzhenlye, No. 12, 1977, pp. 36–40.
[30] Den'gi i Kredit, No. 5, 1978, pp. 71–82; No. 9, 1978, pp. 31–35.

Along with all this, the ministries are developing their own systems (OASU's), which frequently are not compatible either with one another or with computer systems in the State Committees such as Gosplan or with those in subordinate entities. In a word, each unit seems to be going its own way, using whatever machines it gets to computerize parts of its data processing operations. Although such a "departmental" approach is widely deplored, nobody seems to know what to do about it. Now, computer-owners at all levels are having to re-design their systems to accommodate to the more modern Ryad models that are becoming available. Meanwhile, in the Institutes of Cybernetics, people are continuing to design and redesign systems for the planning of systems for the future OGAS.

In actual practice, the economy's problems with its computers are legion. Many of these problems were aired at the Second All-Union Conference on ASU's held in Moscow in May 1978. Following are some of the standard complaints: [31] over the past 5 years the average daily operation of computers rose only from 10.5 to 11.7 hours (the latter figure apparently applying to 1977 or 1978); hardware is of poor quality, there are frequent breakdowns and qualified repairmen are scarce; standard programs and peripheral equipment are hard to come by, of poor quality and design and often unsuitable for the hardware at hand; some three-fourths of the problems solved with computers relate to accounting and statistics, and they are little used for improving planning through optimizing calculations; in some cases computers fail to result in reduction in administrative staffs and even cause financial losses.

Along with these perennial complaints, the press reports large planned savings from the use of computers (3.8 billion rubles during 1976–80 and 1.6 billion rubles during 1976–78 [32] and small steps to improve matters. An All-Union Association (probably under the Ministry of the Radio Industry) was established recently to provide centralized computer service and to train programmers; it has outlets in 43 cities, and it is planned to establish one in every city that has at least 5 machines.[33] Standardization efforts are underway, and the Ministry of Instrument Making, Automation Equipment and Control Systems (Minpribor) has established a specialized science-production association to design, produce and distribute standard programs, but it is getting off to a slow start.[34] Finally, time sharing is spreading slowly; the requisite computer centers are supposed to be established in 6 cities by 1980. Gosplan has published a "Standard Methodology for Calculating the Efficiency of ASU's", has devised a standard payoff period for computer systems (3.3 years) and has instructed ministries and enterprises to include plans for ASU's in their Five-year Plans, specifying the expected monetary and personnel savings to be realized.

The advent of the computer has made it possible not only to plan centrally a much larger volume of detail, but also to use sophisticated

[31] See, for example, Ekonomicheskaia gazeta, No. 3, January 1977, p. 17; No. 23, June 1978, p. 14; No. 29, July 1978, p. 17. Planovoe Khoziaistvo, No. 5, 1977, pp. 48–53. Sotsialisticheskai a industrii a, August 21, 1977; June 4, 1978. Pravda, March 2, 1977; March 13, 1978; December 3, 1978.
[32] Ekonomicheskai a gazeta, No. 23, June 1978, p. 14.
[33] Ibid., No. 31, July 1978, p. 15.
[34] Ibid., No. 22, May 1978, p. 7. Sotsialisticheskai a industria, April 11, 1978.

mathematical forecasting models, manipulate input/output data and employ mathematical optimizing techniques. Over the years the literature has revealed a continuing quarrel among groups of Soviet economists over the role that such approaches should play in the concrete formulation of the annual and long-range plans themselves. This quarrel still continues. A Gosplan economist recently claimed that "most economists" now understand the "correct" role of input/output techniques in planning, but also asserted that "an overabundance of mathematical models and the exaggeration of their role" can do serious damage to the efforts to improve planning.[35] Despite the hopes of some economists, it is clear that input/output data and analyses are employed primarily as additional sources of information and not as the basis for plan decisions. I/O techniques are used as an adjunct to plan-making; they have in no sense replaced the "tried and true" (material balance) methods of drawing up the plans. Nonetheless, mathematical approaches are employed extensively, mainly in the research institutes, to calculate alternative plan variants based on different forecasts, to answer questions involving finding the "best" solution in problems of choice and to test the consistency and balance of alternative plans. Linear programming techniques are used to a considerable extent by Gossnab in devising optimal patterns of distribution of products, Research institutes, using mathematical approaches, have developed optimum production and distribution plans for a number of products, such as fuels, power, pipe, hardware, cement, glass and lumber. Their use in current planning has been hampered, it is claimed, by problems with the mathematics involved, but primarily because of lack of interest on the part of ministries and enterprise managers.[36] One source reports, for example, that Gossnab produced an optimal plan for the distribution of tires, but the ministries concerned failed to take the results into account in formulating production and shipment plans.[37]

C. Program-Goals Approaches

Recent planning literature is replete with discussions and recommendations for new approaches to planning, variously labelled a "systems approach," "complex planning" and of late the "program-goals" approach to planning.[38] Interest in these new approaches has stemmed from the practical problems involved in planning the sizeable number of large, integrated territorial-production complexes (such as those for Krasnoyarsk Kray and Tyumen' Oblast. Also, there has been increasing advocacy of preparing detailed, separate plans for integrating all the elements involved in accomplishing some major intersectoral or inter-regional goal, such as the complex of measures to mechanize labor throughout the economy. The Tenth Five-year Plan includes a number of such programs—agriculture, building materials, the non-Black Soil areas, fuel and energy, and development of raw material resources in Eastern Regions. Gosplan reportedly has drawn

[35] Planovoe Khoziaistvo, No. 1, 1978, p. 32. For a contrary view, see Kommunist No. 16, 1978, pp. 31–42.
[36] Ekonomicheskie Nauki, No. 1, 1978, pp. 47–54. Kommunist; No. 16, November 1978, pp. 31–42.
[37] Sotsialisticheskaia industria, June 4, 1978.
[38] See, for example: Ekonomika i matematicheskie metody, No. 4, 1978, pp. 626–638. Voprosy ekonomiki, No. 1, 1978, pp. 313. Kommunist, No. 16, 1978, pp. 43–56. Planovoe khoziaistvo, No. 12, 1977, pp. 127–139; No. 1, 1978, pp. 35–43.

up a list of programs to be included in the plan for 1976–90 and has outlined methodologies for drafting them.[39] Presumably, the latter will be spelled out in the revised Methodological Instructions for Compiling the National Plan, which was scheduled for publication in 1978.[40] According to one source, it has been decided that these complex programs are to have priority in the allocation of resources.[41]

IV. The Supply System

The Kosygin reforms attacked anew the perennial problem of creating an effective system for centralized rationing of materials and equipment throughout the economy. Besides establishing a new bureaucracy to carry out the function, the program called for widespread use of direct contracting arrangements among suppliers and their customers, gradual adoption of a system of wholesale trade in place of rationing, and imposition of penalties for contract violations. After some 12 years, how do matters stand?[42] First of all, the rationing system remains highly centralized. At present, Gosplan works out material balances and distribution plans for nearly 2,000 products, which account for 70–80 percent of industrial output; the allocations for 274 products require approval of the Council of Ministers.[43] Gossnab and its regional units allocate 14,500 others, and the ministries distribute another 40,000. Although the Gossnab system was supposed to largely replace the ministerial supply systems, this has not occurred. In 1976, Gossnab handled only about half of the total value of rationed producer goods.[44] Departmental supply bodies outnumber those of Gossnab, allegedly duplicating their functions at much higher cost.[45]

The extension of direct contracting arrangements proceeded slowly during the first 10 years. At the beginning of 1976 they involved 5,500 suppliers and 25,000 customers and amounted to some 30 billion rubles (out of a total wholesale trade of 260 billion rubles).[46] The Tenth Five-year Plan called for rapid acceleration of this program and for its completion in respect to all mass-produced goods by 1980. The past two years have witnessed a general campaign to conclude such agreements. By the end of 1977, they amounted to some 37 billion rubles and covered 90 percent of steel, cast iron and nonferrous forged products, 67 percent of lumber and 54 percent of paper and pulp.[47] At the end of May 1978, however, a *Pravda* article sharply criticized Gossnab for the slow pace at which long-term ties were being worked out, accusing it of having a material interest (loss of service fees) in delaying things.[48] Moreover, a barrage of criticism has been directed at the way contracts are being worked out:[49] in many cases they are

[39] Planovoe Khoziaistvo, No. 1, 1978, p. 34.
[40] Planovoe Khoziaistvo, No 6, 1977, pp. 81–89; No. 7, 1977, pp. 112–125.
[41] Ekonomischeskaia gazeta. No. 29, October 1978, p. 17.
[42] For a full description of these reforms and their implementation during 1966–71, see: Gertrude E. Schroeder, "The 'Reform' of the Supply System in Soviet Industry", Soviet Studies, Vol. XXIV, No. 1, July 1972, pp. 97–119.
[43] V. M. Lagutkin and A. A. Yakob (eds.), Organizatsiia i planirovaniye material' Notechnicheskogo snabzheniya v narodnom khoziaistve. Moscow. 1977, p. 171. Another source (Material'no-teknicheskoe snabzheniye, No. 11, 1977, pp. 65–79) gives the share as 80 percent.
[44] Izvestia, Apr. 16, 1976.
[45] Material-no-tekchnicheskoe snabzheniye No. 8, 1978, pp. 31–35.
[46] Ekonomicheskaia gazeta, No. 23, June 1977, p. 10.
[47] Ibid., No. 13, March 1978, p. 11.
[48] Pravda, May 5, 1978.
[49] For example: Material'no technicheskoe snabsheniye, No. 8, 1977, pp. 28–38. Khoziaistvo, i pravo, No. 8, 1977, pp. 28–34. Sotsialisticheskaia industria, Oct. 20, 1977. Planovoe Khoziaistvo, No. 3, 1978, pp. 90–100.

merely formalistic, reflecting a ministry or plant's response to some campaign; even though ties are supposed to be arranged for 5 years and to remain stable, in practice they usually cover only one year; ministries frequently change both plans and ties, despite rules forbidding this practice without Gosplan and Gossnab approval; many firms simply refuse to sign contracts, even though fines are imposed, or conclude them with great delay. The whole process evidently reeks with formalism, bureaucracy and red tape. The situation probably will not be made better by new rules, effective in 1978, that punish enterprise personnel for failure to adhere strictly to contracts in respect to quantity, quality and delivery terms. Finally, the separate system of fines for contract violations continues to be ineffective, despite increases in their size.[50]

The gradual derationing of producers goods that was a part of the 1965 program has not ocurred, if for no other reason than that it would obviate the need for the bureaucrats who were supposed to carry it out. In the early years, a few reportedly successful experiments with derationing of some petroleum products were carried out, but were quickly aborted. Meanwhile, Gossnab has effectively redefined the concept to refer to whatever Gossnab does, i.e., the centralized distribution of goods is now described as "wholesale trade in the means of production". At the same time, however, Gossnab has created a network of stores which sell a variety of small items to industrial customers without requiring ration certificates; the volume of sales is supposed to rise from 6 billion rubes to 12 billion rubes during the Tenth Five-year Plan. Instead of moving toward derationing, Gossnab is implementing a system labelled "comprehensive supply", whereby Gossnab becomes the fundholder for rationed products and contracts with enterprises to provide the full range of supplies to which they are entitled by their plans. This new approach has been carried out most extensively in respect to construction projects and research and development units.[51]

Whether these changes in the management of supply have improved matters much is an open question. The press continues to report extensively on supply failures at individual enterprises, and supply still seems to be the most frustrating problem for their managers.[52] As a result of complaints aired at the 25th Party Congress, the Council of Ministers in April 1976 set up a special commission to draft a set of measures to put things right once and for all and to "establish a general plan for management of the branch". Three years have passed, and the report of this commission has yet to be published. Meanwhile, Gossnab is carrying out a major reorganization of its subordinate units, setting up some 120 associations specializing in the distribution of individual products.[53]

V. Incentives

The original reforms introduced a new concept into the Soviet system of enterprise management—the idea of "economic levers". These

[50] For example, Ekonomika i organizasia promyshlennogo proizvodstva, No. 1, 1978, pp. 30–40. Planovoe Khoziaistvo, No. 6, 1978, pp. 101–109. Pravda, Feb. 18, 1978.
[51] Material'no-tekhnicheskoe snabzheniva, No. 2, 1978, pp. 8–14.
[52] For example: Pravda, Mar. 18 and 19, 1978: Dec. 20, 1977. Material'no-tekhnicheskoe snabzheniye, No. 5, 1978, pp. 13–20. Sotsialisticheskaia industria, Apr. 6, 1978; May 12. 1978. Planovoe khoziaistvo, No. 3, 1978, pp. 90–100.
[53] Material'no tekhnicheskoe snabsheniye No. 2, 1978, pp. 8–14.

levers—prices, a charge for the use of fixed and working capital, increased use of bank credit, retention of a substantial share of profits, an enterprise investment fund, and incentive funds and bonuses tied to plan indicators designed to stress efficiency in the use of resources and a product quality and mix geared to customers' needs. The levers were supposed to operate more or less spontaneously to elicit the desired behavior. As described in earlier papers,[54] the bureaucracy quickly moved to deprive the levers of all spontaneity by integrating them into the planning routine. Since the subject of prices has been fully treated elsewhere,[55] we shall not cover it here. It is generally conceded that the pecuniary variables—bank credits and the capital charge—have not produced the intended results, and for ten years the press has aired proposals for changing the rules.[56] The planners have now completely nullified the leverage effect of the enterprise investment fund (production-development fund) by abolishing the concept of decentralized investment and treating expenditures from the fund like all other investment, that is, centrally planned and monitored. The fund, in effect, has simply become one more way to provide investment financing. The levers involving plan indicators, incentive funds and bonuses have been frequently and extensively modified in a seemingly endless process of reforming the reforms. These levers deserve extended treatment.

A. Plan Indicators and Formation of Bonus Funds

The original 1965 reforms provided for the formation of greatly enlarged enterprise incentive funds from retained profits and transfers from the wage fund; that is, white collar employee bonuses were to be paid from profits instead of being treated as planned elements of the wage fund. The incentive funds were to be built up in accord with enterprise performance in respect to meeting plans for two basic plan indicators—sales (or profits in some sectors) and profitability (return on fixed and working capital). Monies were allocated to the funds on the basis of ministry-set coefficients (percentages) relating plan performance in respect to the two indicators to the total wage fund. During the first 5 years of implementation of the reforms, successive amendments were made to add subsidiary variables that influenced the size of the fund. Thus, enterprises were punished through fund reductions for failing to meet the plan for production of key products (nomenclature plan) in physical units, for overspending the planned wage fund and for permitting average wages to increase faster than labor productivity.

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[54] Gertrude E. Schroeder, "Soviet Economic Reforms: A Study in Contradictions." Soviet Studies, vol XX, No. 1, July 1968, pp. 1–21. "Soviet Economic Reform at an Impasse" Problems of Communism July–August 1971, pp. 36–46."

[55] Gertrude E. Schroeder, "The 1966–67 Industrial Price Reform: A Study in Complications." Soviet Studies, vol. XX. No. 4, April 1969, pp. 462–477. Morris Bornstein, Soviet Price Policy in the 1970's, JEC, Soviet Economy in a New Perspective, Washington, 1976, pp. 17–66. Morris Bornstein, "The Administration of Soviet Prices", Soviet Studies, vol. XXX, No. 4, October 1978, pp. 466–490.

[56] For a review of these aspects of the reforms see: Gertrude E. Schroeder "Post-Krushchev Reforms and Public Financial Goals", in Z. M. Fallenbuel (ed.), Economic Development in the Soviet Union and Eastern Europe, vol. II, New York, Praeger, 1976, pp. 348–367.

The next five years saw a further complication of these already complicated rules. During that period, the number of fund-determining indicators was increased to include fulfillment of plans for labor productivity and for product quality, the latter defined as the change in the share of the highest-quality category in the total value of output. The number of subsidiary variables also was increased by adding devices (depending on the sector) for rewarding enterprises for producing consumer goods and for upgrading their quality, assortment and modernity. Finally, to induce enterprises to adopt tauter plans, an intricate scheme was superimposed on all of the above, whereby incentive funds are increased at higher rates in respect to each of the fundforming indicators, when the enterprise voluntarily adopts more demanding plan targets than those originally set for it in its Five-year Plan. These additional obligations are termed "counterplans." During this period, also, new procedures for setting total incentive funds for ministries were introduced, with the intended effect of limiting their growth to conform to the requirements of incomes policies. The details of all these arrangements have been given elsewhere; the interested reader is referred to that source.[57] Finally, in this period, and earlier as well, these "basic" incentive funds were supplemented by a sizable number of other incentive funds formed on one basis or another to encourage one or another form of enterprise behavior. In particular, annual campaigns are conducted to "persuade" firms to take on still more "Socialist obligations," financed from the Fund for Victory in Socialist Competition.

In 1976, incentive schemes were changed once more, to be effective during the Tenth Five Year Plan. The new set of rules, adopted in December 1976 in a formal Regulation [58] makes some important changes. First ministries are accorded the right to determine the fund-forming indicators for enterprises and associations, choosing among the following indicators: labor productivity (defined as the ministry sees fit), proportion of highest quality category products in total output, profitability or capital/output ratio, growth of output (in kind or in rubles) or of profits, reduction of cost per unit of output,[59] and timely mastery of new capacities. In general, the ministries are supposed to select not more than 3 or 4 of these plan targets, with labor productivity and product quality indicators to be mandatory "for the most part." As before, ministries set the size of planned incentive funds by year for each enterprise, based on the chosen indicators, but now the coefficient relating the indicators to rubles in the funds are taken as percentages of the incentive funds in 1975. The general regulation fixes these normatives (1 or 2 percent of the 1975 fund) in respect to the targets for labor productivity and product quality, as well as those for planned profitability and the capital/output ratio. These norms are to apply "in general," but are differentiated for enterprises in consumer goods industries (light, food, meat and dairy and fish). For example, in these branches the norm in respect to labor productivity is 1 percent, rather than 2 percent, as for the rest of industry; the

[57] Gertrude E. Schroeder "Recent Developments in Planning and Incentives", loc. cit., pp. 30–35.

[58] Ekonomicheskaia gazeta, No. 50, December 1976, pp. 1–8 (insert).

[59] An earlier decree had given ministries the right to set cost-reduction targets for enterprises and award bonuses for meeting such targets, but only when the cost reductions resulted from the enterprises own efforts (not from windfalls). Ekonomicheskaia gazeta, No. 10, March 1977, p. 17.

reverse is true in respect to the norm for product quality. The applicable norms were also to be used to provide additional monies in the funds for enterprises that adopt counterplans. Finally, the new rules superimpose on this basic arrangement, in a more detailed way than before, a scheme to reward enterprises for producing more consumer goods (in heavy industry) and to raise their quality. For the present plan period, too, a plethora of other incentive arrangements are in effect, including a distinct and an exceptionally intricate one applicable to research and development entities. Finally, the new rules strengthen and elaborate an innovation of the preceding set—the establishment of centralized reserve funds in ministries and associations. These funds are formed as a deduction from the total profits of enterprises and are not supposed to exceed 10 percent of the ministry's total allowable incentive funds.

The ink was scarcely dry on this creation, when the authorities published a new Statute, adopted in January 1977, amending the rules governing counterplans.[60] Another amendment was made in early 1978.[61] Apparently, counterplanning had not spread widely. In 1977, for example, only 13,100 enterprises had adopted such plans, and problems in dealing with them were numerous.[62] The new procedures require that counter plans be submitted, when the regular annual plan is being formulated. They are reviewed at the ministerial level to ensure conformity with general national plan objectives, integrated into the plan as a whole, and monitored in the usual way. To stimulate adoption of such plans, the latest rules double the applicable normatives for the indicators in respect to which higher plans are adopted. Counterplans are supposed to be adopted mainly in respect to the targets for efficiency and product quality improvement originally set in the firm's Five-year Plan. In case of failure to fulfill the counterplan, bonus funds are reduced in accord with specified norms, but basic bonuses are still paid, if the original plan targets are met. Despite a campaign to foster counterplanning, a source reported in August 1978 that only one-third to one-half of all enterprises had adopted them.[63] Along with the push for counterplanning, a push is being made to persuade workers to adopt "personal" or brigade plans,[64] and drives to promote Socialists Competitions continue.

Having monies in the incentive fund is a necessary, but not a sufficient condition for receipt of bonuses, which are governed by another set of rules. We focus here on the bonus arrangements for managerial-technical employees of enterprises and associations.

B. Determination of Bonuses

Two basic documents, published in September [65] and November 1977 [66] (amplified in November 1978) spell out the revised general rules for awarding bonuses to production workers and to white collar

[60] Ibid., No. 7, February 1977, p. 7.
[61] Ibid., No. 10, March 1978, p. 16.
[62] Khozinistvo i pravo, No. 2, 1978, p. 9.
[63] Ekonomicheskaia gazeta, No. 32, August 1978, p. 7.
[64] Ibid., No. 3, January 1978, p. 16. This source gives the text of Recommendations for Adoption of Personal (or Brigade) Plans approved on Nov. 28, 1977, by Gosplan, Goskomtrud, the Central Statistical Administration and the All-Union Central Council of Trade Unions.
[65] Ekonomicheskaia gazeta, No. 36, September 1977, p. 16.
[66] Ibid., Nos. 45–48, November 1977, p. 22 (in each case).

employees. These rules modify the arrangements introduced during 1971–75. Taking into account the provisions of the general statutes, ministries, in consultation with the appropriate trade union body, are to work out the rules that will apply to subordinate units. The ministries are accorded large powers in the administration of the new rules; in the final analysis, they choose the fund-forming indicators, establish the normatives, define terms, and specify the complex tradeoffs among the various criteria that determine the ultimate size of an individual's bonus.

The new arrangements are extremely complicated. We shall try to sort out the essentials. Managerial personnel receive bonuses for fulfilling plans for the basic, incentive fund-forming indicators chosen by the ministry or other authority; fulfillment of plans for labor productivity and the share of products of highest quality in the total value of output are mandatory. Since the general statute does not specify the tradeoffs, evidently the ministry determines them, and probably they differ among branches. The general statute requires denial of any bonuses for plan fulfillment, if the enterprise fails to fulfill its plan for key products in physical units. The ministry itself determines the composition of this list. The statute specifies a number of other requirements that superior bodies may fix as conditions for payment of bonuses, e.g., timely mastery of new capacities, adherence to product standards, and saving on fuel and energy. If the wage fund is exceeded, managerial bonuses must be reduced by half, until the overexpenditure is made up. An Appendix to the statute lists 12 additional kinds of behavior that can result in deprivation of bonuses; these are specified in various extant legislation and decrees.

The most important innovation is the specification that managerial personnel must be deprived of all or part of their bonuses for failure to fully comply with contractual arrangements for product deliveries. Although this rule was actually inaugurated by decree in 1974, it evidently was not enforced. The details of the new provisions are spelled out in a document issued in September 1977. They require the enterprise to report, in value terms, the planned and actual amounts of output delivered in accord with contracts or other obligations. The ministries fix the percentage of the planned value of such deliveries (separately for producer goods and for consumer goods) that must be met, in order for supervisory personnel to receive bonuses. They may also fix a scale by which bonuses are merely reduced rather than denied entirely in case all contracts are not met. For example, a ministry might specify that no bonus would be paid, unless the delivery plan was met by 95 percent and that bonuses would be reduced by 20 percent for each percentage of underfulfillment between 96 and 100. The new scheme took effect on January 1, 1978.

There are other important provisions of the latest set of bonus regulations. First, a ceiling of 50 percent of salary is imposed on the size of bonuses paid for plan fulfillment from the material incentive fund; the limit is 60 percent in industries designated by the government as "especially important" (8 in 1977). Total bonuses for an enterprise are limited to the incentive fund, with specific shares being set in annual plans for white collar workers and production workers, respectively. To attack the chronic problem of "storming", superior organs may pay supervisory employees only 75 percent of the earned

monthly bonus, reserving the rest for payment, if the quarterly plan is fulfilled; to receive the bonus, the enterprise must have fulfilled its plans for all relevant indicators in each month of the quarter. In awarding individual bonuses, managerial personnel at all levels must obtain concurrence of the appropriate trade union body. An effort also is being made to bring order out of the chaos created by a multiplicity of separate bonuses systems. Clearly, the potential for conflict among the many bonus criteria and plans is large. Finally, a first step has been taken toward the oft-stated objective of achieving consistency in incentive arrangements among the various levels in the hierarchy—from shop to ministry. A regulation published in June 1978 [67] requires uniformity in approach in respect to subordinate enterprises and their immediate superiors—trusts, industrial administrations and ASSR ministries. The application of this regulation is not wide.

C. Campaigns and Experiments

Along with these modifications in the incentive arrangements that presumably affect most enterprises, much publicity is given to special schemes to elicit various kinds of desired behavior; once declared successful, the innovations take on the status of campaigns to get one and all to emulate the pathbreakers. In addition, a number of experiments are being conducted to test various kinds of new plan indicators and incentive rules. All this activity gives diversity and confusion to the incentive scene. Since today's emulation campaigns and experiments may well be tomorrow's mandatory rules, it is useful to sketch briefly the nature of the more extensive innovations. The most venerable and publicized is the Shchekino method, designed to induce enterprises to reduce employment or at least halt its growth. First introduced at the large Shchekino Chemical Combine in 1967, the scheme, in general, is supposed to allow enterprises to keep for incentive purposes the wage fund savings obtained through meeting output plans with an unchanged or reduced labor force. Despite an enormous amount of propaganda, support at the highest levels of the Party (Brezhnev himself recently endorsed the idea), and several revisions in the rules and procedures for putting it into effect, only about 1200 enterprises had adopted it by mid 1978 they are; concentrated in the chemical, petrochemical paper and pulp and maritime industries.[68] While citing the large gains in productivity and the large numbers of workers "saved" in plants that have adopted the Shchekino method, the press is replete with complaints about the way the experiment is working in practice and about the reluctance of ministries and enterprises to adopt it.[69] The most common reasons given for its slow spread and limited success are these: ministries drag their feet, because it upsets established routines; the experimentors are hindered by supply failures, frequent changes in plans, "planning from the achieved",

[67] Ibid., No. 24, June 1978, p. 16.
[68] Pravda, Sept. 13, 1978.
[69] The following are typical recent examples of this literature: Pravda, Dec. 9, 1977; July 26, 1978; Sept. 13, 1978. Sotsialisticheskaia industria, Mar. 2, 1978; Mar. 15, 1978; Mar. 28, 1978; Apr. 12, 1978. Sotsialisticheskiy trud, No. 7, 1978, pp. 3–11; No. 8, 1978, pp. 20–25. Ekonomicheskaia gazeta, No. 49, December 1977, pp. 11–14. Voprosy ekonomiki, No. 10, 1977, pp. 104–112. Ekonomika i organizatsia promyshlennogo proizvodstva, No. 2, 1978, pp. 75–87.

confiscation of excess wage funds, restrictions on the use of the wage savings, and conflicts between the rules of the experiment and other in-force rules and incentive arrangements. Also, there are complaints about "excessively" high earnings of some plants and workers resulting from the experiment.

In April 1978, a new set of regulations for introducing and carrying out the Shchekino experiment was promulgated, replacing a set issued in January 1977.[70] The new rules shift the burden of being the initiators from the ministries to enterprises and associations. However, the ministries still play a large role. They may award bonuses up to one month's salary to personnel in industrial associations who successfully launch the experiment in subordinate units. Moreover, ministries are required to establish stable wage expenditure norms per unit of output for the experimenting enterprises and are supposed to extend and facilitate the experiment, including helping to devise plans for retraining and finding jobs for laid-off workers. The new rules specify a complicated set of conditions for increasing incomes of workers who raise labor productivity above plan and who take on extra work. Additional wage savings remaining at the end of the year are to be transferred to the material incentive fund. Whether these complex rules and procedures, grafted on to the regular incentive arrangements, will provide the catalyst to spread the experiment remains to be seen. Judging from measured performance in the industrial sector, its overall impact on efficiency has been minimal thus far.

Along with the Shchekino and related campaigns, experiments are in process, especially in industry and construction, to test one or another plan indicator or combination of indicators as bases for measuring and rewarding enterprise performance. For at least a decade, the economic literature has debated the pros and cons of the use of "net" output instead of gross output ("Val") in planning and evaluating the activities of enterprises "Val" encouraged the over-use of intermediate inputs, especially ones with high prices. Net output may be roughly defined as gross output less raw materials and related costs. During 1965–71, experiments were carried out in some 100 enterprises to test the affects of the use of net output in measuring labor productivity; the experiments proved unsuccessful and were abandoned.[71] Beginning in 1973, under the aegis of Gosplan, a new set of experiments was begun in 45 enterprises in 7 ministries to test the net output indicator in planning and incentive arrangements. This experiment has been gradually extended, and at the beginning of 1978 it covered 433 enterprises in 19 ministries, most of them in the machinery, wood processing, medical and building materials industries. At that time, another 100–125 firms were preparing to joint the experiment.[72] The experiments and discussion of them were given impetus by Brezhnev's endorsement at the 25th Party Congress of the idea of rewarding workers and firms for "final" results. That endorsement also launched a debate on how to define and measure "final results" everywhere in the economy.

Over the past two or three years, an extensive discussion, has taken place not only over purported results of on-going experiments, but

[70] Ekonomicheskaia gazeta, No. 7, February 1977, pp. 17–18. Ibid., No. 21, May 1978, p. 2.
[71] The history of this experiment is given in Planovoe Khoziaistvo, No. 3, 1978, pp. 78–79.
[72] Voprosy ekonomini No. 2, 1978, p. 107.

also about an array of propsals for alternative definitions, indicators and incentive schemes. Since the accounts conflict, it is difficult to describe and assess these experiments to replace the notorious "val" with some measure of net output. One thing is abundantly clear, however,—complications abound. It appears that in most of the tests, net output is being calculated not in respect to the total output of enterprises, but rather for individual products or groups of products. In the most extensive experiment, the term "normative net output" is used to describe the new indicator, which is being used to measure and evaluate plan fulfillment in respect to output and labor productivity, as well as to serve as criteria for the formation of incentive funds and award of bonuses. Wage funds are being planned, using "standard" or "normative" expenditures per unit of net output. Evidently, much complicated calculating and re-calculating is involved.

The aim of the shift to the use of net output is to eliminate the incentive, built into the use of gross output measures, for firms to prefer excessive amounts of expensive intermediate inputs (materials). The press discussion of the results of the experiments gives a mixed impression, although on balance the appraisal seems to be positive;[73] at any rate, the experiments are being continued and expanded. On the one hand, observers report that net output grows faster than gross, that enterprises no longer seek to maximize material inputs, that contracts and key products lists are better fulfulled, that firms produce more new, labor-intensive and higher quality products, that they are not discouraged from producing spare parts, and that subcontracting and specialization are encouraged. On the other hand, critics deny many of the above assertions and declare that the net indicator contains most of the sins of the gross value measure, that it leads firms to prefer labor-intensive products, that the normative values are laborious and time consuming to calculate and soon become obsolete, that the revealed preference of firms for producing high-priced and high-profit products has not been eliminated, and that new abberrations occur as a result of conflicts with other retained plan indicators. Along with critiques of the net output indicator, the press airs numerous proposals for all kinds of permutations and combinations of plan indicators designed to solve one or another problem, or all of them at once.

VI. Evaluation

The Soviet economy is losing its dynamism, a result, at least in part, of systemic arterioschlerosis. Its economist-doctors, along with its politicians, long have been convinced that the disease can be cured by continuing doses of administrative reorganizations and revision of plan indicators and related incentive rules. Up to now, these medicines have failed to arrest the disease and may even have made matters worse. According to the latest available Western calculations,[74] rates

[73] The following are good examples of the large recent literature on the net output experiments: Pravda, Sept. 27, 1977; Jan. 7, 1978. Voprosy ekonomiki, No. 2, 1978, pp. 107–114. Den'gi i Kredit, No. 4. 1978. pp. 34–39. Planovoe Khoziaistvo, No. 1, 1978, pp. 54–62; No. 3, 1978, pp. 78–89. Finansy SSSR, No. 4, 1978, pp. 33–38. Ekonomika i organizatsia promyshleninogo proizvodstva, No. 6, 1977, pp. 118–145.

[74] National Foreigner Assessment Center. Handbook of Economic Statistics 1978. pp. 46–47. The source provides date through 1977; the extension to 1978 is the author's rough estimate.

of growth of both GNP and industrial production have continued their slow decline, a finding that is reflected in official Soviet data, also. Thus, during 1976–78, the average annual rates of growth of GNP and industrial production, respectively, were 3.6 percent and 3.7 percent, compared with rates of 3.8 percent and 5.8 percent during 1971–75 and 5.3 percent and 6.3 percent during 1966–70. Also, productivity has failed to make a comback. Whereas productivity in the economy as a whole grew by 1.1 percent annually during 1966–70, it actually declined during 1971–78. In the industrial sector, the growth of productivity has declined steadily since 1973 and was negative during 1976–78. These results have obtained, in the face of an increase in fixed capital stock of nearly four-fifths in both the total economy and in industry since 1970,[75] and in the face of massive imports of foreign machinery and equipment intended to significantly upgrade the quality of the capital stock. The modest pickup in labor productivity growth experienced in industry during 1971–75 was followed by a sharp reduction in growth during 1976–78. In fact, the quantitative gains in productivity during the first 3 years of the Tenth Five-year Plan, labelled the "Plan of Efficiency and Quality" have been among the poorest in Soviet post-war experience. This performance is all the more noteworthy, when one considers that the change is measured from 1975, a year of severe crop failure, and that none occurred during 1976–78.

Many of the economic reforms were aimed at alleviating chronic ills in the research and development process and at overcoming managers' reluctance to incorporate innovations in the production process. Judging from measured productivity performance and from continuing press lament, the many alternations in organizational and incentive arrangements for R and R entities[76] and for enterprises have done little to increase innovation in the economy. The new (and frequently changing) incentive schemes for both groups have become extremely complex; the bonus schemes for R and D units, for example, are supposed to reward researchers in accord with the calculated "economic affect" of the results of their projects. Such a scheme seems certain to produce inflated estimates of the beneficial results of research projects. The 150 science-production associations can have had little impact as yet; as already noted, they seem to be suffering acute growing pains.

The economic "levers" in their many incarnations were supposed to result ultimately in substantial upgrading of the quality of Soviet manufactured products, which have met chronic sales resistance both at home and abroad. Following the innovation introduced in 1973, whereby ministries were required to classify their products in 3 quality categories, and enterprise plans and incentives were geared to raising the share of highest quality goods in total output, the press released a flurry of statistics reporting remarkable progress on the quality

[75] Narodnoe Kehoziaistvo SSSR v 1977 godu. p. 41. The extension to 1978 is the author's rough estimate.

[76] For detailed discussion of the reforms in R and D, see: Louvan E. Nolting, The Reforms of Scientific Research, Development and Innovation in the USSR, U.S. Department of Commerce, Bureau of Economic Affairs, Foreign Economic Report No. 11, September 1976. Like the economic reforms in general, continued tinkering with the R and D reforms is taking place, with the aim of removing one or another abberration created by the previous rules.

front.[77] Official handbooks report that the number of products awarded the State Seal of Quality annually rose from 1700 in 1970 to 29,100 in 1977.[78] At the beginning of 1978, some 48,300 products had the Seal. The total is supposed to rise to 65,000 in 1980. Besides glowing statistics, what has been accomplished by this many-sided attack on the quality problem? Have Soviet products become more salable abroad and more satisfactory to domestic consumers? In respect to foreign customers, the answer must be negative, for the share of manufactured goods in Soviet exports to the West remains less than 4 percent, even after a decade of strenuous effort and the introduction of special incentive arrangements affecting the production of goods for export. At home, the continued and perhaps growing dissatisfaction of the populace with the goods offered for sale is evident from a mountain of testimony provided by the press. To this observer, there has been no diminution in the volume of such reporting, nor a change in its character. Complaints about random shortages and surpluses and about poor quality are numerous, along with evidence indicating the lack of much improvement in the ties between retail trade outlets and producing enterprises, despite special arrangements aimed in that direction.[79] Customers, stores, producers and their suppliers, along with administrators and product designers, continue to blame one another for the malfunctions. Finally, since 1975 the USSR no longer publishes data on inventories in retail trade, from which one might be able to discern whether alleged improvements in quality and assortment were being reflected in improved inventory ratios. But in 1977, (1) the budget allocated 1 billion rubles (apparently refers to 1978 plan) to cover losses of retail stores because of price markdowns, which averaged 60 percent; [80] (2) trade inspectors rejected one-tenth of all garments and one-eighth of all shoes; [81] (3) as of July 1, stocks of TV sets amounted to 1.6 million, or 118 days of trade turnover; [82] (4) the percentage of dresses, shoes and fabrics rejected by inspectors was higher in 1977 than in 1976; [83] (5) at the start of 1978, above-norm stocks of non-food goods in retail trade were 2.4 billion rubles; [84] (6) wholesale and retail trade have a continuing inventory of 3 to 4 billion rubles of unsaleable goods, with attendant annual storage costs of 200 million rubles,[85] both producers goods and consumer goods and (7) examples of poor quality of individual products are too numerous to document.

Finally, we shall attempt to assess from another dimension the impact of the many tinkerings with incentive arrangements, including prices, penalties, incentive funds and bonuses, as well as special schemes like the Shchekino and net output experiments. All of these have been

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[77] Some of this detail is cited in NFAC, Organization and Management in the Soviet Economy: the Ceaseless Search for Panaceas, op. cit. p. 9.
[78] Narodnoe khoziaistvo SSSR v 1977 godu. p. 100.
[79] In 1974, enterprises in light industry were given the right to plan their own product assortment based on orders from wholesale and retail trade organizations within the limits of allocations of raw materials and a value for total output set by the ministry. Little, if any, benefit seems to have resulted. See, for example: Pravda, March 1, 1978; October 20, 1978. Voprosy ekonomiki, No. 7, 1978, pp. 54–64. Literaturnaia gazeta, August 23, 1978. Kommunist, No. 13, 1978, pp. 54–64.
[80] Kommunist, No. 13, 1978, p. 63.
[81] Voprosy ekonomiki, No. 7, 1978, p. 60.
[82] Ibid., p. 57.
[83] Finansy SSSR, No. 8, 1978, p. 8.
[84] Planovoe khoziaistvo, No. 7, 1978, p. 55.
[85] Pravda, December 4, 1978.

implemented in a period that witnessed a big push for changes in formal organizational arrangements, as well. First of all, enormous amounts of bureaucratic activity and paperwork have been generated. Over the past decades in their ceaseless search for panaceas, the administrative hierarchies, aided and abetted by their many economic research institutes, have introduced several major changes in the "rules of the game" for producing units and many minor ones. They have altered the channels of authority and communication. They have engaged enterprises in large-scale experiments, simultaneously with imposition of changes in the rules in general. All of this activity has required additional reporting, monitoring, analysis and description. The situation is one of bureaucratic overkill and over-determination of the position of producing units, whether individual enterprises or amalgamations of them into associations. The present set of basic incentive arrangements, along with those governing the Shchekino and net output experiments, are so complex as to almost defy description. The ministries must spell out the tradeoffs among the many variables, either formally or informally. Because the product and resource prices underlying all value indicators do not reflect economic scarcity tradeoffs, inconsistent demands are likely to result from whatever set of indicators and bonus formulae is chosen. New kinds of undesired behavior are a predictable consequence, followed by another set of changes in the rules to correct them.

In practice, the formal rules evidently are not rigidly enforced, for faithful adherence to them might punish enterprise personnel for poor performance through no fault of their own (e.g., supply failures, poor quality of materials), and might reward other enterprises for "good" performance that resulted from windfalls, price abberrations and the like. Under these circumstances, distribution of rewards on the principle of "an earring for each sister" could well be a sensible operating rule. In any event, even if "deserved" rewards could somehow be meted out by a set of working rules, these "spontaneous" results would be largely nullified in practice because of a clearly revealed bureaucratic aversion to diversity, i.e., to "unjustified" differences in bonus funds among enterprises in a given region or ministry and "excessive" rewards to individuals. Indeed, the expanding system of reserve funds at superior levels seems to be used to mitigate for good or ill, the spontaneous results of the working of whatever set of indicators is in vogue. The latest set of rules that punish enterprise personnel for failure to adhere to the terms of contracts is likely to prove unenforceable, for many of these same reasons, reinforced by the continuing prevalance of a sellers' market in producer goods. Finally, we should note that the attempts to reform incentives have been constrained by an overall macro-economic policy that has sought to slow the growth of incomes to accommodate to the slower growth of consumer goods and services. Thus, in industry, average monthly wages rose at an average annual rate of 5 percent in 1966–70, 4 percent in 1971–75 and 3 percent in 1976–78. The aggregate size of incentive funds seems to be little related to the variables that are supposed to determine it. A Soviet econometric study found, for example, that incentive funds in surveyed enterprises in light and food industries in 1966–76 showed little correlation with changes in fund-forming indicators, but rather seemed to be

related to desired relationships between growth in wages and growth in labor productivity.[86]

Ideological preference for uniformity and egalitarianism, along with the guarantee of a job for everyone, continues to fetter efforts to substantially reduce the excessive manning that prevails almost everywhere. The slow spread of the Shchekino experiment in labor-saving owes much to these biases. Ministries have dragged their feet, disliking both the diversity that the experiment created, and the greater freedom of action accorded to a few enterprises. The scheme met resistance from workers, who were reluctant to take on the extra work required for the small rewards offered, or who feared loss of jobs. The Shchekino campaign has been resisted by enterprise managers, because the conditions that make it advantageous to keep extra workers still prevail. The overuse of labor [87] results from many persistent features of the system: [88] incentives are tied to meeting plans: supply failures are common; managerial salaries vary with size of enterprise measured by employment directly or indirectly; incentive funds and bonuses for Socialist Competition are tied to the wage fund, which depends on employment; planning "from the achieved" prevails; plan targets are often changed in mid-plan; and levies are imposed to supply workers to help with crash construction projects or with the harvest. In respect to the latter, it is estimated that in 1976 the levy on urban areas to help with the harvest amounts to an average annual employment of 750,000 workers.[89]

Large waste of resources results from the prevalent use of physical indicators to plan production and reward producers. Despite pleas for delegation to lower levels, Gosplan continues to plan and allocate the vast bulk of total industrial output in physical units. The Gosplan product list, which has remained essentially the same for more than a dozen years, is used to calculate the material balances, which remain the core of the annual plan, despite the grafting on of value measures, input/output tables and mathematical planning approaches. This list forms the basis for the key products lists in enterprise plans. Fulfillment of those physical plans has been a mandatory requirement for the payment of bonuses throughout the many modifications of the rules of the reform, as it was before. As noted earlier, the ministries (not the associations) are the arbiters of the key products lists for individual enterprises. The adherence to physical planning, tied to incentive systems means that the associated waste of resources continues. Thus, metals and machinery are still planned in tons, and the revealed preference for production of heavy items persists. Changes in the nature of a physical indicator, e.g., from tons to linear meters or number of units only produces new abberrations.

Large inefficiencies in the Soviet economy result from the small extent of specialization of production, compared with other industrialized economies. The call for more specialization has been a theme in

[86] Izvestia Sibirskogo Otdeleniya Akademii Nauk, Seriia ekonomicheskaia, No .11, 1977, pp. 137–143.

[87] A noted Soviet labor economist asserts that 20 percent of labor is wasted within industry and even more in construction. Ekonomika i organizatsia promyshlennogo proizvodstva, No. 4, 1977, p. 5.

[88] The press provides a plethora of testimony that these characteristic phenomena still prevail. Typical are: *Ibid,* No. 2, 1978, pp. 75–87, Voprosy ekonomiki, No. 8, 1978, pp. 3–14 and 38–48.

[89] Sotsialisticheskiy trud, No. 9, 1978, p. 20.

Party-Government plans and pronouncements for decades. Since endemic supply uncertainties are the main reason for enterprises to be their own suppliers the reforms in the supply system were supposed to alleviate the problem. Little progress has been made, with ministries and enterprises alike retaining a strong proclivity for vertical integration. A recent Soviet source describes vividly the prevalence of the philosophy of having "one's own" sources of materials and other inputs in the machinery, timber and woodworking and transportation sectors.[90] The author cites the sharply higher costs of such subsidiary production compared with specialized plants. Such practices are so deeply embedded in the system that even new plants soon follow suit. Another source reports the results of a recent survey of 100 machinery plants, which showed self-production as follows: cast iron—71; steel—27; non-ferrous castings—57; forgings—84; stampings—76; pinions—99; industrial clamps—61.[91] Lack of specialiation and fragmentation of authority are blamed for the poor quality and assortment of household appliances, e.g., some 300 enterprises under 30 ministries produce 76 types of household appliances, few of them in specialized plants.[92] With the advent of the associations, the problem is being attacked through efforts to foster specialization of production facilities within individual associations, as well as the concentration of similar lines of production in industrial associations. Progress is at a tortoise pace, apparently, because of the disruptions that necessarily are involved and the fact that supply problems persist.

In sum, the beneficial effects of the numerous changes in organizational and incentive arrangements over the past dozen years have been minimal, at best.[93] Predictably, the Party has responded by stepping up pressure for "discipline" of all kinds (planning, labor, financial, contract, etc.), by stressing "moral" incentives, by launching campaigns to accomplish one goal or another (to produce consumer goods in heavy industry, to save fuel and electricity, to be thrifty) by stressing Socialist competition and emulation of progressive experience (Shchekino, L'vov, Zlobin and others), and, finally, by strengthening its own role in the day-to-day conduct of economic affairs. Also, the role of various social organizations and "control" bodies has been stepped up. For example, during 1978–80, the Komsomol, the trade unions and Gossnab authorities have been ordered to conduct an "All-Union Review" of the efficiency with which raw materials, fuels and power are used in enterprises and organizations throughout the country.[94] And in January 1978, the Party leadership published its usual letter of appeal to the people to work harder and more productively and called on Party, Komsomol and Trade Union organs to re-double their efforts.[95]

VII. What Is To Be Done?

A decade of reforming the reforms has not altered the nature of the Soviet economic system in any essential respect. It remains one of

[90] Planovoe khoziaistvo, No 2. 1978, pp. 102–114. See also Kommunist, No. 9, 1978, p. 116.
[91] Izvestia Akademii Nauk SSSR. Serlia ekonomicheskaia, No. 3, 1978, p. 55.
[92] Planovoe Khoziaistvo, No. 5, 1978, p. 45.
[93] The deputy editor of Pravda has provided a graphic description of the prevalence of the traditional modus operandi and its consequences, despite the reforms. Pravda, Nov. 10, 11, and 12, 1977.
[94] Trud, Apr. 6, 1978.
[95] Pravda, Jan. 14, 1978.

rigid, highly centralized planning of production, formal rationing of nearly all producer goods, centrally-fixed prices, and incentives geared to meeting plans. Since these characteristics of the system contain the roots of its difficulties in using resources efficiently and gearing production to customers' wants, it is no surprise that the problems have defied solution. But the need for solutions is becoming increasingly urgent. During the next decade, the economy will face sharp reductions in the number of new entrants to the labor force. The costs of materials will increase rapidly because of the need to develop their sources in Siberia and the Far East. Investment costs per unit of output therefore, will continue to rise, and the competition for investment will be keen, forcing painful choices on the political leadership. The basic problems will be made worse by diminishing supplies of oil and other raw materials relative to domestic and export requirements.[96] These heightened strains make it all the more imperative for the USSR to raise the yield on inputs and obtain maximum utility from the resources allocated to consumption.

The present political leadership evidently is counting on further manipulation of organizational forms and incentive arrangements to produce the desired improvement in economic performance. Press discussion on economic themes centers on descriptions and analyses of what ails the present arrangements, accompanied by a variety of proposals to remedy the deficiencies through new organizations (superministries, coordinating bodies for regional development projects, a ministry for inter-sector production) and through new or modified plan indicators and bonus rules, along with more "scientific" ways of planning, setting prices and calculating "final results" of economic activity. The thrust of such proposals, as well as of recent changes in practice, is to lay the wager on further centralization and more detailed and rigid control over producing units, whether they are called enterprises or associations.[97] Their proponents have faith that all of the problems are soluble by men of good will within the confines of the Socialist system of central planning. If the past is any guide, they are bound to be disappointed. As long as incentives are tied to meeting plans for whatever indicator and other essentials of the system are not altered, the relationships among all units in the production-distribution chain of suppliers, producers, shippers, distributors and customers will remain administrative rather than economic in nature. The behavior of each link will continue to be oriented toward meeting its own particular plan targets and satisfying its own superior organizations. This orientation will be reinforced by the fact that each link in the chain lacks alternative suppliers and customers.

Aside from proposals for specific new organizations, plan indicators and bonus rules of the kind already discussed, what other advice are Soviet economists offering? The literature dealing with proposals to "improve the economic mechanism" is very large. To systematically sort out and discuss the numerous proposals (including those addressed to the pattern of resource allocation) is a task beyond the scope

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[96] For a discussion of these problems see: Soviet Economic Problems and Prospects, Joint Economic Committee, Washington, Aug. 1977.

[97] Theoretical articles argue for strong centralization in the present stage of Socialist development—termed "developed Socialism" or "mature Socialism". See: Ekonomicheskaia gazeta, No, 48, November 1977, p. 10. Voprosy ekonomiki, No. 11, 1977, pp. 116–126.

of this paper. Accordingly, what follows is a brief, impressionistic account of proposals relating to organization and management per se, as a prelude to the thorough survey, which the subject deserves. First of all, the few advocates of decentralization and the use of markets either have changed their minds or gone underground. The proposals now being aired invariably would retain state ownership of resources and central planning of output. Within this framework, there is a wide spectrum of recommendations, and evidence of some fundamental disagreements. Some of the differences, however, seems to concern the practicality and timing for carrying out some of the proposals, rather than matters of principle.

At present there is widespread discussion of the pros and cons of the use of net output rather than gross output as a basis for measuring production and evaluating plan performance. Another prevalent theme is a debate over whether a single performance criterion or several criteria are required to evaluate plan performance of Socialist enterprises. For advocates of a single criterias, the most common suggestion is net profits, with arguments raging over how to define it. Others suggest unit cost reduction, labor productivity or some other measure of "final results". A number of economists advocate various forms of profit sharing schemes, with fixed and stable allocations of profits between producing units, their superior organization and the state budget. Other frequent proposals are the following: (1) Impose charges for the use of land, labor, and other resources; (2) raise interest rates on bank loans, sharply increase the capital charge and eliminate the many exemptions; (3) revise prices to incorporate all resource costs; (4) extend self-finance throughout the economy; (5) greatly extend the use of normatives (e.g., wage expenditures per unit of output) in planning and evaluating performance; and (6) gradually deration most producer goods, shifting to long-term contractual arrangements. Finally, the mathematical economists continue to urge much more extensive use of mathematical models and techniques in actual planning practice and decision-making than Gosplan has been willing to do up to now.[98]

Many economists propose adoption of an entire complex of measures, incorporating many of the ideas listed above. To illustrate, four mathematical economists recently urged adoption of the following: the program-goals approach to planning; a single organ to manage the entire process of supplying food to the population; formation of associations everywhere, putting them on self-finance; expanded role for financial plans; widespread use of long-term contracts and normatives of various kinds; use of net output, abolishing gross output and physical output targets for enterprises; and elevating the role of basic wages in incentive arrangements.[99] Another prominent economist recommends a package of measures to be introduced all at once, including revamped prices incorporating full costs, charges for all resources, increase in net profits as the sole success criterion, and introduction of a profit-sharing arrangement between enterprises and the budget.[100] There are many other sets of proposals, often coupled with recommen-

[98] For example, see: I. Prostiakov in Planovoe khoziaistvo, No. 1, 1978, pp. 24–34. N. P. Federenko in Kommunist, No. 16, 1978, pp. 31–42.
[99] Pravda, Mar. 23, 1978.
[100] Ekonomika i organizatsiia promyshlenngo, proizvodstva, No. 4, 1977, pp. 13–23.

dations to reduce the overall tautness of plans and reallocate resources in preferred ways.[101]

The proponents of these assorted remedies, nevertheless, seek to have them carried out within a system of state ownership and central planning. To this observer, these are not the voices of reformers; they are the voices of conservatives, who believe that the problems of the economy can be solved by making revisions in its working arrangements, without altering any of its systemic traits or sacrificing basic ideological premises. Perhaps, this somber mood has been influenced by observation of the experience with more radical reforms in Hungary, where marketization and decentralization helped to produce an investment boom, balance of payments problems, and rising prices; these problems, along with threats to workers' job security and the egalitarian ethic, have led to some retrenchment. Moreover, the reforms have not produced a major acceleration of economic growth or productivity. The Yugoslav "road to Socialism" continues to be anathemma to everyone.

The most comprehensive of the reform proposals is embodied in the concept of the "optimally functioning Socialist economy" (SOFE). This schema has been espoused for more than a decade by mathematical economists, without much change in its essential features.[102] The ideas are laid out anew in a recent book by N. P. Federenko.[103] Relying heavily on the availability of suitable computers everywhere, the planners will compile a central plan with sub-plans for all units that will embody the optimal (most efficient) allocation of resources to achieve the given goals (objective function). Optimization will be achieved through the use of mathematical models and techniques, which will also generate the optimal (opportunity cost) prices that are required to implement the scheme. Enterprises and associations (whose role would be expanded) will be given optimal plans for both outputs and inputs. Rationing of producer goods will gradually be replaced by contractual arrangements among producers, suppliers and customers. Producers will pay charges for all inputs (capital, labor and natural resources), and these costs will be reflected in prices. Enterprises will be given stable plans and stable normatives for administering wage funds, paying resource charges and allocating profits among planned uses, including transfer to the state budget. In implementing the plan, enterprises will be guided by optimal prices, stable normatives and a system of "regulators," designed to ensure that their economic interests coincide with their task—to fulfill the optimal plan. The operational principle is to be "what is good for society should be good for each enterprise and each worker." SOFE is viewed as a grand design for achieving the aims of centralized planning through the "correct" motivation of independent, self-financing production units, which in the course of implementing their plans will provide feedback information to the central planners. Given its heavy dependence on sophisticated computer technology and mathematical approaches, SOFE can scarcely be regarded as a set of operational recommendations at pres-

[101] For example, A. V. Bachurin, Planovo-ekonomicheskie metody upravlenlia, Moscow, 1977. Planovoe khozialstvo, No. 2, 1979, pp. 43–51. Ekonomika i matematischeskie Metody, No. 5, 1978, pp. 1006–1011. Izvestia Akademii Nauk, Seria Ekonomicheskaia, No. 6, 1978, pp. 5–18 Ekonomika i organizatsia promyshlennogo proizvodstva, No. 1, 1979, pp. 9–23.

[102] See: Michael Ellman, Soviet Planning Today, London, Cambridge University Press, 1972.

[103] N. P. Federenko, Optimizatsiia ekonomiki, Moscow, Nauka, 1977.

ent. Its designers have yet to work out the details of incentive rules and the problems of response in a world of rapid change. In the interim, its authors joined with others in proposing modifications of existing working arrangements to the end of taking the economy a small step or two toward the optimality of the grand design.

Despite evident growing dissatisfaction with the performance of the economy, the present political leadership thus far has opted against even minimal systemic change.[104] Instead, remedies evidently are to be sought in further reforming the reforms—perhaps by establishing new coordinating agencies at the top or in regions, by mandating some type of employment quotas for enterprises, by still more revisions of plan indicators and bonus schemes, and by increasing political pressures on one and all to do better.[105] In the problem-ridden agricultural sector, the ever-larger state and collective farms, which are coming to resemble each other more and more, are to be retained. In an effort to boost food supplies, however, the leadership in the past year or two has displayed a willingness to tolerate a larger amount of private activity. Whether this policy will be reversed, as in the past, remains to be seen. Greater permissiveness has yet to be displayed in respect to private supply of other goods and services, a policy that would help to alleviate prevalent shortages and also counter the flourishing "second economy" operating in the consumer sector.

In the long run, radical economic reforms involving the introduction of market arrangements in some form might alleviate the chronic malaise in the consumer sector and boost productivity. To be effective, such NEP-like reforms would have to include abolition of directive plans for producing units, replacing central allocation of producer goods with market exchanges, freeing of most prices and introduction of incentives based on profits. Transition to such a system of "market Socialism" would surely result in serious economic difficulties in the short run, including inflation and unemployment, and rupture existing fabrics of political and economic power. The idea would be fiercely resisted by the state bureaucracy, where jobs, careers and political influence would be at stake, as well as by the Party bureaucracy, whose jobs and control over resource allocation would be threatened, along with, perhaps, its very raison d'etre. Faced with uncertain long-term benefits, certain high short-run costs and strong opposition, a Soviet leadership of any presently foreseeable stripe likely would not opt to take such risks, even more since long-held ideological positions are also at stake. The Party probably would seriously consider NEP-type reforms only if it faced a severe economic crisis, such as evident economic paralysis, declining production and widespread popular unrest. As long as present working arrangements continue to yield modest, even if declining, increments in annual output, the leaders as well as the led, will probably prefer to put up with the familiar deficiencies of the system, rather than to embark on untried and ideologically distasteful paths with unknown payoffs and certain disruptive consequences. After 60 years of experience with a Socialist economy run by government agencies, nearly everyone seems to have devised ingenious ways to turn its shortcomings to his individual advantage.

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[104] The recent election speeches of both Brezhnev and Kosygin support this conclusion. Pravda, Mar. 2 and 3, 1979.

[105] On July 29, 1979, *Izvestia* published a Party-government decree providing for another set of modifications in planning indicators and incentives. The new decree endorses many of the arrangements that have been the subject of experiments; further complicates the rules and tightens central controls. According to a CPSU announcement in *Moskovskavia pravda,* July 28, 1979, the question of organizational changes is still under review.

SOVIET POWER AND INTENTIONS: MILITARY-ECONOMIC CHOICES

(By Henry W. Schaefer*)

CONTENTS

With mounting economic problems Soviet intentions in the military sphere have become an increasingly controversial question. Some observers have argued that Soviet institutions and ideology, in conjunction with Russian history, virtually dictate a continued rapid military build-up and its aggressive use for political—and perhaps economic—purposes. Others have maintained, generally with less fervor, that technological and economic necessity may lead the USSR to slow the pace of its military expansion. Neither side has been able to develop a persuasive case on the basis of recent evidence, for Soviet actions and doctrines have often appeared contradictory. The result has been highly unsatisfactory, both in terms of clarifying expectations about future Soviet policies and in terms of developing approaches for countering or influencing these policies.

This paper argues that there are better ways to think about the question than have heretofore generally been employed. It adapts basic economic theory to an exploration of the military-economic tradeoffs facing the Soviet leadership. A basic premise is that Soviet policymaking is rational to a significant degree and not dominated by some constricted set of objectives or determinants. Power maximization in the broad political-military-economic sense is taken to be the Soviet goal, with the military and economic facets of aggregate power viewed as the primary means of achieving political power.

This approach does not imply that there are no significant bureaucratic politics or defense lobbying in the Soviet Union, but rather that one can go further in exploring Soviet behavior with a rational actor model than conventional wisdom and current debate often appear to assume.

Differing Assumptions

There appear to be two basic ways in which observers tend to think about the relationship between the economic and military sectors when considering the impact of the Soviet economic slowdown. One is to view military production as a "burden" and to ask how the Soviets can afford to devote such a large share of GNP to the military sector and to continue to maintain a high rate of military growth as the economy

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slows. Behind this way of thinking appears to lie the assumption that logic or rational policy ought to dictate a parallel reduction in the military growth rate as economic growth declines; i.e., it posits a positive correlation between changes in military and economic growth rates.

The second approach tends to view military production as the top priority goal, as the ultimate "final product" of the Soviet economic system, rather than as a burden on that system. The expectation is that military production will be maintained at past growth levels despite the increasing costs this imposes on economic growth and consumption. Those who take this approach in effect argue that even though productive capacity is growing at a progressively slower rate, the Soviets can afford and will choose to allocate an increasing share of GNP to the military, i.e., they posit essentially no correlation between changes in military and economic growth rates.

Military-Economic Choices

Application of basic economic theory can help to clarify the military-economic choices available to Soviet leaders and to illustrate the implicit assumptions which lie behind these differing hypotheses about Soviet behavior. By measuring military power on the vertical axis and economic power on the horizontal axis in Figure 1, one can plot a "power production-possibility frontier" ((PPPF) analogous to the standard production-possibility frontier used to depict trade-offs between any two partial substitutes in production (diminishing returns are assumed here initially). If one then plots a planned or actual power production point "a", calling for x amount of military production and y amount of economic production, one can get some idea of the policymaker's actual indifference (revealed preference) curve (the locus of points, i.e., combinations of military and economic power, deemed of equal value or utility by policymakers and tangent to the PPPF).

Utilizing this model, one can make more explicit the underlying assumptions being made about Soviet production possibilities and preferences. In Figures 2–6, the PPPFs labeled "u" depict the production levels projected if growth possibilities were undiminished, while the PPPFs labeled "d" depict the diminished growth levels. The latter may be anticipated (as in the case of the original, modest targets of the current, Tenth five-year plan) or unanticipated (as in the case of the even lower results which must now be expected during this plan). For the rate of military growth to be maintained as the growth in overall Soviet productive capacity slows, it is necessary either that PPPFs shift in favor of military production as income rises (d in Figure 2) or that Soviet preferences shift toward military production as income rises (p in Figure 3). For military growth to slow appreciably as the growth in overall capacity slows Soviet production possibilities and preference patterns either must have a certain degree of symmetry (as in Figure 4) or must tend to counterbalance each other—that is, if one shifts in favor of military production, the other must shift away from military production (as in Figures 5 and 6).

The shapes of the relevant PPPFs and indifference curves are thus of fundamental significance in interpreting Soviet policy. What is often loosely termed Soviet "intentions" can be defined more precisely as the military/economic production mix chosen when establishing or implementing plans. Soviet intentions, in this model, are as much the result of production possibilities (PPPFs) as of preferences (indifference curves).

Near-Term Policy

A particularly topical question is whether the recent slowdown in Soviet military growth is likely to continue or be reversed in the near future. It has been estimated that since at least the mid-1960's the Soviet military sector and the Soviet economy as a whole have grown at about the same rate, resulting in the military's share of GNP remaining roughly constant at 11–13 percent.[1] Both military and GNP growth are estimated to have slowed to below four percent in recent years. This pattern suggests that military growth may slow in tandem with the diminishing economic growth anticipated in the future. In other words, there appears to have been some positive correlation between economic and military growth over the past decade or so.

This observed pattern, however, may not have been a simple or direct causal relationship. Several factors may have been involved. If, for example, as would appear plausible, changing growth requirements—from "extensive" to "intensive" growth in Soviet terms—were increasing the potential gains from transferring certain resources from military to civilian applications, military growth could be slowing largely because of a change in the shape of PPPFs as income rises. This situation is depicted in Figure 6 where despite a shift in Soviet preferences toward the military as income growth slows, PPPFs shift in favor of economic production sufficiently to neutralize the shift in preferences.

The military growth rate could, on the other hand, soon return to something like its previous estimated rate of 4–5 percent, exceeding the expected growth rate of GNP and taking a growing share of GNP. Such an increase could, as noted above, be the result of: (a) more militaristic Soviet preferences (Figure 3); or (b) a shift in production possibilities in favor of military production (Figure 2). If one or both of these conditions prevail, the recently observed slowdown in Soviet military growth may prove temporary, perhaps merely reflecting the tailing-off in deployment of certain major weapon systems as some observers have argued.[2]

It should be noted that the contention that the Soviets produce military goods "because that is what they do best," is *not* at issue here. The argument that the Soviet system produces military goods best projects skewed, but relatively symmetrical, PPPFs as in Figure 7. What is required for Soviet military growth rates to be maintained because of favorable production possibilities as overall growth slows,

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[1] "Estimated Soviet Defense Spending: Trends and Prospects," CIA, SR 78-10121, June 1978.

[2] "Estimated Soviet Defense Spending . . ." *op. cit.*

however, is that PPPFs *increasingly* favor military production at higher income levels (as from c to d in Figure 2).[3]

Increasing Returns

The actual curvature of PPPFs is also important in explaining patterns of Soviet decisionmaking and in considering Western policy. The assumption of diminishing returns to this point, although useful for purposes of exposition, is suspect. Depending on current capacity utilization and other factors, PPPFs could show increasing returns, as in Figure 8. This appears to be potentially the most favorable situation from the perspective of Western policy. If the PPPFs and the indifference curve diverge sharply from their point of tangency, as with decreasing returns in Figures 1–7, a significant change in the Soviet military/economic production mix would require a major shift in one of the curves. If, however, as one would expect with increasing returns, the curves are more nearly identical as in Figure 8, then the prospects for influencing Soviet policymakers by shifting one or the other curve are considerably enhanced.

In effect, although Western policymakers do not appear to think about it in these terms, the argument that increased technology flow from the West can help to steer the Soviets away from their preoccupation with military power, tends to assume implicitly that Soviet PPPFs or indifference curves can be shifted to less militaristic points or tangency as income grows relatively easily, as in Figure 9. Those who argue that Western technology will merely bolster Soviet military growth appear to assume that such favorable shifts will be unlikely or marginal. This latter argument would be strengthened if decreasing returns could be demonstrated, because decreasing returns make a significant impact on Soviet "intentions" more difficult. Thus, although the impact of Western technology flows on Soviet preferences is difficult to judge (and probably will be less the result of technology flow *per se* than of the political climate accompanying it), the shape of Soviet PPPFs—whether there are increasing or decreasing returns to scale—appears to be a potentially important factor in developing Western policies.

In Search of the Real World

By separating Soviet intentions into the questions of production possibilities and preferences, this model serves to highlight the distinction between those aspects which are essentially economic (PPPFs) and those which are essentially political (indifference curves). But can anything be said, even tentatively, about what Soviet PPPFs actually look like? It would appear that the time factor may be quite important in addressing this question.

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[3] The argument that military production is what the Soviets do best has been undercut, in any case, by the near doubling of the share of Soviet GNP estimated (by the CIA) to be devoted to the military sector. The Soviet military sector now appears to be much less efficient than many thought a few years ago. Moreover, as arms competition has become more qualitative, the advantages claimed for the Soviet command economy in producing large quantities of arms may well be in the process of being overtaken by the disadvantages the Soviet system faces in developing and applying new technology.

For many years the Soviets have devoted considerably more of their resources to military production than most countries. This has been reflected in the structure of the economy, particularly the lack of consumer goods and housing. An a *priori* case can be made that a command economy will in the short run be best prepared to produce more of what it has accorded top priority; given the level and particularly the quality of military production capacity, there may well be increasing returns if military production is raised in the near term.

However, these same circumstances suggest that the opposite may be true in the long run. Because so much stress has been placed on military production, many sectors of the economy have been neglected and are very inefficient by world standards (e.g. materials handling). A good case can be made that the transfer to the civilian sector of certain resources now utilized in military R & D and military investment would yield good returns.[4]

This suggests that in the short run the Soviets may face production possibilities that look something like Figure 10, in which returns are increasing for military production while quite possibly decreasing (or at least increasing less rapidly) for economic production. But in the long run, when a shift in investment resources could begin to impact favorably on productivity, potential Soviet PPPFs may look more like Figure 11, in which returns are increasing for economic production but decreasing (or increasing less rapidly) for military production.

If the Soviets appear to face better military returns in the near term but potentially better economic returns over time, the question of technology transfer becomes more complex. On the one hand, technology which has a relatively rapid impact on production would appear to have the greatest prospects of ending up supporting military production. On the other hand, technology which takes a considerable time to affect production would appear less likely to be used in support of military production. While obviously many factors need to be considered in any particular case (especially the transferability of the technology itself), the desire to transfer civilian—but not military—technology to the Soviet Union may in general be better served by encouraging Western involvement with long-range projects which promise to increase the returns in the economic sphere for long-run Soviet PPPFs. Encouragement of such involvement, if taken by the Soviets as a sign of an improved and more stable political climate, might also have some impact on Soviet preferences, the other basic determinant of elusive Soviet "intentions."

[4] See "The Opportunity Cost of the Nonmonetary Advantages of the Soviet R. & D. Effort," Gur Ofer, RAND, August 1975.

Figure 1.

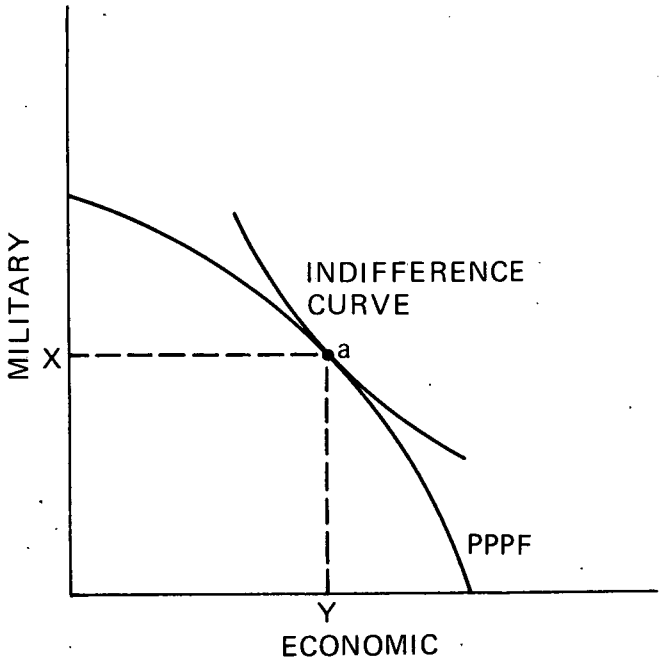


Figure 2.

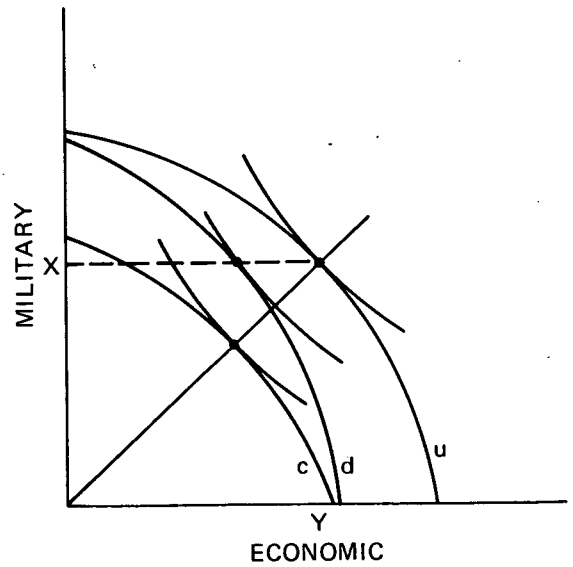


Figure 3.

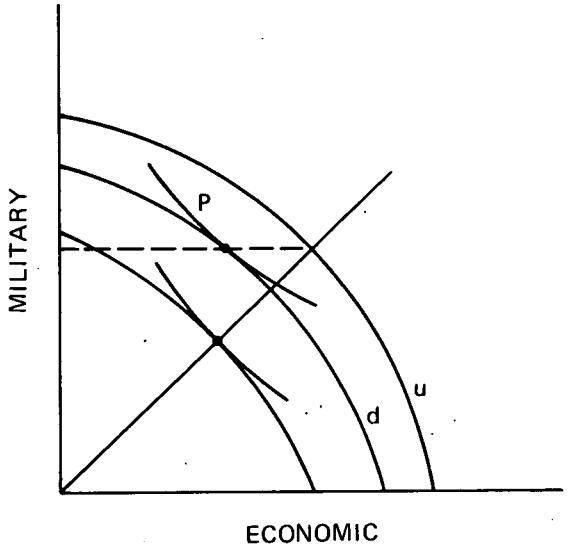
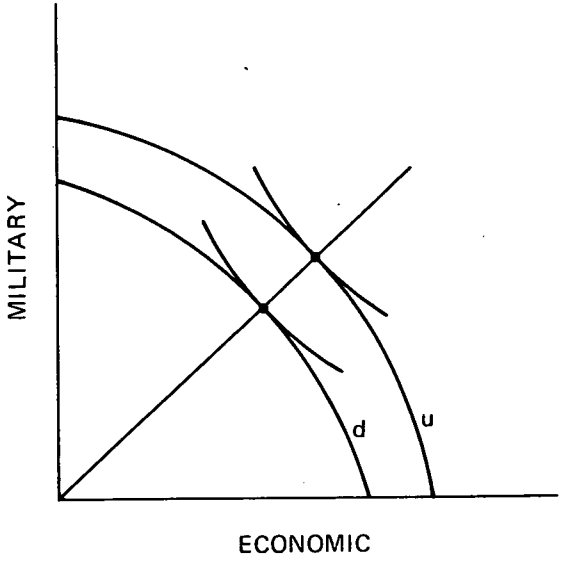


Figure 4.



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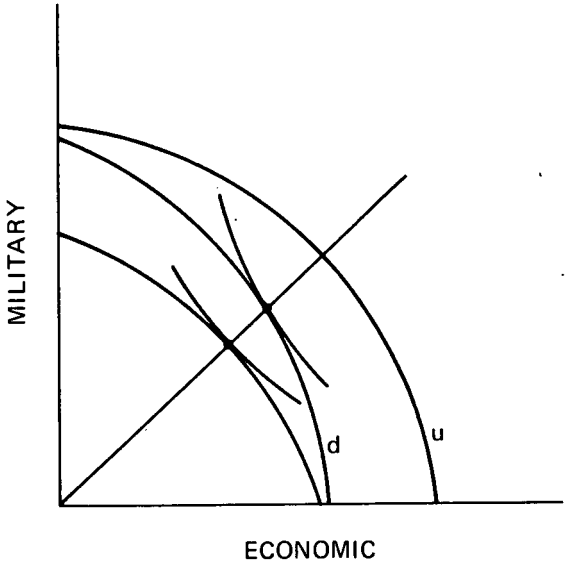

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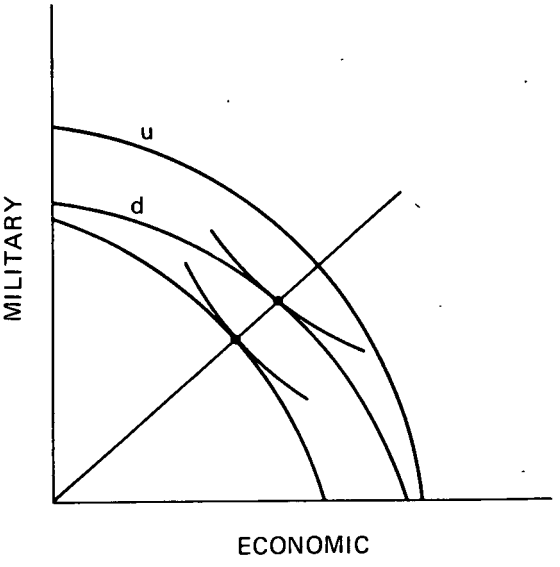


Figure 7.

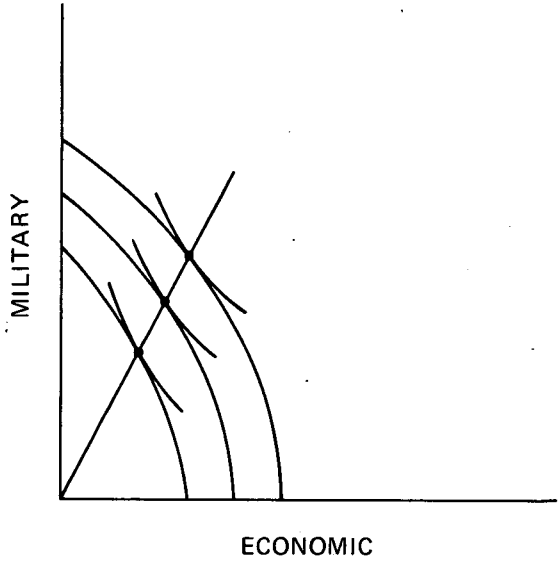


Figure 8.

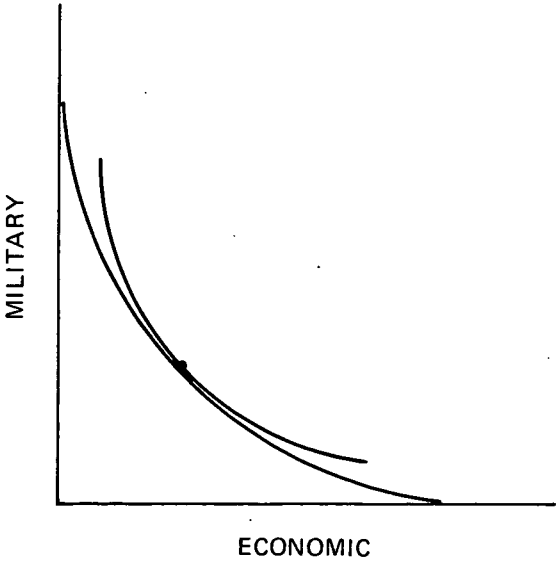


Figure 9.

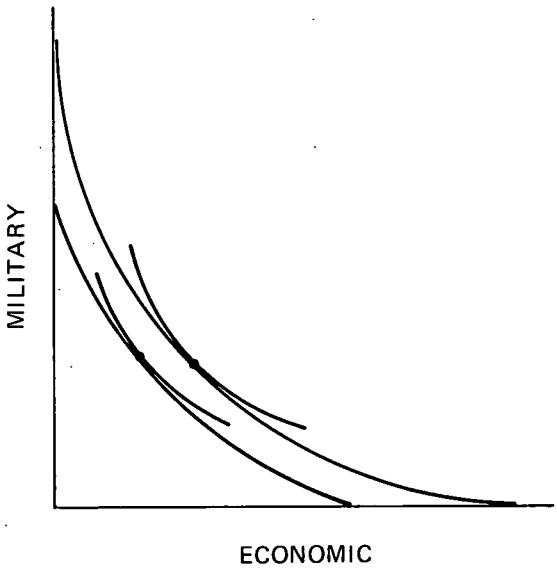


Figure 10.

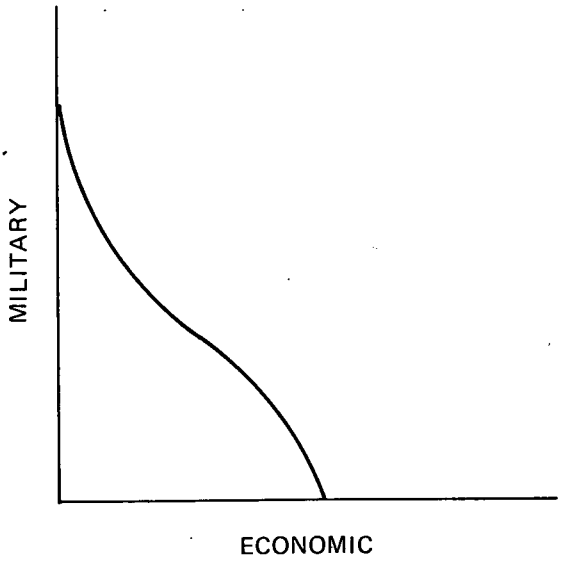
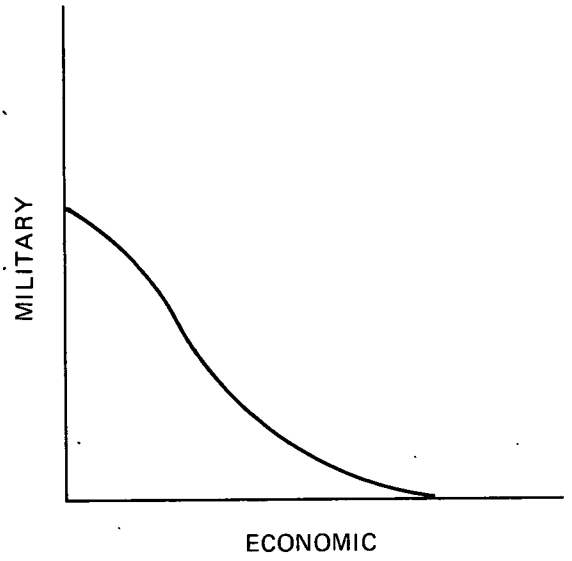


Figure 11.



THE MEANING AND MEASURE OF SOVIET MILITARY EXPENDITURE*

(By Abraham Becker)

CONTENTS

A. Military Expenditure and Military Power

An appraisal of the comparative record of Soviet and American military expenditure (ME) must begin by posing the question of the meaning and usefulness of a comparison of outlays. After all, interest in such analysis does not reside in financial issues but in the relations of ME to the military power of the two states. What are the connections between ME and military power? Are we justified in interpreting ME in power terms? What concept of power is appropriate?

It would be desirable if ME could be interpreted as an indicator of national security. However, this concept embraces many other factors besides military forces—in particular, the whole complex of international economic and political developments, whose changes may run counter to those in military force levels. To avoid this difficulty, one might narrow the focus to military security—the aspect of national security that can be effected by military means. Unfortunately, this concept, too, is unmanageable for measurement, because it requires specification of the external threat and the degree to which military force can be utilized to counter the threat. It involves identification of relevant scenarios and quantification of such intangibles as morale and national determination. Thus, the effect of a change in a country's ME on its own military security is not determinable without reference to a complex set of exogenous factors.

To surmount this difficulty, consider a measure based only on the national capabilities to apply physical force against external opponents—that is, without any reference to the external context. This may be dubbed military force potential. Evidently, this is a major component of military or national security, but it is not the only one, or even in many cases the decisive one. However, force potential lends

*Drawn from: Arthur Alexander, Abraham Becker, and William Hoehn, Jr. "The Significance of Divergent U.S.-U.S.S.R. Military Expenditure," A Rand Note prepared for the U.S. Air Force (N-1000-AF) February 1979.

itself to interpretive linkage with ME, because it is independent of the opponent's capabilities and intentions or of the multiplicity of possible conflict scenarios.

Nevertheless, the interpretation of ME in the sense of force potential is problematic in two senses. First, ME is a "flow" concept, but force potential is derived from the "stock" of military forces. In any period, potential military power is a function of the forces in being at the beginning and of those added during the given interval, net of withdrawals and unintentional losses. ME takes no account of the contribution of the existing equipment inventory except in terms of maintenance and repair costs; and the additions to the weapons, equipment, and structure inventory constitute gross, rather than net, investment. In a single period, ME represents the value of current gross capital additions to force potential plus the costs of operating and maintaining existing and added forces (along with outlays on R&D—the addition to future knowledge and capability). The important missing element is the value of the services of preexisting capital during the interval. The shorter the interval, the greater this obvious shortcoming of ME as a measure of force potential. For any state with longstanding armed forces, annual ME is generally a sharp underestimate of national force potential; cumulative ME over a decade or so more closely approaches an appropriate value of force inventories.

The second problem relates to the value units underlying ME figures. If the figures are to be interpreted in terms of force potential, even in the limited sense indicated above, the relative prices of military goods and services must be roughly proportional to the rates at which these goods and services can be substituted for each other to yield given quantums of force potential. This would be the case if reality had the properties of the textbook mathematical model, where military planners, taking prices as given, maximize a military utility function under a fixed budget (or minimize costs for a fixed utility level). However, reality diverges from model simplicities:

(1) *Inconsistent choices.*—Military utility functions are difficult to specify, especially with respect to present contributions to future force potential. Moreover, choices may be guided by nonmaximizing criteria, such as "satisficing" or compromising conflict among significant interest groups in the society.

(2) *Prices not parameters.*—The military establishment of a major power is often so large relative to its supplying industry that procurement choices inevitably affect prices, thereby limiting the applicability of a maximization model.

If ME is difficult to relate to force potential "output," the linkage must be sought in "inputs." Such an interpretation recognizes that prices of military goods and services reflect production costs rather than military utilities. ME would therefore be interpreted in terms of potential to produce military goods and services, analogous to the economist's view of national income as potential to produce economic goods and services, an alternative to the welfare interpretation in terms of utilities.

The noneconomist may wonder at this point whether the game is worth the candle. If ME has such a qualified connection to military

power, why bother with value measurement at all? Why not stick to physical indicators of force levels and power potential? For many purposes, the physical indicators are indeed appropriate and necessary. No effort to develop an intercountry balance of military forces should content itself with comparative ME. Analysts will want to compare numbers of men and weapons, levels of firepower, readiness states, etc. However, physical units of heterogeneous elements cannot be added or subtracted unless converted to a common denominator. The most general of all metrics is money; therefore, the simplest means of aggregating physical forces across the board of services, missions, and programs is money prices. This is particularly useful if the prices used as weights to combine physical goods and services can be given a conceptual interpretation that provides specific, if second-best, meaning to the value measures. Such a modest but definably relevant meaning should not be dismissed, given the often considerable hazards and doubtful benefits of manipulating a variety of physical indicators.[1]

B. Soviet ME

Given this understanding of the meaning of ME in its relation to military power, we turn now to consider the measures of Soviet ME. Despite periodic belaboring, the issues involved in the measurement of Soviet military outlays are still confused in public discussion. As Rush V. Greenslade lamented a decade ago:

Rubles, dollars
Computer, collars,

Engineers, chemists
Male or femist,

Capital and labor
For plough or saber,

Opportunity cost,
Steel capacity lost;

We'd choose a measure if we knew how!
Burden, burden, who's got the burden now?

Before taking up the available estimates (the most comprehensive of which originate in CIA), we must consider the nature and applicability of the measures in common use. In view of the continuing controversy over the reliability and accuracy of CIA's estimates, it also seems desirable to summarize the alternative approaches to measurement of Soviet ME.

1. Conceptual Issues of Measurement

There are four kinds of measures required for particular objectives: comparative (U.S./USSR) size of ME, rate of growth of Soviet ME, the "burden" of Soviet ME, and comparative (U.S./USSR) size of ME and GNP.

[1] A particular and major case in the point is strategic offense where a careful study concluded that "in terms of indices of the balance or of dynamic calculations of strategic attack capabilities . . . [all the existing] methods and measures suffered from severe limitations." James L. Foster, "Essential Equivalence: What Is It and How Should It Be Measured?" in Equivalence, Sufficiency and the International Balance. Proceedings of the National Security Affairs Conference, July 17–19, 1978, National Defense University, August 1978, pp. 49–50.

The measurement of comparative size of Soviet ME relative to that of the United States is a special case of the general class of binary international economic comparisons and is treated in the same way as other cases—by reevaluation of the outlays of one of the pair of countries in the prices and costs of the other. Thus, the standard method for sizing Soviet ME involves its transformation into dollar values.

Some observers are very uneasy about the seemingly artificial nature of the dollar valuation methodology, which asks, in effect, what would it cost the United States to train, maintain, procure, etc. the Soviet force? Some are upset that the large number of Soviet men under arms, obtained by conscription and paid at nominal rates, is costed at the higher U.S. pay rates. When U.S. military pay rates were sharply increased in the late 1960s, Soviet ME in dollar valuation suddenly (and, it is alleged, unjustifiably) shot up. Of course, U.S. ME also increased as a consequence of the pay hikes, so that the ratio of Soviet to American ME was affected only by the structural effect. Moreover, it may be counterargued, alternative calculations can be made using U.S. conscript force pay rates. These calculations show an expected reduction in the relative size of Soviet ME, but by a much smaller margin than the critics suggested. In any event, the value of comparative size measurements is contained not in the reading at any point but in the time trend. We return to this issue shortly.

The more general and somewhat more sophisticated objection to dollar measurement as an approach emphasizes the artificiality of the sizing question. If the Soviets were confronted by dollar relative prices, they would probably develop a substantially different force from that observed, which is a response to a different set of scarcity relations. By the same token, it would not be rational for the United States to imitate Soviet force posture decisions under U.S. cost conditions. Actually, there may be well-founded arguments why U.S. military planners might wish to consider at least parts of the Soviet force as alternatives to our own. However, the basic response to this objection is that it points to the need for a parallel ruble measurement. Along with the valuation of Soviet ME in dollars for comparison with that of the United States, it is necessary to develop a valuation of U.S. ME in rubles for comparison with the counterpart Soviet ruble outlays. This comparison poses the equally awkward question, What would it cost the USSR to train, maintain, procure, etc. the American force? Both ratios represent equally valid readings on the difficult measure of the relative national capacities to produce military goods and services. No other readings are possible, because any other set of price weights would be irrelevant.

Each country tends to emphasize activities that are relatively cheaper er than in the other country, so valuation at U.S. prices emphasizes Soviet manpower-intensiveness; conversely, the ruble valuation attaches high ruble price weights to the more advanced American technology. The consequence is that the ruble-weighted USSR/U.S. ratio is lower than the counterpart dollar comparison. The difference in results is the consequence of different relative prices and quantities produced in the two countries. In general, in any international comparison, the greater the structural differences between the two economies, the wider

the probable gap between the two ratios and the more misleading is an average of the two ratios in concealing the important information about structural divergence. There is some evidence that the structural disparities between the United States and the USSR have narrowed over the past two decades, so the difference between ruble and dollar-based size ratios is probably smaller now than it was in the 1950s.

Earlier it was stated that size ratios at any one time have a restricted utility. If we wish to view ME in terms of military capabilities, we must recognize that the distinction between stock and flow is greatest for the single annual snapshot. If ME is to be accepted as a reasonable proxy for inventory values, this can be only for a cumulative time series and over a reasonably lengthy period—say, a decade or more. In this report, we stress a somewhat different view of ME, in terms of potential to produce military goods and services—an interpretation oriented toward cost rather than effect. Although such an interpretation provides a more defensible basis for size comparisons at one time, we should recognize that relative production potential is best pictured as a process in time. Therefore, the focus should be on the time change in size ratios.

This leads directly to consideration of the measure of the rate of growth of Soviet ME. The main issue is whether the rates of change are to be measured on the basis of ruble or dollar values. Comparison of outlays by a single country in two time periods is formally identical as a measurement problem to comparison between two countries in a single interval. The passage of time brings structural change within a country analogous to the structural differences of international comparisons. Thus, it may be expected that the measurements using each period's prices as weights will yield different results. Generally, earlier period weights enhance the observed change relative to later period weights, and the greater the degree of structural change between the two periods, the wider will be the gap.[2]

Two corollaries flow from this principle:

(1) In terms of modernization or structural sophistication, U.S. dollar prices may be viewed as constituting late period, and ruble prices as early period, price weights. Hence, the rate of growth of Soviet ME in rubles should be larger than that of the counterpart series valued in dollars. However, the legitimacy of the dollar-weighted series in this case is not self-evident but depends on the assumption that the expansion path of Soviet production is headed roughly in the general direction of the U.S. quantity mix and set of cost relations. If that were not the case, dollar prices would have no higher standing as a set of index weights than any other country's prices equally distant from the USSR's growth path.

(2) Just as the sizing objective required two equally valid complementary measurements, so, in principle, does the objective of assessing the rate of growth of Soviet ME require alternative measures with price inputs drawn from different periods. On the assumption indicated, dollar price weights are an appropriate

[2] The principles stated here apply whether rates of growth are calculated as the implied average annual change between initial and terminal points of a series or whether the calculation takes into account, by any of a number of different formulae, intervening changes.

complement to ruble price weights. In addition, depending on the length of the period considered, it may be useful to introduce a second set of Soviet price weights. It would be expected that Soviet ME over, say, the past two decades grew faster when measured in 1955 than in 1978 prices. The differences between the two calculated rates of growth would reflect the degree to which relative prices and quantities changed between the measurement points. This prediction is based on known changes in the Soviet price system, from which it may also be hazarded that the effect of changing from 1970 to 1978 prices is likely to be considerably transformation of economic structure, the more difficult it is to evaluate late period growth in terms of early period prices, because of the difficulty of framing appropriate weights for sophisticated goods not produced in the early period.

The third measurement objective is the effect of ME on the Soviet economy. This is generally described as the measurement of the "burden of defense" in the USSR, and the conventional indicator is the share of GNP devoted to ME. The issues involved in assessing economic effects are far broader than the defense share of GNP. It is also generally recognized that the policy relevance of the defense burden can only be to its perceived effect, which may bear no relation to the crude objective indicator of Defense/GNP. However, some evaluation of the extent of the military drain on national resources and the penalty paid in terms of civilian alternatives forgone is probably made at some level of Soviet decisionmaking. A simple aggregated comparison of ME and total output may be a starting point for Soviet policy formulation as well as for Western analysis.

What are the appropriate values for the simple burden measurement? Clearly not dollar prices, which bear no necessary relation to the tradeoffs among the Soviet national bill of goods and services that are intended to be summarized in the ME/GNP ratio. Only ruble prices could satisfy that requirement. Also, prices of the year of the calculation, rather than any set drawn from the past, are the most appropriate mirrors of production alternatives in the interval of interest. A time series of such ratios should be based on current-price ruble values of each year.

It is well known that the administered nature of Soviet prices makes them deficient tools for analysis of real costs. The problem of appraising the Soviet price system and its utility for economic measurements and analysis preoccupied Western analysis of the Soviet economy for many years. The consensual resolution of the difficulty has involved adjustment of reported Soviet magnitudes for the major deficiencies of the price system. The results, as far as national output and its components are concerned, are viewed as approximations to factor cost valuations sufficiently close to bear the weight of economic analysis. The same criterion of valuation is applicable to the measurement of ME and its share of GNP.

It is also generally known that Soviet planners and statisticians operate with a different set of national accounting concepts than is used in the West. Gross and net material product are ideologically preferred to the West's gross and net national product, and the two

sets of aggregates differ substantially in concept and definition. It is not clear to what extent such calculations figure in the Soviet decision-making process, but it seems likely that it is the Soviet, not the Western, accounting framework that would be used.

More sophisticated efforts at measuring the economic effects of ME on the national economy involve various econometric approaches, ranging from regression analysis to simulations with complex models of the economy. The pricing principles discussed briefly here generally also apply to the econometric approaches.

Finally, there has also been interest in simultaneous U.S./USSR comparisons of ME and GNP. Such calculations are seldom made but when they are they have been subject to methodological abuse, so that the public has been confused by the results. The typical layman's question is: If the Soviet economy is only half as large as ours, how can they spend half again as much on defense as we do and still devote only one-eighth of their GNP to defense? The reason for the confusion is that the three elements of this comparison are constructed with different price weights and therefore cannot be legitimately juxtaposed.

The ratio of Soviet to American defense is based on a dollar valuation of both sides' ME, and the Soviet ratio of defense to GNP is a ruble calculation. However, the GNP ratio is an average of the ruble and dollar sizings, implying a set of weights for both countries that is neither rubles nor dollars. The illegitimacy of this comparison is underscored by the numerical absurdities to which it can lead.[3] The appropriate formulation of this problem would note that Soviet ME is half again as large as ours when the dollar valuation shows Soviet GNP as much as two-thirds of the American. In the complementary ruble sizing, the Soviet-American gap is wider but the Soviet/U.S. ME ratio is also smaller.

2. Measurement Approaches

The issue of alternative ways of measuring Soviet ME arises, of course, because of unanimity in the West that official Soviet figures are unreliable. The Soviet government reports only a single number, allegedly total outlays for "defense." However, the discussion in Soviet sources of the scope and coverage of this datum is ambiguous, the reported time series displays obvious inconsistencies with known increases in the physical numbers of Soviet forces, and the recent absolute levels of "defense" seem impossibly small for the size of the increments of Soviet armed power. Moreover, there is substantial reason to believe that important ME components are concealed under other headings in the Soviet state budget.

The evident unreliability of the official Soviet claims and the concealment of all structural detail necessitates independent estimates of Soviet ME. There are two different approaches to independent estimation. The first manipulates Soviet economic data to uncover concealed military elements in the published statements on the state budget, national income, and machinery production (for an estimate

[3] See A. S. Becker. "Comparison of United States and U.S.S.R. National Output: Some Rules of the Game," World Politics, 13 :1, October 1960, pp. 99–111.

of procurement). The task of identifying and pulling away the concealment imposes severe methodological and data problems, and it is doubtful that these problems have been successfully resolved. Estimates of total Soviet ME obtained in these ways remain subject to an unknown but possibly wide margin of error.

In view of the major data difficulties attached to manipulating Soviet financial and production statistics, CIA has long relied on the second, so-called "building block" approach, in which total military expenditures other than R. & D. are obtained by aggregating Soviet military activities in physical units weighed by appropriate prices. Because this approach depends upon accumulating massive detail on Soviet military activities, prices, and costs, it has proved feasible only for the government; analysts outside the government have not had access to either the resources or the intelligence apparatus necessary to compete effectively. However, the two categories should not be viewed as exclusively competitive. Estimates derived from budgetary national income and production statistics cannot detail the structure of Soviet expenditure by program, mission, and military organization. But the statistical approaches could, in principle, provide valuable checks on the major aggregates of Soviet military outlays, thereby helping to identify part of the estimating error inherent in building block calculations. It is of national importance to maintain adequate mutually supporting levels of effort along both lines.

3. CIA Estimates [4]

In CIA estimation, the cumulative total of U.S. ME since the mid-1960s is roughly equal to the cumulated sums of dollar valuation of all Soviet military programs in the same period. However, where the dollar-costed Soviet aggregate defense basket seems to have been growing monotonically since 1965, U.S. outlays rose steeply until 1968, then declined steadily through 1976. The crossover point of the two national value lines came in 1971, and the Soviet margin widened until 1978. By now, the dollar value of Soviet activities, net of military pensions, exceeds U.S. ME, comparably defined, by about 45 percent. Soviet military manpower levels substantially exceed those of U.S. forces, and dollar costs per man are high; so exclusion of all personnel costs from both U.S. and Soviet valuations reduces the current U.S.S.R./U.S. ratio, but only to about 1.25 to 1.

Dollar costing suggests that the cumulative gross additions to military forces of the two powers were roughly the same over the past 12–13 years but increasingly divergent during the early and middle 1970s. Another way of expressing this result is by breaking down the aggregates into their resource category elements. Such a distribution of costs indicates that whereas the U.S.S.R./U.S. ratio for cumulative total operating outlays (including personnel costs) over the past decade was only somewhat greater than unity, the ratio was about 1.25 for cumulated investment (procurement and construction). These value data take no account of depreciation or of losses and their re-

[4] A Dollar Cost Comparison of Soviet and U.S. Defense Activities . . .: 1966–76, SR 77–10001U, January 1977; 1967–77, SR 78–10002, January 1978; 1968–78, SR 79–10004, January 1979. Estimated Soviet Defense Spending in Rubles, 1970–75, SR 76–10121U, May 1976; and Estimated Soviet Defense Spending: Trends and Prospects, SR 78–10121, June 1978.

placement, a fact that, in light of U.S. involvement in the Vietnam War, may understate the Soviet/American ratio. There is little doubt, however, that in the 1970s the ratio was increasing markedly. On the average in the last three or four years, the dollar value of annual Soviet investment was roughly 75 percent greater than counterpart U.S. outlays. Because the comparison of RDT & E is a much less firmly based estimate, CIA will say only that "Soviet RDT & E activities in 1978 were substantially larger than those of the United States." Soviet operating activities in dollar terms are now 25 percent larger than U.S. operating outlays.

The conclusion of a substantial growth in the aggregate size of Soviet programs relative to those of the United States holds not only in dollars but apparently also in ruble valuation. Methodological and empirical problems still stand in the way of systematic ruble costing of U.S. programs, but the calculations that have been made indicate that the ratio of Soviet ME to the ruble value of U.S. activities is also greater than 1, though observably less than in dollars (1.25 rather than 1.45). Ruble sizing would probably show a later crossover point and, of course, a smaller cumulative Soviet than U.S. total.

The dollar cost of Soviet strategic forces programs since the mid-1960's has been considerably and significantly larger than U.S. outlays on this set of missions. The margin of difference has varied, but over the period as a whole it has been roughly 150 percent. In 1978, the Soviet package measured three times as large as the American. Part of the gap is accounted for by the fact that the United States has no counterpart to Soviet peripheral attack forces. Moreover, the United States devotes far less attention and fewer resources to strategic defense. However, U.S. outlays on intercontinental attack (the strategic offensive component of strategic forces) are only two-thirds as large as the dollar cost of Soviet activities in this category.

The dollar value of Soviet GPF programs began to exceed U.S. outlays for this purpose in 1971 and since 1973 has been more than 50 percent greater in each year. The USSR/U.S. ratio for support forces was only about 0.5 in the mid-1960's and is just now reaching unity. Because of the sharp decrease in U.S. expenditures on land forces since the peak of the Vietnam involvement and the steady increase of Soviet outlays, the dollar value of Soviet land force activities is now more than two and a half times the value of U.S. land force activities. All U.S. naval expenditures are larger than the dollar-costed Soviet programs; if attack carriers and their associated aircraft are excluded, the sign of the ratio reverses and the Soviet naval basket appears about one-quarter larger. U.S. outlays on tactical air have generally trended downward, and Soviet outlays have grown considerably. The result is that from a level five times as large, U.S. tacair expenditure is now only about 50 percent greater than the dollar-valued Soviet tacair programs.

An important observation about these impressive changes in comparative size levels is that by and large they were not the result of dramatic spurts in Soviet spending. They resulted from American post-Vietnam downturns and generally moderate but steady rates of buildup on the Soviet side. Over the past decade or more, Soviet ME

valued at 1970 ruble prices is estimated to have grown at 4–5 percent per year, roughly apace with the increase in GNP.[5] Measured in dollars, the rate of growth appears smaller, about 3 percent. As suggested earlier, this direction of difference is to be expected, when dollar prices are viewed as comparable in their effect to a set of "early-year" ruble prices.

TABLE 1.—PERCENTAGE SHARES OF SOVIET SERVICES IN ESTIMATED MILITARY EXPENDITURE (INVESTMENT AND OPERATING) AT 1970 RUBLE PRICES

Service	1967	1970	1973	1977
Strategic rocket forces	10	7	5	8
PVO	14	15	12	12
Ground forces	21	22	22	22
Navy	22	22	19	20
Air Force	17	19	26	22
Command and support	16	15	16	16

The Soviet expansion has tended to be comprehensive and "balanced" in terms of service distribution, as can be seen from Table 1. Owing probably to the existence of RDT&E and procurement cycles in strategic offensive programs, the SRF share in investment and operating outlays is somewhat volatile. Also, the Air Force's share has risen considerably; there were compensating small declines in the shares of the SRF, PVO, and Navy. Despite these changes, the general pattern is one of stability in the outlay distribution over the ten-year period.

4. Alternative Estimates

The complexity, costliness, and intelligence-dependence of the "building block" system effectively prevents its use outside of the U.S. government, which means that nongovernmental size comparisons are also precluded. Instead, the challengers concentrate on the ruble value of Soviet ME, derived through manipulation of Soviet economic and financial statistics. Table 2 below assembles the most prominent recent calculations by two Americans, Stanley H. Cohn and William T. Lee; an anonymous (possibly government-origin) French effort; and a widely noted but still mysterious Chinese set of figures.[6] For contrast, the table also includes Soviet official claims and the CIA estimates.

Sharp differences are apparent among the non-Soviet series, only some of which may be traceable to variant price weights. However, the methodology of the estimates cannot be reviewed here. They do have one common feature: In the 1970s, the non-Soviet estimates are all twice or more as high as the official "defense" figure. A similar statement could probably also be made for the 1960s, if the non-Soviet estimates were available for the two benchmark years in current price valuation.

[5] The fastest growing resource elements of Soviet ME, in ruble valuation, are RDT&E and investment; at 2–3 percent, operating costs have been increasing less rapidly than the aggregate average.

[6] The methodology of the Chinese figures has not been explained. Some observers have suggested that the numbers are reflections of Western estimates; others believe the figures are independently derived, perhaps based on knowledge obtained before the Sino-Soviet break in 1960.

TABLE 2.—ALTERNATIVE ESTIMATES OF SOVIET MILITARY EXPENDITURES, 1955–76

[Billions of rubles, current prices, except as indicated]

Estimate	1955	1960	1965	1970	1975	1976
Official Soviet: "Defense"	10.74	9.30	12.78	17.85	17.43	17.4
CIA (1970 prices)	(1)	(1)	31–41	40–50	50–60	52–62
Cohn (1970 prices)	(1)	18.40	29.1	35.4	[2] 40.6	(1)
French	(1)	(1)	(1)	34	42.3	(1)
Lee	14.0	16.0	26.0	46.0	71.5	(1)
Chinese	(1)	19.0	29.2	49.6	[2] 69.4	(1)

[1] Not available.
[2] 1974.

SOURCES

"Defense:" Soviet government statistics.

CIA: 1965, projected backward from 1970 at the annual rate of 4.5 percent, CIA's estimate of average annual—growth in the decade 1967–77; 1970, 1975 from CIA, Estimated Soviet Defense Spending in Rubles, 1970–75, SR 76-10121U, May 1976; 1976 from Allocation of Resources in the Soviet Union and China—1977, hearings before the subcommittee on Priorities and Economy in Government of the Joint Economic Committee, U.S. Congress, pt. 3, Washington, D.C., 1977, pp. 18–19. With respect to the published figures, the lower end of the range corresponds to the scope of U.S. defense outlays and the upper end to an enlarged scope intended to cover activities that the Soviets may include in their estimates of military expenditure (e.g., civil space).

Cohn: Stanley H. Cohn, "A Reevaluation of Soviet Defense Expenditure Estimates," submission to the Stanford Research Institute, revised August 1976, cited in Robert E. Leggett and Sheldon T. Rabin, "A Note on the Meaning of the Soviet Defense Budget," Soviet Studies, 30:4, October 1978, p. 561.

French: "X.X.X," "Combien de Roubles pour la Défense?" Défense Nationale (Paris), November 1976, p. 54. The source provides absolute figures for each year in 1971–75 and percentage increases over the previous year, as well as the aggregate increase between 1970 and 1975. There is a slight difference between the implied 1970 figures that may be calculated from these percentages; therefore, the 1970 entry is rounded.

Lee: William T. Lee, The Estimation of Soviet Defense Expenditures, 1955–75. An Unconventional Approach, New York, Praeger, 1977. Table 6.2, p. 98. The numbers are rounded midpoints of estimated ranges.

Chinese: Peking Review, Nov. 28, 1975, p. 9 and Jan. 30, 1976, pp. 10–11. The following data are provided relative to Soviet military expenditure: as a share of "national income," 13.1 percent in 1960, 17.1 percent in 1970 and 19.6 percent in 1974; as a share of "government expenditure," about 35 percent in 1974: average annual rates of growth, 9.7 percent in 1961–74, 9 percent in 1961–65, 11.1 percent in 1966–70 and 11.9 percent 1971–74. The product of the subperiod aggregate growth factors is 4.0834 whereas the implied compounded total over the 14-yr. period is 3.6550. Consideration of the absolute ruble values implied by these data (using "produced" national income totals at current prices from TsSU, Narodnoe khoziaistvo S.S.S.R. v 1970 g., Statistika, 1971, p. 533 and Narodnoe khoziaistvo S.S.S.R. v 1975 g., Statistika, 1976, p. 563) suggests that the problem lies with the 11.9 percent growth rate figure for 1971–74. This datum is, therefore, ignored (it is possible that the figure should be 8.9 percent). The source does not indicate whether the estimates are based on constant or current prices. From the nature of the figures supplied, current prices seem probable.

The variant series may also be compared in terms of the implied or indicated rates of growth. CIA suggests that Soviet military expenditures have been rising by 4 to 5 percent annually and more or less steadily since the early or mid-1960s.[7] Cohn's series, with a somewhat higher average rate of growth, 5.8 percent, displays sharp deceleration in the 1960s, from about 10 percent in the first half to 4 percent in the latter half; for 1971–74, the rate is 3½ percent. Judging by observed force developments, the time pattern of the first two subperiods seems dubious.

Lee's estimates quintuple over the two decades, averaging out at about 8½ percent per year. These values are, of course, at prices of each year. Lee does provide figures at "1955" prices for the sub-period 1955–1966 and at "1970" prices for the subperiod 1966–1975. However, the difference between his estimates for 1966 at "1955" prices and at current prices is less than half a billion rubles, or about 1 percent. The corresponding difference for 1975 (comparing the current-price value with that at "1970" prices) is larger, 4–5 billion rubles and 6–7 percent, but in the reverse direction: Lee seems to believe that the military price level fell by that difference between 1970 and 1975,[8] which is quite unlikely. The 1955–1970 entries of Lee's series in Table 2 apparently reflect his view of the real growth of the Soviet military out-

[7] CIA, Soviet Economic Problems and Prospects, ER–77–10436U, July 1977, p. 1.
[8] Lee, The Estimation of Soviet Defense Expenditures, 1955–75, Tables 4.5 and 4.6, pp. 65, 66.

lays—in excess of 8 percent per year. He also finds a real increase of close to 11 percent annually for 1971–75. The results seem unacceptably high.

The figures released by the Peking Review parallel Lee's estimates and also seem to downplay the distinction between current and constant prices. In testimony before the Joint Economic Committee of the Congress, Lt. General Samuel V. Wilson, then Director of the CIA, declared:

> While we agree with the community estimate for 1970–76 when valued in constant 1970 ruble prices, we believe that an estimate of Soviet defense spending published in the People's Republic of China weekly Peking Review, a magazine, may accurately represent the growth rate and total expressed in current prices.
>
> The *Peking Review* series is supported by information from [security deletion] and others. This data indicate a 1975 Soviet defense total of over 70 billion rubles and an economic burden of between 14 and 15 percent.[9]

General Wilson's remarks imply a CIA estimate of the rate of inflation of Soviet military prices of something like 6–7 percent per year between 1965 and 1970 and perhaps 3–4 percent in the first half of the 1970s.[10] The rate of price change probably slowed in the 1970s, although the indicated size of the change seems high. However, no evidence has been presented to support these estimates, and General Wilson implied lack of agreement on the part of CIA.

Note that the official Soviet "defense" figures indicate an average annual rate of increase (at current prices) of near 7 percent in each of the two subperiods of the 1960s. This is faster than the CIA and Cohn estimates for the latter half of the 1960s but not as fast as the Lee estimate for either subperiod and Cohn's for the first half of the decade. All the non-Soviet calculations reject the Soviet claim of zero or negative growth of ME during the 1970s.

Finally, the alternative (to CIA) estimates of Soviet ME probably also imply somewhat different views of the Soviet burden of defense, as measured by the ME/GNP ratio. This may be seen most readily in the Lee estimates, for he provides an explicit ruble GNP series. According to his reconstruction, the ratio fell sharply in 1955–57, from 11.5 to 8.5 percent, then rose steadily in 1960–62 (to 10.5 percent), dropped again in 1964–66 (to 10.0 percent), rose sharply in 1967–68 (to 12.0 percent) and dropped off half a point in 1970; Lee projected a GNP share of 14–15 percent in 1975.[11] CIA's estimate is only 11–13 percent, measured in 1970 prices, and roughly constant for the past decade or more.

Lee's estimate of GNP for 1970, which is at established prices rather than factor cost, is slightly higher than CIA's for that benchmark year. His 1975 estimate assumes GNP growth at 4–5 percent per year after 1970, equivalent to the CIA estimate. However, for the latter half of the 1960s, Lee's series shows 9 percent annual growth of GNP and 12 percent for ME, all at current prices. It is difficult to believe that Lee accepts 9 percent as both the real and the nominal

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[9] Allocation of Resources in the Soviet Union and China—1977, Part 3, p. 78.

[10] Derived by juxtaposition of the rate of change of the Chinese series and the 4–5 percent estimate of the U.S intelligence community. A 1975 figure for the Chinese series is assumed at a level 4½ percent greater than the 1974 entry.

[11] Lee, The Estimation of Soviet Defense Expenditures, 1955–75, Table 6.2, p. 98.

GNP growth rate. If, instead, he believes that real growth of Soviet GNP approximated the CIA's estimated 4–5 percent, he implies an equivalent GNP inflation rate. However, the details of his GNP calculations have not been published.

To sum up: Alternative estimates of total Soviet ME diverge more or less markedly from CIA's for various reasons, some of which are unknown because of insufficient detail in the available explanation of the different series. However, all reject the official Soviet "defense" claims and agree that a considerable increase has taken place in the annual level of Soviet ME, adjusted for inflation, over at least the last decade and a half. That is not true of American defense outlays.

5. Projects of Soviet ME

CIA has been reluctant to undertake or make public detailed projections of Soviet ME. Those released so far are mainly general statements about the probable change in aggregate ME. The recently issued "dollar" report declares that available evidence "indicates that the long-term growth trend in Soviet defense activities will probably continue into the 1980s." In the next two years, the dollar cost of Soviet investment activities is expected to accelerate in growth, helping to push the aggregate total up by perhaps 7–10 percent.

As of mid-1978, the Agency projected continued increases in Soviet ruble spending over roughly the next five years—at a rate "slightly lower than the long run average" of 4–5 percent a year in the "next two or three years" (as some current programs near completion), and "to a pace more in keeping with the long-term growth trend" during the early 1980s. No decelerating effect was seen as a result of the conclusion of SALT II. This careful language suggested a projected rate of growth for the period from 1978 through "the early 1980s" of slightly below the 4–5 percent "long-term" trend. On the whole, CIA expected that Moscow's concerns about the health of the Soviet economy were likely to affect the continuing pace of increase of Soviet ME "only marginally."

In 1977, Lee attempted to replicate planned Soviet ME in the current 10th Five Year Plan from Soviet sources. His calculations indicated a rate of growth in 1976–1980 of almost 10 percent per year at either "1970" or "1976" prices. The absolute values involved are extremely large, reaching 108–128 billion rubles in 1980. Lee noted:

> There are very large sums that may seem impossibly large to some readers, and quite understandably so. After all . . . we are talking about (roughly) 20 to 23 percent of GNP being devoted to the military in 1980.[12]

Evidently, Lee saw Soviet GNP growing no faster than 3 percent per year and perhaps as slowly as 1½ or 2 percent in 1976–1980. Nevertheless, the "burden," in terms of ME/GNP, was supposedly planned to increase in these five years by one-third to almost two-thirds.

Whatever the likelihood of Lee's reconstruction of plan intentions, the record of most of the 10th Five Year Plan is already complete. CIA estimates that GNP rose 10 percent in the first three years [13] with little or no change in the ME/GNP ratio. The recent harvest may have

[12] William T. Lee, "Soviet Defense Expenditures in the 10th FYP," Osteuropa Wirtschaft, 22:4, December 1977, pp. 287–288.
[13] CIA, NFAC, Handbook of Economic Statistics, 1978, p. 46.

raised the GNP relative increase in 1978, but the last two years of the Plan period may not be as bountiful. The pattern of change in the defense burden is unlikely to be substantially affected by 1980.

C. Conclusions

Contrary to the newspaper headlines, the U.S. government estimates do not show that the Soviets "outspend" the United States, because Soviet military spending does not take place in dollars, nor do Soviet military planners respond to U.S. relative costs and prices. The same conclusion would hold in a ruble comparison with the actors' roles reversed. However, there is little question that the aggregate of Soviet military programs as well as most of the major components are larger in size than those of the United States, and have been so for most of this decade. The Kremlin has maintained a fairly steady pace of increase in Soviet military outlays for 10–15 years, and U.S. ME declined during the first part of the 1970s.

But, so what? Does it matter?

The problematic connection between ME and military power was stressed at the outset of Part I. However, two conclusions from the available estimates must temper the observer's agnosticism:

(1) *Given the duration of the Soviet ME buildup and the only somewhat shorter period of decline in American ME, a change must have taken place in comparative capability relative to the situation of the early 1960s.*—Only two factors could negate that result—substantial diversion of Soviet energies in directions that do not bear on the U.S.-USSR military balance or increasing inefficiency of Soviet relative to U.S. ME.

Critics of the allegedly "alarmist" view of the Soviet buildup have pointed to the massing of Soviet forces along the Sino-Soviet frontier as evidence of the operation of the first factor. However, apart from the fact that Soviet Asian forces can be used in a variety of other contingencies that do affect the central superpower balance, it appears that deduction of the estimated cost of Soviet programs with a primary mission against China would lower the dollar value of total Soviet activities in 1978 by only 15 percent. Moreover, a significant portion of U.S. outlays may also be deemed peripheral in this sense.

As for the second factor, the possibility of increasing gaps between resource costs and military capability, this may be understood in two senses. The first is the ordinary idea of productivity, relating input to output, and on this no hard evidence is yet available. True, the corollary of the CIA's 1976 change in ruble estimates was a downward revision of the implicit estimate of Soviet military productivity, but this was a one-time change with no implications for the trend—that is, it represented a parallel shift downward of the trend line, not a change in its inclination. It seems likely that Soviet military production costs have been rising (based on a variety of evidence, including the increased complexity of certain categories of Soviet hardware). So have the costs of U.S. weapons procurement. The comparative rates of change in cost appreciation are unclear. This is certainly true of the change in comparative military efficiency.

A second sense of the cost-capability gap raises the familiar question, How much is enough? As William Hoehn notes,[14] the United States and the Soviet Union have had sharply different strategic perspectives. The Soviet commitment to "war-fighting" is expectably costly, but perhaps the Kremlin is misguided and is simply wasting resources. This is not the place to enter into that question, but it must be noted that U.S. government views are apparently changing and drawing closer to the Soviet perspective, as signalled in Defense Secretary Harold Brown's recent "posture statement," which in turn may be connected with the change in Congressional and public attitudes.

(2) *Continuation of the outlay trends of the early and mid-1970s into the 1980s is likely to result in additional capability changes in the same direction.*—As noted, there are no signs of a halt to the Soviet buildup; CIA forecasts "business as usual" for the next few years. SALT II, if it comes into operation, will probably have only a marginal effect on either side's military effort. Much has been made of the recent turnaround in U.S. outlays and the 3 percent annual increase promised our NATO allies. However, many observers doubt that U.S. ME in aggregate will achieve a sustained real rate of increase of as much as 3 percent annually, because of the pressures of competing domestic U.S. interests.

How long the USSR will be able to maintain the steady pace of enlargement of its military might cannot, of course, be predicted. The Western perspective has been substantially altered by the sharp revision in 1976 of CIA's estimates of Soviet ruble ME, which resulted in raising the estimated ME share of Soviet GNP from 6–10 to 11–13 percent. Also, major economic problems—related to energy, demography, and productivity—are on the Soviet horizon, the first symptoms of which are already being experienced. However, a judgment on how heavy a "burden" the current defense/GNP ratio constitutes must take into account Soviet historical experience, not just the contemporary record of other nations. Above all else, the judgment depends on appreciation of the perceptions of various Soviet leadership groups. This is a very large subject and cannot be attempted here.

Unless internal economic and political pressures act to slow down the Soviet military buildup, the United States must expect that stabilization of American ME will mean a continued lag in improvement of military capability relative to that of the USSR.

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[14] See part III of "The Significance of Divergent U.S.-U.S.S.R. Military Expenditures," *op. cit.*

II. PLAN AND PERFORMANCE

U.S. AND U.S.S.R.: COMPARISONS OF GNP

(By Imogene Edwards, Margaret Hughes, and James Noren*)

CONTENTS

*Office of Economic Research, Central Intelligence Agency. These comparisons represent a summing-up of the work of more than a dozen analysts in the Office of Economic Research—work carried out over a period of several years. The comparisons and procedures summarized in this paper will be elaborated in a separate volume to be published next year under the auspices of the Joint Economic Committee.

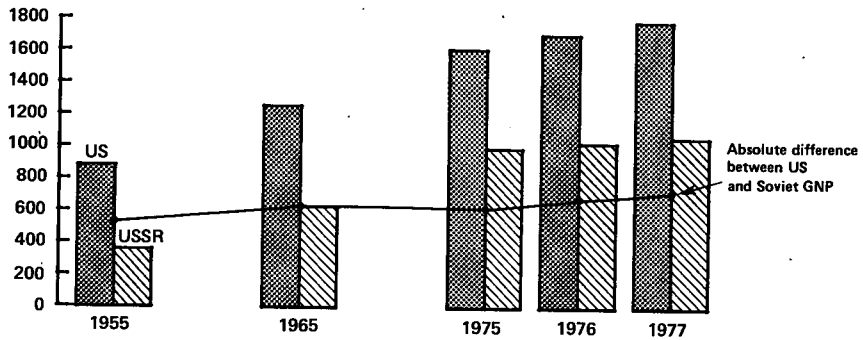
I. Summary

Since 1955 the Soviet economy has gained substantially on the American economy in relative terms although the absolute gap separating them is still increasing. In 1955, with postwar recovery completed, the USSR's gross national product (GNP) was 40 percent of U.S. GNP. Ten years later, the ratio had climbed to 50 percent. After 1965, the U.S.S.R. continued to close the gap, although at a slower rate. By 1977, Soviet GNP had reached 60 percent of the U.S. level. Over the whole period 1956–77, the absolute difference between U.S. and Soviet GNP increased slightly. (Figure 1.)

US and USSR: GNP

Figure 1

Billion 1976 US Dollars [1]



1. Soviet GNP in dollars calculated by using the geometric mean of comparisons of US and Soviet GNP carried out alternatively in 1976 ruble and 1976 dollar prices.

These estimates represent a revision in the comparisons of Soviet and U.S. national product that have been published annually by the Office of Economic Research. They are based on new U.S.-Soviet purchasing-power-parity ratios covering consumption, machinery, construction, and defense. The comparisons, which are carried out in 1976 prices, also rely on a new set of national accounts for the U.S.S.R. for the year 1976.

Soviet progress vis-a-vis the U.S. has been markedly uneven, with the most rapid gains occurring in defense and new fixed investment. Progress in consumption has been less remarkable.

AVERAGE ANNUAL INCREMENTS IN GNP BY END USE

[In billions of 1976 dollars]

	1956–65		1966–75		1976–77	
	U.S.S.R.	United States	U.S.S.R.	United States	U.S.S.R.	United States
Consumption	12.7	24.6	19.4	31.7	11.9	57.5
New fixed investment	9.7	8.2	11.4	1.3	33.0	21.5
Defense and space	NA	2.1	4.2	−1.8	3.5	1.0

In 1960 Khrushchev proclaimed the goal of overtaking the United States in terms of per capita consumption, and evidently believed that its realization was not far distant. Khrushchev's dream was forgotten in the 1960s as Soviet economic growth slowed. By 1977, the U.S.S.R. had posted solid gains in per capita consumption—from 29 percent of the U.S. level in 1955 to 36 percent in 1977. Nonetheless the U.S.S.R. still trails all of the developed countries in this summary measure of popular welfare.

Most of the Soviet gains in relative U.S.–U.S.S.R. consumption levels occurred in the food and soft goods categories. The effects of the Khrushchev-Brezhnev grain and livestock program can be seen in the rise of per capita consumption of meat and dairy products from 27 percent of U.S. consumption in 1955 to 48 percent in 1977. Even larger relative gains were made in the provision of consumer durables and household services. The Soviet consumer fell further behind in housing and health and lost his lead in education.

Meanwhile, Soviet outlays for investment and defense and space caught up with and surpassed those of the U.S. Investment in the U.S.S.R. was 46 percent of the U.S. level in 1955 and 116 percent in 1977. Trends in defense spending are equally striking. Between 1965 and 1977, Soviet defense outlays increased as a share of U.S. spending from 72 percent to 137 percent. Perhaps the most noteworthy aspect of Soviet economic history over the past 25 years has been the U.S.S.R.'s success in supporting both civilian and military investment so lavishly. As returns on fixed investment continue to decline and the costs of providing the economy with energy and raw materials rise, however, the Sovet leaderhip has concluded that investment cannot continue to climb at past rates.

As a result of the varying trends in consumption, investment, and defense in the two countries, the composition of GNP (established prices) was by 1976 quite different in the two countries:

PERCENTAGE DISTRIBUTION OF GNP, 1976

	U.S.S.R. rubles	U.S dollars
Consumption	56.5	69.8
New fixed investment	28.1	16.4
Defense and space	12.3	5.4
Administration	2.3	7.5
Other	.9	1.0

With economic growth slowing down, the tradeoffs between new fixed investment and defense spending and between new fixed investment and consumption seem to have become more apparent to Soviet policymakers.

The comparisons in this paper are binary comparisons of the kind pioneered by Gilbert and Kravis in the 1950s. The present study compares Soviet and U.S. GNP in both ruble and dollar prices of 1976. A set of dollar-ruble ratios was used to convert Soviet GNP from rubles to dollars; ruble-dollar ratios were used to convert U.S. GNP from dollars to rubles. The dollar-ruble ratios and the ruble-dollar ratios are the foundation of the U.S.-Soviet GNP comparisons. The

ratios are drawn from a research effort extending over several years in which purchasing-power-parity ratios were determined for large samples of representative goods and services in consumption, new fixed investment, and defense.

As a single value for comparisons of relative size of GNP or its end uses, we use the geometric mean of comparisons carried out separately in ruble and dollar prices. The geometric mean value is a handy compromise but has a weak theoretical justification. Therefore, the ruble and dollar comparisons should be given at least equal consideration. The differences separating the ruble and dollar comparisons, however, are frequently quite large. A country stands taller in a binary match-up when its goods and services are valued in the other country's prices than when its own prices are used. This oft-noted phenomenon of international comparisons results from the differences in relative prices and output mixes in the two countries. Average ruble-dollar ratios tend to be high when U.S. expenditure weights are used because U.S. prices tend to be low relative to Soviet prices on goods and services produced more abundantly in the U.S. Because the U.S.-weighted ruble-dollar ratios are employed to convert U.S. GNP from dollars to rubles, the U.S. fares better in a ruble comparison than in a dollar comparison.

What the comparisons measure is another matter. They are best regarded as useful benchmarks of the relative level of Soviet and U.S. GNP by end use. For a variety of reasons, the comparisons do not meet the technical requirements for either measures of relative real income or relative production potential. They are perhaps better indicators of real income or the relative preferences of the two societies than they are of production potential. The comparisons are in established prices rather than the factor cost prices needed for assessing production potential. Moreover, while the USSR probably pays scant attention to prices in investment and defense decisions, Soviet consumers do take relative prices into account when they decide what to buy.

The estimates in this paper—it should be noted—probably fall in the upper end of the range for ratios of Soviet GNP to U.S. GNP. Soviet GNP as a share of U.S. would be lower if the individual ruble-dollar ratios were fully adjusted for the inferior quality of Soviet goods and services. The ratios do not take into account the convenience, variety, and availability of goods to the American consumer. The U.S. advantage with respect to productivity and training of workers in health, education, and administration could not be reflected completely. Although they do not meet rigorous (and never satisfied) technical standards for international comparisons, the comparisons in this paper are, we think, a decided improvement over the U.S.-Soviet comparisons currently published.

II. Introduction

Until now, U.S. government comparisons of U.S. and Soviet GNP have been based on purchasing-power-parity ratios (ruble-dollar ratios) based on 1955–56 prices. To make comparisons in dollar prices of more recent years, the average 1955–56 price ratios were brought forward by applying U.S. price indexes. Changing conditions, shifts in relative prices, and the error introduced by updating ruble-dollar

ratios for groups of products by aggregate price indexes covering a period of more than 20 years require a reexamination of the relative size of the national product of the United States and the U.S.S.R.

Since 1976, three major studies of purchasing power parities have been undertaken for Soviet and U.S. consumer goods, construction projects, and machinery and equipment.[1] The sample of consumer goods and services includes 250 items, the machinery and equipment sample 245 items, and the construction sample 277 items. In addition, a detailed set of national accounts for the U.S.S.R. has been compiled.[2] This paper draws together the results of this research to compare U.S. and Soviet GNP in 1976 in both ruble prices and in dollar prices. U.S. and Soviet GNP have been deflated to a 1976 price base for other years to provide perspective on the growth in size and structure of the two economies. In order to keep the statistical presentation within reasonable bounds, however, the comparisons are carried out only for the benchmark years 1955, 1965, and 1975–77—and only for GNP by end-use (consumption, new fixed investment, defense, and other outlays). Comparisons of GNP by sector of origin (for example, industry, agriculture, and other sectors that generate goods and services) would require price deflators and an array of ruble-dollar ratios for intermediate products that are not now nor likely to become available.[3] Comparisons of the distribution of GNP by sector of origin in current prices, furthermore, would require factor cost adjustments to both Soviet and U.S. GNP in established prices. They will be presented and explained in a separate paper.

In its order of march, the paper first discusses some of the concepts of international comparisons of national product as they bear on a U.S.-Soviet comparison. Then, for the benchmark year 1976, the size and structure of U.S. and Soviet GNP are compared. Next trends in total GNP and GNP by major end-use are contrasted. Finally, the comparisons are assessed in terms of their meanings and the suitability of the underlying procedures and data.

III. Background and Assumptions

A. Background

Comparisons of production in any two economies must compare different assortments of output in a common set of prices. International currency exchange rates are deficient for this purpose because they do not reflect relative purchasing power of different currencies over the whole range of output of goods and services included in GNP. Exchange rates are determined mainly by supply and demand for goods and services traded internationally and by international capital transactions. Exchange rates may differ greatly from pur-

[1] CIA ER 76–10068, Ruble-Dollar Ratios for Construction, February, 1976. The studies describing ruble-dollar ratios for consumption and for machinery and equipment will be published later this year. All of this work received much of its impetus and direction from Rush V. Greenslade, whose deep interest in Soviet-U.S. comparisons began in the early 1950's and continued until his death in 1978.

[2] CIA A(ER) 75–76, U.S.S.R.: Gross National Product Accounts for 1970, November 1975. These accounts were updated to 1976 for this paper.

[3] For a comparison of U.S. and Soviet agricultural production using the general procedures of this paper, see Douglas Whitehouse and Joseph F. Havelka, "Comparison of Farm Output in the U.S. and U.S.S.R., 1950–1971," in Congress of the United States, Joint Economic Committee, Soviet Economic Prospects for the Seventies, 93rd Congress, 1st session, Washington, D.C., 1973, pp. 340–374.

chasing-power-parity ratios, especially when comparisons involve economies at substantially different stages of economic development and consequently with substantially different price structures.[4] In the case of the U.S.S.R., moreover, the ruble is not convertible and exchange rates between the ruble and other currencies cannot be used as even a rough measure of relative purchasing power.

The comparisons of GNP in this paper rely on purchasing power parities (ruble-dollar ratios) that indicate the number of rubles (dollars) required to purchase the same quantity of goods and services that can be bought with a U.S. dollar (Soviet ruble). Purchasing power varies widely among commodities. Although in 1976, 43 cents bought as much canned orange juice in the United States as one ruble bought in the U.S.S.R., it took over $5.00 in the U.S. to purchase the same amount of frozen cod sold in the U.S.S.R. for one ruble.

Price ratios constructed for individual goods and services (bread and meat, for example) are aggregated into category ratios (food, for example) using expenditures as weights. Soviet-weighted dollar-ruble ratios for a category are derived by weighting the individual ratios by Soviet outlays. U.S.-weighted ruble-dollar ratios for the same category would use U.S. outlays as weights.

Ruble-dollar (or dollar-ruble) price ratios for the various categories of consumption, investment, defense, and administration are in turn applied to dollar (or ruble) expenditure weights for each of the categories to value each country's output in the other country's prices. The expenditure weights are taken from U.S. and Soviet GNP accounts by end use. After U.S. GNP has been valued in ruble prices, and Soviet GNP in dollar prices, U.S. and Soviet GNP can be compared both in rubles and in dollars.[5]

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[4] See for example, the findings of the U.N.-sponsored study on this point. Irving Kravis, et al., International Comparisons of Real Product and Purchasing Power, IBRD/World Bank/U.N., 1978, pp. 8, 10.

[5] The alternative comparisons can be thought of as Laspeyres and Paasche quantity indexes where the U.S.S.R.(s) provides the Laspeyres price weights and the U.S.(u) the Paasche weights:

Laspeyres Index

$$\frac{\text{U.S.S.R.}}{\text{U.S.}} = \frac{\Sigma PsQs}{\Sigma PsQu}$$

Paasche Index

$$\frac{\text{U.S.S.R.}}{\text{U.S.}} = \frac{\Sigma PuQs}{\Sigma PuQu}$$

Our procedure of deriving category comparisons and GNP comparison using weighted averages of ruble-dollar ratios can be described as follows:

(1) $$\frac{\Sigma PsQs}{\Sigma PsQu} = \frac{1}{\Sigma\left((Ps/Pu)\cdot\frac{PuQu}{\Sigma PuQu}\right)} \cdot \frac{\Sigma PsQs}{\Sigma PuQu}$$

(2) $$\frac{\Sigma PuQs}{\Sigma PuQu} = \Sigma\left((Pu/Ps)\cdot\frac{PsQs}{\Sigma PsQs}\right)\cdot\frac{\Sigma PsQs}{\Sigma PuQu}$$

The Soviet-weighted and U.S.-weighted ruble-dollar ratios are Laspeyres and Paasche price indexes:

$$\frac{\Sigma PsQs}{\Sigma PuQs} \text{ and } \frac{\Sigma PsQu}{\Sigma PuQu}$$

The dollar comparison of GNP can be derived by dividing the ruble comparison by the ratio of the Soviet-weighted ruble-dollar ratio to the U.S.-weighted ruble dollar ratio:

$$\left(\frac{\Sigma PsQs}{\Sigma PsQu}\right) \div \left(\frac{\Sigma PsQs}{\Sigma PuQs} \Big/ \frac{\Sigma PsQu}{\Sigma PuQu}\right) = \frac{\Sigma PuQs}{\Sigma PuQu}$$

Thus the ratio of the ruble size comparison of GNP to the odllar szie comparison equals the ratio of the (a) Soviet-weighted ruble-dollar ratio to the (b) U.S.-weighted ruble-dollar ratio.

As a reasonable average of the ruble and dollar comparison we also calculate the geometric mean (Fisher ideal) index numbers:

$$\frac{\text{U.S.S.R.}}{\text{U.S.}} = \left[\left(\frac{\Sigma PsQs}{\Sigma PsQu}\right)\cdot\left(\frac{\Sigma PuQs}{\Sigma PuQu}\right)\right]^{1/2}$$

The results of the dollar comparison differ from those of the ruble comparison. The explanation lies in the differences in the pattern of output and prices in the two countries whose tastes, levels of income, natural resources, technology, and the state of development all differ. The ratio of prices of goods in any two countries is generally inversely related to the ratio of quantities produced so that goods produced in relatively large quantities in either country tend to sell at relatively low prices in that country, and vice versa. As a result, Soviet GNP is a larger share of U.S. GNP when comparisons are made in dollars since dollar prices place greater weight than ruble prices do on investment and defense goods, in which the U.S.S.R. specializes.

Ruble and dollar comparisons yield different results, and neither provides an unambiguous measure of the difference in GNP. Under certain conditions the comparisons represent alternative measures of the relative capacities of the two countries to produce goods and services.[6] The dollar comparison implies that the U.S. could shift to the Soviet pattern of output and still produce the same value of output as before. Thus, the dollar comparison at best measures the relative ability of the two countries to produce the Soviet mix of output. Similarly, the comparison in ruble prices measures their relative ability to produce the U.S. mix of output. The quantitative result that the dollar comparison favors the U.S.S.R. and the ruble comparison favors the U.S. implies, not surprisingly, that each country is better equipped to produce its own pattern of output.

Alternatively, under a separate set of conditions, the ruble and dollar comparisons would reflect real differences in income or welfare.[7] The ruble comparison would approximate the ratio of Soviet income to the ruble income needed to make a Soviet citizen as well off as an American faced with Soviet prices. The dollar comparison would approximate the ratio of Soviet income to the dollar income needed to make a Soviet citizen as well off as an American faced with U.S. prices. When the dollar comparison exceeds the ruble comparison, the two comparisons probably bracket the "true" welfare indexes.[8]

The geometric mean of ruble and dollar comparisons can be thought of as an approximate measure of each country's ability to produce a mix of output that lies between the actual mixes in the two countries. The validity of geometric mean comparisons is disputed. Abraham Becker emphasized in a discussion of comparisons of Soviet and U.S. national product that a geometric mean comparison had no concrete meaning of its own.[9] Nonetheless, this hybrid comparison retains its

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[6] If relative prices in each economy reflect the marginal rates of transformation of one product into another (movement along a production possibility surface that is concave to the origin or not appreciably convex to the origin) the comparisons can be thought of as approximating production potential. The geometry, to our knowledge, was first set out by Richard Moorsteen in "On Measuring Productive Potential and Relative Efficiency," Quarterly Journal of Economics, August, 1961. It was elaborated by Abram Bergson in The Real National Income of Soviet Russia Since 1928, Cambridge, Harvard University Press, 1961, pp. 25–34. See also the discussion by Abram Bergson, Dan Usher, and Rush Greenslade in D. Daly, ed., International Comparisons of Prices and Output (New York: National Bureau of Economic Research, 1972), pp. 185–193, 208–216.

[7] Relative prices of goods and services in each country would have to equal the marginal rates of substitution among these goods and services.

[8] The true comparisons are marked by distances between Soviet and U.S. budget planes tangent to the Soviet and U.S. indifference surfaces. For a discussion of these relationships see Dan Usher in D. Daly, ed., op. cit., pp. 208–216; Paul A. Samuelson, "Analytical Notes on International Real Income Measures," Economic Journal, September 1974; and Kravis, et al., International Comparisons of Real Product and Purchasing Power, pp. 247–249.

[9] Abraham Becker, World Politics, October, 1960, pp. 99–111.

appeal. The U.N. international comparisons project offers the geometric mean comparison because "it is widely regarded as an evenhanded compromise between the index reflecting the consumption pattern of one partner and the index reflecting that of another." [10] Paul Samuelson defended the use of geometric mean comparisons in this way:

> If luxuries tend to be relatively cheap in the rich countries, the usual Paasche-Laspeyres index numbers will bracket the true real income measures. The exact true measure calculated in a country's own prices will give it a lower real income measure than if calculated in the other country's prices. To use a blend of the Paasche and Laspeyres indexes, such as Fisher's "ideal" geometric mean, does seem more evenhanded than to use either alone.[11]

B. Assumptions

The validity of the comparisons in this paper depends on a number of conditions. First, the benchmark years used in the comparisons are assumed to be "typical" in the sense that unemployment is not abnormally high and relative prices are not distorted by unusual supply or demand conditions.

For the U.S.S.R. the selected benchmark years are characterized by wide swings in agricultural output. GNP increased by 8.7 percent in 1955 and by 6.0 percent in 1965—a poor agriculture year. The harvest disaster of 1975 pulled GNP growth down to 2.3 percent; residual effects on food supplies were felt in 1976 despite a bumper crop. Overall growth in personal consumption slowed in 1976 as did Soviet investment programs. GNP rose by 4 percent. A decline in crop production in 1977 reduced GNP growth to 3.3 percent.

Economic conditions in the United States are more volatile, although GNP growth trends are similar to those of the U.S.S.R. The following tabulation summarizes key indicators of economic performance in the United States in the benchmark years:

[In percent]

	1955	1965	1975	1976	1977
GNP growth	7.0	6.0	−1.3	6.0	5.0
Unemployment rate	4.4	4.5	8.5	7.7	7.0
Utilization of industrial capacity	87.0	89.9	73.6	80.2	82.3

Both 1955 and 1965 were years of economic expansion fueled by rapid growth in consumer spending and business investment. In 1975, the U.S. economy was recovering from its most severe recession of the postwar period. The economic recovery continued during 1976 and 1977. Thus, the gap between actual and potential U.S. GNP was greater in 1975–77 than in 1955 and 1965. Nonetheless, 1976 and 1977 comparisons of U.S. and Soviet national product should be reasonably comparable on this score with those of 1955 and 1965. Differences between actual and potential national product probably cause less dis-

[10] Kravis, et al., International Comparisons of Real Product and Purchasing Power, p. 70.

[11] Samuelson, loc. cit., p. 607. In his justification of the use of a geometric mean compromise, Samuelson cites approvingly Professor Bela Balassa's arguments in December 1973 and June 1974 articles in the Economic Journal.

tortion than the procedure used to estimate Soviet GNP in years other than the base year.

Indeed, the second critical assumption is that useful comparisons can be made for other years in prices of the base year. The more distant the comparisons are from the base year, the more strain is placed on this assumption. Comparisons of U.S. and Soviet GNP in 1955 are less reliable than those for 1976. For the U.S., GNP in current prices must be deflated to 1976 dollars using price deflators that are subject to error. Soviet GNP must be estimated for years other than 1976 by moving 1976 weights with quantity indexes of output that inevitably introduce some distortion.

Third, we assume that meaningful comparisons can be made for quite dissimilar countries. Comparisons are generally considered more reliable for countries with similar levels of development and social systems. When countries at different stages of development (the United States and the U.S.S.R.) are compared, any average of alternative price comparisons tends to overstate the relative position of the less advanced country. The more advanced country could shift to a less complicated product mix more easily than the less advanced country could produce a more complicated assortment of goods and services. The U.S. turns out goods and services that the U.S.S.R. does not produce at all; in many cases the U.S.S.R. cannot produce these goods and services because of its widely-noted difficulty in manufacturing top-quality goods. Very probably, therefore, the ruble comparison of Soviet and U.S. GNP overstates appreciably the relative abilities of the U.S.S.R. and the U.S. to produce the U.S. output mix.[12] For comparison purposes, however, the U.S. and the U.S.S.R. are different in a more crucial aspect than in their stage of development. If the ruble and dollar comparisons are to approximate measures of relative capacity to produce a particular mix of goods and services, relative prices should be inversely proportional to the marginal rates of transformation among products. There is sufficient governmental and monopoly interference with price formation in the U.S. to cast doubt on the measure of the dollar comparisons of Soviet and U.S. GNP; the rigidity of Soviet prices, the existence of black markets, and the still large and uneven impact of indirect taxes (turnover tax) in the U.S.S.R. arouse much greater suspicion regarding the ruble comparison.

Lastly, as a measure of relative real incomes, the comparisons assume that prices are proportional to the utility of consumption and defense goods and to the discounted rate of return on investment goods. The credibility of this assumption is discussed below.

IV. Soviet and U.S. GNP in 1976

Since the ruble-dollar ratio research centered on the year 1976, the U.S.-Soviet comparisons for this year carry the most weight. The index number problem stands out clearly. In ruble prices, Soviet GNP was 50 percent of U.S. GNP; in dollar price, the U.S.S.R. produced final goods and services equal to 74 percent of the U.S. national product. The geometric mean of the two size comparisons was 60 percent.

[12] See for example the discussion of this issue by Rush Greenslade in D. J. Daly, ed., International Comparisons of Prices and Output, pp. 186–187.

UNITED STATES AND SOVIET GNP, 1976

	U.S.S.R.	U.S.	U.S.S.R. as percent of U.S.
Billion rubles	505	1,020	50
Billion dollars	1,253	1,700	74

The geometric mean comparison resulting from the new ruble-dollar ratio research is 4 percentage points higher than the 56 percent that had been estimated for 1976.[13] Almost all of the increase in the average ratio is accounted for by a change in the ruble comparison. The new estimates replace a comparison in 1955 ruble prices with one in 1976 ruble prices. The estimated rise in ruble prices is greatest for defense—increasing the weight of the end-use category in which the U.S.S.R. has the greatest comparative edge. Nonetheless, no reasonable adjustments of purchasing-power-parity price ratios or GNP coverage would disturb the finding that the Soviet economy is the second largest in the world but is still a distant second.

TABLE 1.—SOVIET AND U.S. GNP IN 1976

[In billions]

	Rubles			Dollars			U.S.S.R. as percent of United States, geometric mean
	U.S.S.R.	United States	U.S.S.R. as percent of United States	U.S.S.R.	United States	U.S.S.R. as percent of United States	
GNP	505	1,020	49.5	1,253	1,700	73.7	60.4
Consumption	285	810	35.2	644	1,186	54.3	43.7
Food	137	230	59.6	175	242	72.3	65.4
Soft goods	61	159	38.4	85	140	60.7	48.3
Consumer durables	26	225	11.6	33	160	20.6	15.5
Household services	31	127	24.4	143	420	34.0	28.8
Health	11	43	25.6	96	118	81.4	45.6
Education	20	25	80.0	112	105	106.7	92.4
Investment	142	132	107.6	390	278	140.3	122.9
Machinery and equipment	44	51	86.3	164	116	141.4	110.5
Construction	83	81	102.5	181	162	111.7	107.0
Capital repair	15			45			
Administration	12	21	57.1	77	128	60.2	58.6
Defense and space	62	48	129.2	131	91	144.0	136.4
Other	5	10	50.0	11	37	64.7	56.9

The two economic superpowers, however, turn out quite different assortments of goods and services. In 1976 the U.S.S.R. spent much more on fixed investment and defense than did the United States, while, compared with the American population, the Soviet citizen had to be satisfied with a far smaller provision of consumer goods and services (see table 1). In terms of average consumption levels, the Soviet consumer fared even worse. Whether valued in ruble or dollar prices, per-capita consumption of soft goods, durables, and services other than health and education ranged from 10 to 61 percent of the U.S. level.

[13] CIA ER 78–10365, Handbook of Economic Statistics 1978, October, 1978, p. 19.

PER CAPITA CONSUMPTION IN 1976: U.S.S.R. AS PERCENT OF UNITED STATES

	In ruble prices	In dollar prices
Total	30	45
Food	50	61
Soft goods	32	51
Durables	10	20
Services	20	28
of which:		
Housing	19	22
Health	21	68
Education	65	77

A Soviet citizen came closest to American consumption levels in educational services and—in dollars—health services. The gap between Soviet and U.S. per capita consumption was greatest in consumer durables and services—especially housing. The per capita dollar comparison of total consumption (U.S.S.R. 45 percent of U.S.) suggests that the U.S.S.R. still has some distance to go before it catches up with other developed countries. In the UN-sponsored study the developed countries in the sample all were closer to the U.S. in terms of per capita consumption (calculated in U.S. prices) in 1973 than was the U.S.S.R. in 1976: [14]

Per capita consumption in 1973: Consumption of selected countries as percent of U.S. in dollars

Belgium	80	Netherlands	65
France	74	Japan	57
UK	69	Italy	54
FRG	68	Hungary	50

The differences between the comparisons based alternatively on ruble and dollar prices run in the expected direction, almost without exception. Valuation in dollars puts the U.S.S.R. in a more favorable light than valuation in rubles. This finding—as indicated above—simply reflects the pervasive tendency for U.S.-weighted ruble-dollar ratios to exceed Soviet-weighted ruble-dollar ratios (see Table 2).

TABLE 2.—U.S.S.R.- AND U.S.-WEIGHTED RUBLE-DOLLAR RATIOS, 1976

	Soviet-weighted ruble-dollar ratios	U.S.-weighted ruble-dollar ratios
Consumption	0.443	0.682
Food	.783	.951
Soft goods	.719	1.331
Durables	.718	1.405
Services excluding health and education	.215	.302
Housing	.103	.114
Utilities	.277	.370
Personal transportation	.226	.190
Personal communications	.313	.353
Personal care and repair	.353	.509
Recreation	.185	.144
Automobile services	.647	.667
Miscellaneous	.215	.302
Health	.114	.364
Wages	.080	----------
Materials	.433	----------
Education	.155	.240
Wages	.145	----------
Materials	.365	----------
Investment	.364	.474
New fixed	.368	----------
Machinery and equipment	.266	.434
Construction and other	.459	.502
Capital repair	.337	----------
Administration	.151	.163
Defense and space	.473	.523
GNP	.403	.600

[14] Kravis, et al., International Comparisons of Real Product and Purchasing Power, p. 196 ff.

Within almost every expenditure category, the United States spends relatively more than the U.S.S.R. on goods and services that are relatively more expensive in the U.S.S.R. (that have in other words, relatively high ruble-dollar price ratios). As for comparisons of major end-use categories—consumption, investment, and defense—ruble-dollar ratios tend to be high in consumption, which preempts a larger share of U.S. GNP than Soviet GNP, and low in investment and defense, which take more of Soviet GNP than of U.S. GNP. The exceptions to this rule are the consumer services that are labor-intensive (Soviet health and education) or heavily subsidized (Soviet housing).

Comparisons of investment in machinery and equipment contrast sharply with those for household consumption of food, soft goods and durables. Soviet output of investment goods is large and prices low relative to production and prices of consumer goods. The reverse is true for the U.S. As a result, ruble-dollar ratios for machinery and equipment are low and Soviet investment in machinery and equipment outstrips U.S. investment, while Soviet consumption trails far behind U.S. consumption.

In per capita terms, the dollar value of Soviet new fixed investment was 19 percent larger than U.S. new fixed investment in 1976. The margin, although substantial, is not unprecedented. In the U.N.-sponsored study, the FRG, Japan, and France all invested considerably more than did the United States: [15]

Per capita new fixed investment in 1973: Selected countries as percent of U.S. in dollars

FRG	125	Belgium	87
Japan	115	UK	63
France	112	Italy	61
Netherlands	101	Hungary	57

Comparisons of U.S. and Soviet investment are shown for selected machinery categories in table 3.[16]

TABLE 3.—UNITED STATES AND U.S.S.R.: COMPARISONS OF INVESTMENT IN MACHINERY AND EQUIPMENT, 1976

	U.S.S.R.		Soviet-weighted ruble-dollar ratio	U.S.S.R. as percent of United States in rubles	United States		U.S.-weighted ruble-dollar ratio	U.S.S.R. as percent of United States in dollars
	Rubles	Dollars			Rubles	Dollars		
Mining, oilfield, metallurgical equipment	2,839	15,413	0.184	749.1	379	1,622	0.228	927.4
Metalworking equipment	2,751	19,888	.138	314.0	876	4,425	.198	449.4
Construction machinery and equipment	2,358	13,130	.180	215.7	1,093	4,445	.246	295.4
Tractors and agricultural machinery	4,673	22,416	.208	200.5	2,331	9,075	.257	247.0
Energy and power machinery and equipment	5,023	20,862	.241	180.9	2,776	11,409	.243	182.9
Instruments	3,669	13,414	.274	40.9	8,967	14,699	.610	91.3
Transportation equipment	6,246	20,766	.301	50.5	12,363	29,357	.421	70.7

It takes 30–42 kopeks in the U.S.S.R. to purchase transportation equipment available in the U.S. for one dollar. Instruments are also relatively expensive in the U.S.S.R. Metalworking equipment, on the

[15] Kravis, et al., International Comparisons of Real Product and Purchasing Power, p. 196 ff.

[16] These investment categories cover about two-thirds of total investment in machinery and equipment.

other hand, costs only 14–20 kopeks in the U.S.S.R. for quantities available in the U.S. for one dollar. Conversely, Soviet investment in transportation equipment is 50–70 percent of the U.S. level while Soviet outlays for metalworking equipment are 3–4 times greater than U.S. outlays depending on whether comparisons are made in rubles or in dollars.

The comparisons of investment in transportation equipment and in instruments primarily reflect the U.S. advantage in production of automobiles, trucks, and computers. The relatively low U.S. price for these goods makes Soviet investment relatively small when valued in dollars.

The difference between U.S.-weighted and Soviet-weighted ruble-dollar ratios indicates the degree of similarity in the structure of prices and product in the U.S.S.R. and the United States. The spread in the overall ratio for investment in machinery and equipment is 63 percent.[17] This is greater than the spread in the ratio for food (21 percent), and soft goods (58 percent), but much smaller than the spread in ratios for consumer durables (80 percent). Except for instruments (whose ratios have a 123-percent spread), the differences in machinery ratios shown in table 3 are relatively small. Ratios for energy and power equipment show a 1-percent spread; for agricultural machinery and mining, oilfield and metallurgical equipment about 24 percent; and for other categories, 37–43 percent.

V. Trends in Relative Size of Soviet and U.S. GNP

A. Aggregate Trends

The ratio of Soviet GNP to U.S. GNP increased from 40 percent in 1955 to 50 percent in 1965 and to 62 percent in 1975 (geometric mean comparison—see Table 4 and Figure 1).[18] As a result of Soviet economic problems in 1976–77 and a rebound in U.S. growth, the ratio fell to slightly below 60 percent in 1977. While the U.S.S.R. gained relatively, the absolute difference between U.S. and Soviet GNP increased—by 79 billion rubles or $19 billion:

	Increments in GNP		
	1956–65	1966–77	1956–77
Billion rubles:			
U.S.S.R.	130	219	349
United States	213	298	511
Billion dollars:			
U.S.S.R.	330	500	830
United States	373	530	903

[17] Calculated by dividing the U.S.-weighted ruble-dollar ratio by the Soviet-weighted ruble-dollar ratio.

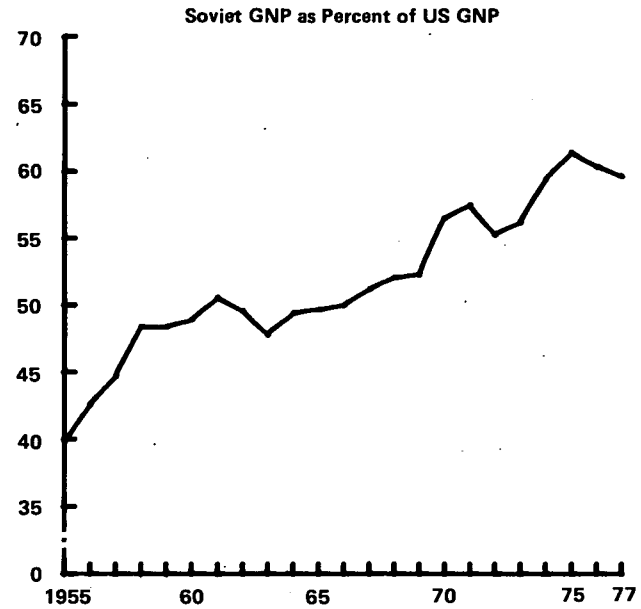
[18] The geometric mean for 1955 in 1976 dollars (Soviet GNP 40 percent of U.S. GNP) is slightly higher than the 38 percent estimated 20 years ago by Morris Bornstein for 1955 in 1955 dollars ("A Comparison of Soviet and United States National Product", Comparisons of the United States and Soviet Economies, Part II, JEC, 1959, p. 385). Almost 10 years ago, Abram Bergson estimated the ratio of Soviet to U.S. GNP in 1955 prices as 26.3 percent in rubles and 40.2 percent in dollars—a geometric mean of 34.5 percent (D. J. Daley, ed., International Comparisons of Prices and Output, p. 148). The difference between the Bornstein and Bergson estimates stems almost entirely from Bergson's lower ruble estimates of Soviet GNP.

To indicate the erratic nature of this economic competition, we have moved the 1976 dollar values of U.S. GNP and Soviet GNP (geometric mean comparison) through time by indexes of GNP in 1976 prices.[19] The results in terms of ratios and differences in relative GNPs are presented in figure 2. Relative Soviet gains have been marked by an ascent to successive plateaus—1955–57, 1958–69, 1970–73, and 1974–77. The absolute gap between U.S. and Soviet GNP was reduced to its lowest level in 1958 ($470 billion) and reached its highest level in 1973 ($723 billion). Year-to-year changes have been large partly because of harvest failures in the U.S.S.R. (1962–63 and 1972) and recessions in the U.S. (1958 and 1974–75).

[19] This shortcut procedure gives aggregate comparisons that are quite close to those obtained through the more complex procedures used for the benchmark years 1955, 1965, 1975, and 1977.

Figure 2

US and USSR: Trends in Relative Size of GNP



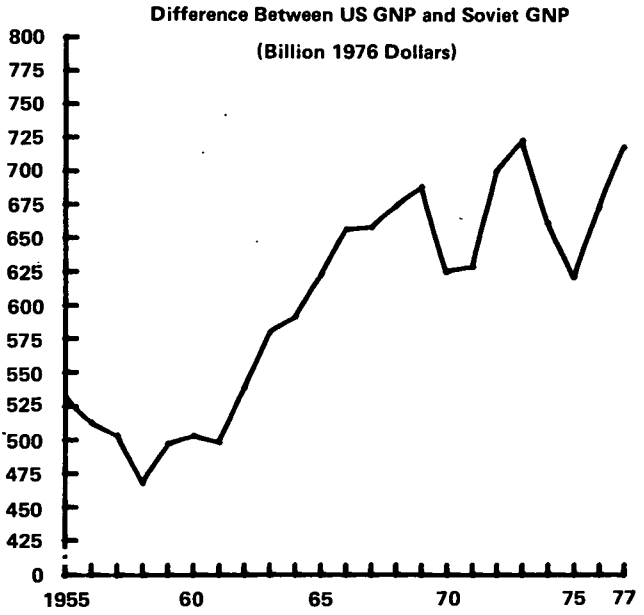


TABLE 4.—TRENDS IN SOVIET AND U.S. GNP

	1955		1965		1975		1976		1977	
	U.S.S.R.	United States	U.S.S.R.	United States	U.S.S.R.	United States	U.S.S.R.	United States	U.S.S.R.	United States
BILLION 1976 RUBLES										
GNP	174	560	304	773	486	955	505	1,020	523	1,071
Consumption	104	415	171	569	277	759	285	810	295	849
Food	61	151	92	191	136	218	137	230	140	237
Soft goods	17	78	33	111	58	153	61	159	63	164
Consumer durables	4	102	9	139	24	201	26	225	28	246
Household services	9	62	16	88	29	122	31	127	32	131
Health	5	14	8	26	11	40	11	43	11	45
Education	9	8	14	15	19	24	20	25	20	26
Investment	32	78	71	118	135	123	142	132	147	145
Machinery and equipment	6	19	18	34	40	47	44	51	46	57
Construction	23	59	46	84	81	76	83	81	85	88
Capital repair [1]	3		7		14		15		16	
Administration	6	7	7	10	11	20	12	21	12	22
Defense and space	NA	48	38	60	59	47	62	48	64	49
Other	32	13	16	15	4	6	5	10	5	6
BILLION 1976 DOLLARS										
GNP	464	880	793	1,252	1,202	1,607	1,253	1,700	1,294	1,782
Consumption	257	561	410	807	623	1,123	644	1,186	664	1,238
Food	84	160	121	200	172	230	175	242	179	251
Soft goods	23	68	45	98	81	136	85	140	89	145
Consumer durables	5	67	12	93	30	143	33	160	36	175
Household services	47	194	81	283	136	402	143	420	148	437
Health	45	38	69	70	94	111	96	118	97	122
Education	53	33	82	61	110	101	112	105	115	108
Investment	86	167	202	249	367	262	390	278	406	305
Machinery and equipment	27	51	80	83	150	111	164	116	173	129
Construction	50	116	102	167	175	151	181	162	185	176
Capital repair [1]	8		20		42		45		47	
Administration	41	44	49	64	75	122	77	128	80	137
Defense and space	NA	87	90	108	127	90	131	91	133	92
Other	80	20	42	24	11	10	11	17	11	10

[1] Capital repair is not an accounting category in U.S. national accounts. See the discussion in app. B.

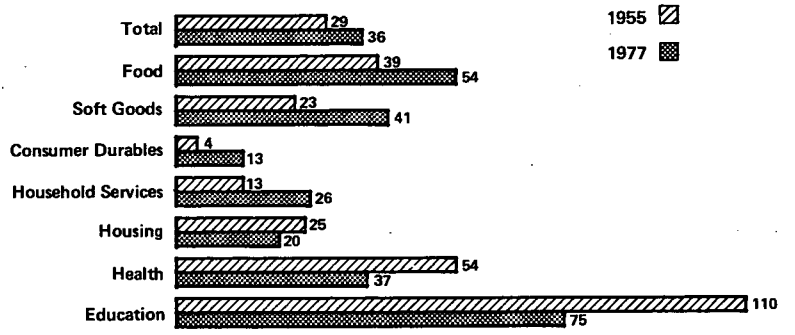
B. Consumption

Over the past 20 or 30 years the most arresting feature of the comparative economic development of the two countries has been the difference in the nature of their growth. In May 1960, Khrushchev proclaimed the goal of overtaking the United States in terms of per capita consumption and seemed to believe its attainment was not far distant. Khrushchev's dream was quietly interred in the 1960s as Soviet economic growth slowed. By 1977 the U.S.S.R. had made solid gains in total consumption but had not appreciably narrowed the distance separating Soviet and U.S. consumption levels (figure 3). Soviet per capita consumption edged up from 29 percent of the U.S. level in 1955 to 36 percent in 1977 (geometric mean comparisons).

Figure 3

US and USSR: Relative Consumption Per Capita

(US=100)



EXPENDITURES ON CONSUMPTION

	1955	1965	1977
Billion 1976 rubles:			
U.S.S.R.	104	171	295
United States	415	569	849
Billion 1976 dollars:			
U.S.S.R.	257	410	664
United States	561	807	1,238
U.S.S.R. as percent of United States:			
Rubles	25	30	35
Dollars	46	51	54
Geometric mean comparison	34	39	43

The Soviet consumer fell further behind the U.S. in housing and health services while a slight Soviet advantage in per capita provision of educational services in 1955 eroded steadily. The U.S.S.R. pushed hard in these areas, but the boom in U.S. housing construction and the enormous growth in federal, state, and local spending on health and education in the U.S. outstripped the Soviet efforts.

The Soviet population gained ground especially in the food and soft goods categories. The effects of the Brezhnev livestock program can be seen in the rise of per capita consumption of meat and dairy products from 27 percent of comparable U.S. consumption in 1955 to 48 percent of U.S. consumption in 1977. In the soft goods category, consumption per capita rose from 23 percent to 41 percent of U.S. consumption during the period. Improvements in quality and style of clothing and footwear in response to changes in consumer tastes did take place, particularly in the 1970's. Even so, much of the merchandise is unacceptable to increasingly discriminating buyers.

C. New Fixed Investment

The period 1955–77 was one of transition in Soviet policy. Indeed the idea of a change from extensive to intensive growth has become almost a cliche in both indigenous and Western economic analysis of the U.S.S.R. and Eastern Europe. Still, the inertia of past policies proved

to be stronger than the prescriptions of the new policy of relying more on productivity gains and less on labor force growth and capital accumulation. In both rubles and dollars Soviet new fixed investment more than doubled between 1955 and 1965 and then doubled again in 1966–77. Meanwhile, new fixed investment in the United States increased by about 50 percent between 1955 and 1965 and by 22 percent in 1966–77. As a consequence, by 1977, the U.S.S.R. had surpassed the United States in terms of new investment in plant, equipment, housing, roads, public buildings and structures, and the like:

EXPENDITURES ON NEW FIXED INVESTMENT

	1955	1965	1977
Billion 1976 rubles:			
U.S.S.R.	32	71	147
United States	78	118	145
Billion 1976 dollars:			
U.S.S.R.	86	202	406
United States	167	249	305
U.S.S.R. as percent of United States:			
Rubles	41	60	101
Dollars	51	81	133
Geometric mean comparison	46	70	116

As pointed out earlier, the large discrepancy between comparisons carried out alternatively in ruble and dollar prices is largely the result of the wide spread between U.S.- and Soviet-weighted ruble-dollar ratios for machinery and equipment (see table 2). In 1977, U.S. investment in machinery and equipment was higher than Soviet investment in new machinery and equipment in ruble prices but much less than Soviet investment in dollar prices.

These comparisons, however, should be viewed with the following caveats in mind. First, in our GNP accounts capital repair—repair that lengthens the useful life of plant and equipment—represents about one-tenth of Soviet new fixed investment in all of the benchmark years. In the accounts of Soviet enterprises, both genuinely new fixed investment and capital repair add to the value of fixed capital while depreciation and retirements detract from it. We assume that only half of the capital repair carried out in the U.S.S.R. actually adds to the useful life of the fixed capital—an arbitrary assumption that could make the capital repair values in table 2 too high or too low. More important, the ruble-dollar ratios for machinery and equipment and construction are almost certainly somewhat low. They were drawn from studies in which every effort was made to match the qualities of individual Soviet and American machinery items and construction components. Nonetheless, the matches inevitably omitted some aspects of quality—especially durability, ease of maintenance, and (in construction) workmanship—that favor the American product. For these reasons, the ruble price of a truly comparable Soviet product would be higher, the ruble-dollar ratio should be higher, and the dollar value of Soviet new fixed investment should be lower. Conversely, the ruble value of U.S. new fixed investment is probably understated using the same line of argument.

D. Outlays for Defense and Space

Relative to the United States, the U.S.S.R.'s most striking progress has been in the defense and space arena. The estimated dollar cost of Soviet defense programs was less than U.S. defense outlays in 1965 and substantially higher in 1977. The same trend is evident in the ruble comparisons, although they are subject to greater uncertainty. The index number effect is present in that Soviet expenditures are higher relative to U.S. expenditures in dollars than in rubles, but vigorous growth in Soviet outlays combined with a decline in U.S. outlays in most years since 1965 gave the U.S.S.R. a clear margin in this area in 1977.[20]

EXPENDITURES ON DEFENSE AND SPACE

	1965	1977
Billion 1976 rubles:		
U.S.S.R.	38	64
United States	60	49
Billion 1976 dollars:		
U.S.S.R.	90	133
United States	108	92
U.S.S.R. as percent of United States:		
Rubles	63	131
Dollars	83	145
Geometric mean comparison	72	138

The growth in the estimated cost of Soviet defense programs was predominantly due to rising outlays for procurement and maintenance of military hardware and research and development. Perhaps the most remarkable aspect of Soviet economic history over the past 25 years has been the U.S.S.R.'s success in supporting both civilian and military investment programs so lavishly. But the strain of continuously increasing the volume of production and responding to demand for greater sophistication and quality seems to be wearing on the Soviet machine-building sector. Judging by the discussion in Soviet periodicals, the U.S.S.R.'s perception of the opportunity cost of defense investment in terms of foregone civilian investment may be increasing.[21]

E. Administration and Other Outlays

Administration includes mainly the wages and material purchases allocated to general administrative bodies, the judiciary, police and fire protection, agricultural services, and various municipal services such as garbage collection and street maintenance. The U.S.S.R. and the United States spent roughly the same amount in real terms on this constellation of activities in 1955 (see table 4). Since 1955, the U.S.S.R. has cut back the growth in its cadres in economic administration, while U.S. spending has soared—particularly for civilian safety, which in-

[20] Estimates of Soviet outlays for defense and space in 1955 are not available on a basis consistent with the estimates for 1965 and 1975–77. The growth in the residual category—defense, space, and other outlays—between 1955 and 1965 provides an impression of the trends in Soviet and U.S. defense programs since defense is the major element in the residual. See Appendix B for a discussion of the nature and valuation of this residual. Arthur J. Alexander, Abraham S. Becker, and William E. Hoehn, Jr. discuss the cumulative impact of these trends in spending in The Significance of Divergent U.S.-U.S.S.R. Military Expenditure, Rand N–1000–AF. February 1969.

[21] See the analysis by F. Douglas Whitehouse and Ray Converse, "Soviet Industry: Recent Performance and Future Prospects," in this volume.

creased eight times during 1955–77. U.S. outlays for utilities and sanitation increased six times while expenditures for transportation and agricultural support quadrupled. By 1977, the United States was devoting far more resources to administration (broadly defined) than the U.S.S.R.

Comparisons in this category are especially treacherous because the activities covered may not be fully comparable. The Soviet government is extremely secretive on such matters; the ruble value of administrative services may be understated. In addition, administration services are by accounting convention equal to the deflated sum of outlays for wages and material purchases. If American workers in administration are more productive than their Soviet counterparts, the U.S. margin would be even greater. American employees in administration unquestionably have more fixed capital (business machines, communication links, specialized equipment) to work with than do Soviet employees; the relative quality of the labor force in terms of training, motivation, and supervision is a matter of conjecture.

EXPENDITURES ON ADMINISTRATION

	1955	1965	1977
Billion 1976 rubles:			
U.S.S.R.	6	7	12
United States	7	10	22
Billion 1976 dollars:			
U.S.S.R.	41	49	80
United States	44	64	137
U.S.S.R. as percent of United States:			
Rubles	85	71	54
Dollars	92	77	58
Geometric mean comparison	88	74	56

Other outlays are a residual end-use category comprising inventory change, net exports, military assistance, and—for the U.S.S.R.—a statistical discrepancy.[22] Ruble-dollar price ratios were not available to convert these components from one price base to another, so ruble values were translated to dollar values (and vice versa) by the average ruble-dollar ratio obtaining for the other components of GNP. In addition, both Soviet and U.S. outlays in this category are highly volatile. Fortunately, because they represent a tiny fraction of U.S. GNP and not much more of Soviet GNP, the treatment of other outlays should not distort noticeably the comparisons of total national product.

VI. Evaluation of the Results

Because of the wide gulf separating the processes of price determination in the United States and the U.S.S.R., how one should think of the comparisons presented above is not obvious. Of the two possibilities—measures of relative production potential and measures of real income—the first seems out of reach given the available information while the second is subject to some strong qualifications.

To measure production potential, prices in the two countries in the base year should satisfy the conditions governing producer equilib-

[22] The discrepancy is the result of using GNP by sector of origin as a control total for Soviet GNP and is the difference between the sector-of-origin total and the sum of identified end uses.

rium.[23] For the United States and especially for the U.S.S.R., the established prices used in the comparisons won't do; factor cost prices are required.[24] But in the U.S.S.R., indirect taxes—which fall almost entirely (although unevenly) on consumption—and an enormous bill for subsidies to agriculture and other sectors ensure that relative factor costs will be quite different from relative established (or market) prices.[25] At the same time, investment goods are effectively rationed and distributed at prices that probably do not fully recover production costs. Until these factor cost adjustments can be made in sufficient detail to avoid having to abandon the advantages of a large ruble-dollar ratio sample, a measure of relative production potential probably cannot be attempted.[26]

The comparisons are more valid as measures of real income differentials. Like all such comparisons, the Soviet-U.S. comparisons assume that the measures are invariant to different distributions of income within the countries and that Soviet and American tastes are the same.[27] Once the proposition of common tastes is accepted, the comparison of real incomes requires that relative prices be proportional to the relative marginal utilities of the goods and services as judged by the representative consumer in each of the two countries. Even for the United States the idea that government procurement agencies act so as to equilize the marginal utility of the last dollar spent strains credulity. For the U.S.S.R. the assumption that the population takes the prices fixed by the state as given and adjusts its purchases so as to maximize its utility with given incomes has appeal. The prevalence of queues and black markets, however, shows that at state prices the Soviet consumer would like to spend more than he is able to on some commodities. Thus, relative prices are not proportional to marginal utilities of goods and services over some part of the market.[28] That the Soviet government operates to maximize its utility (and indirectly, that of a representative consumer) in its decisions regarding investment and defense is impossible to accept. Relative prices play a small role in investment and defense decisions.

On balance, the U.S.S.R.–U.S. ratios of GNP probably are best interpreted as real income comparisons, with the geometric mean having the convenience and degree of justification discussed earlier. Although falling short of theoretical requirements, they perhaps do not suffer when judged against the results of the U.N.-sponsored international comparison project.[29] Included in the U.N. sample are a centrally-planned economy (Hungary) and several developing economies (Colombia, India, Iran, and the Philippines) that pose as much of a conceptual problem for real income comparisons as the U.S.S.R. does.

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[23] Budget expenditure planes should be tangent to production possibility surfaces.

[24] See, for example, the estimates for 1955 compiled by Abram Bergson, op. cit.

[25] In 1976, Soviet GNP in established price is estimated at 505 billion rubles. Turnover taxes amounted to 76 billion rubles, and allowances for all subsidized losses were 30 billion rubles.

[26] Even the use of factor-cost prices, however, can't overcome the ambiguities of a comparison of production potential if, as is frequently alleged, the U.S.S.R. is consistently operating well within its production possibility surface.

[27] See Irving B. Kravis, et al., A System of International Comparison of Gross Product and Purchasing Power (Baltimore: Johns Hopkins University Press, 1975), pp. 17–18, for a defense of the analogous assumptions for countries as different as Kenya and the United States.

[28] Aron Katsenelenboigen in "Coloured Markets in the Soviet Union," (Soviet Studies, January 1977, pp. 62–85) reviews the nature and extent of these markets.

[29] Kravis, et al., International Comparisons of Real Product and Purchasing Power.

If the comparisons qualify as measures of the relative size of real incomes in the U.S.S.R. and the United States, however, we believe they trace the upper bound of the ratios of Soviet to U.S. GNP for a number of reasons:

> The ruble-dollar ratios for consumer durables, machinery and equipment, and construction were not adjusted to account for quality differences beyond those reflected in the original matches.
>
> The ratios of established prices in the two countries ignore the substantial advantage that the American consumer has in terms of convenience, variety, and availability. These "services" are covered in the U.S. price but not in the Soviet counterpart. Therefore, the dollar value of Soviet output is overstated and the ruble value of U.S production is understated.
>
> The ruble-dollar ratios for services—especially health and education—probably are too high because they do not adjust adequately for the different qualifications of Soviet and American workers in health and education.

But reasonable analysts can and will differ on the interpretation and the statistical basis of these comparisons. Many years ago Rush V. Greenslade argued that the useful comparisons were those between components of GNP—like defense, fixed investment, and the elements of personal consumption.[30] He also said:

> The GNP ratios have a broad, general, far from precise meaning, one which tends to disappear if you try to pin it down. Like a faintly fragrant flower, it can be apprehended by gentle inhalations, but an attempt to extract the scented oil and subject it to chemical analysis will ruin it altogether.

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[30] Rush V. Greenslade, "Rubles Versus Dollars," unpublished CIA monograph, 1962.

Appendix A

TABLE A-1.—U.S.S.R.: GNP IN SELECTED YEARS

	Million 1976 rubles					Million 1976 dollars				
	1955	1965	1975	1976	1977	1955	1965	1975	1976	1977
Consumption	103, 701	171, 289	276, 827	285, 332	295, 310	257, 048	409, 938	623, 368	643, 739	664, 378
Food	60, 763	92, 361	135, 539	137, 380	140, 389	84, 461	121, 455	172, 406	175, 434	179, 136
Soft goods	17, 145	32, 895	58, 192	60, 928	63, 304	22, 837	44, 639	81, 062	84, 812	89, 069
Durables	3, 643	8, 667	24, 150	25, 840	28, 315	5, 075	12, 047	29, 704	33, 075	36, 215
Household services	8, 688	15, 589	28, 961	30, 685	32, 156	46, 613	81, 221	136, 039	142, 542	147, 893
Housing	2, 032	3, 143	4, 169	4, 268	4, 367	19, 704	30, 478	40, 427	41, 387	42, 347
Utilities	1, 139	2, 414	4, 712	4, 993	5, 212	4, 113	8, 717	17, 015	18, 030	18, 820
Personal transportation	1, 273	3, 456	7, 486	7, 926	8, 260	5, 644	15, 324	33, 193	35, 144	36, 625
Personal communications	396	785	1, 703	1, 812	1, 918	1, 263	2, 504	5, 433	5, 780	6, 118
Personal care and repair	1, 558	2, 113	5, 194	5, 566	5, 879	4, 407	5, 978	14, 694	15, 746	16, 632
Recreation	1, 679	2, 639	3, 253	3, 208	3, 223	9, 085	14, 280	17, 602	17, 358	17, 440
Automobile services	142	286	1, 186	1, 429	1, 743	219	442	1, 832	2, 208	2, 693
Miscellaneous	469	753	1, 258	1, 483	1, 554	2, 178	3, 498	5, 843	6, 889	7, 218
Health	4, 881	7, 675	10, 695	10, 908	11, 187	45, 475	68, 868	93, 938	95, 738	97, 387
Wages	3, 372	5, 042	6, 826	6, 955	7, 054	41, 988	62, 783	84, 997	86, 603	87, 836
Materials	1, 509	2, 633	3, 869	3, 953	4, 133	3, 487	6, 085	8, 941	9, 135	9, 551
Education	8, 581	14, 102	19, 290	19, 591	19, 959	52, 587	81, 708	110, 219	112, 138	114, 678
Wages	6, 986	10, 348	13, 783	14, 046	14, 414	48, 217	71, 422	95, 130	96, 945	99, 485
Materials	1, 595	3, 754	5, 507	5, 545	5, 545	4, 370	10, 286	15, 089	15, 193	15, 193
Investment	31, 615	71, 060	134, 548	141, 911	147, 003	85, 893	202, 024	366, 874	389, 710	405, 634
New fixed investment	28, 785	64, 228	120, 469	126, 893	131, 047	77, 499	181, 760	325, 116	345, 166	358, 309
Machinery and equipment	5, 984	18, 126	39, 832	43, 676	46, 166	27, 383	79, 736	149, 569	164, 003	173, 353
Construction	22, 801	46, 102	80, 637	83, 217	84, 881	50, 116	102, 024	175, 547	181, 163	184, 956
Capital repair	2, 830	6, 832	14, 079	15, 018	15, 956	8, 394	20, 264	41, 758	44, 544	47, 325
Defense and space	NA	38, 000	59, 000	62, 000	64, 000	NA	90, 000	127, 000	131, 000	133, 000
Administration	6, 113	7, 374	11, 243	11, 600	11, 984	40, 609	48, 985	74, 687	77, 059	79, 610
Other	32, 302	16, 242	4, 285	4, 532	4, 546	80, 060	42, 392	10, 605	11, 234	11, 301
Foreign trade	−2, 208	−5, 662	−13, 137	−14, 100	−14, 836					
Livestock inventories	2, 675	6, 896	−3, 014	880	3, 985					
Inventory change and statistical discrepancy	31, 835	15, 008	20, 436	17, 752	15, 397					
GNP	173, 731	303, 965	485, 903	505, 375	522, 843	463, 610	793, 339	1, 202, 534	1, 252, 742	1, 293, 923

TABLE A-2.—UNITED STATES: GNP IN SELECTED YEARS

	Million 1976 dollars					Million 1976 rubles				
	1955	1965	1975	1976	1977	1955	1965	1975	1976	1977
Consumption	560, 915	806, 616	1, 123, 314	1, 186, 251	1, 238, 404	414, 679	569, 467	759, 017	809, 573	849, 135
Food	159, 998	200, 017	230, 337	241, 982	250, 723	151, 406	191, 308	218, 451	230, 030	237, 1 57
Soft goods	67, 806	98, 198	136, 217	140, 206	144, 630	77, 570	101, 571	153, 244	158, 853	163, 866
Durables	66, 771	93, 471	143, 161	160, 460	175, 072	101, 826	139, 272	200, 712	225, 446	246, 326
Household services	194, 448	283, 380	401, 723	420, 338	437, 078	61, 854	88, 029	121, 991	127, 035	131, 191
Housing	62, 602	98, 918	153, 678	160, 472	167, 200	7, 137	11, 277	17, 519	18, 294	19, 061
Utilities	25, 284	36, 056	48, 649	50, 747	51, 865	9, 355	13, 341	18, 000	18, 776	19, 190
Personal transportation	7, 587	8, 284	9, 205	9, 426	9, 727	1, 441	1, 574	1, 749	1, 791	1, 848
Personal communications	5, 600	10, 435	20, 539	22, 184	23, 455	1, 977	3, 684	7, 250	7, 831	8, 280
Personal care and repair	28, 197	32, 934	28, 777	29, 354	30, 587	14, 352	16, 763	14, 647	14, 941	15, 569
Recreation	11, 716	15, 940	20, 866	21, 598	23, 511	1, 687	2, 295	3, 005	3, 110	3 386
Automobile services	26 738	40, 244	64, 596	65, 949	66, 783	17, 834	26, 843	43, 086	43, 988	44, 544
Miscellaneous	26, 724	40, 569	55, 413	60, 608	63, 950	8, 071	11, 252	16, 735	18, 304	19, 313
Health	38, 461	70, 279	111, 041	117, 947	122, 413	14, 000	25, 582	40, 419	42, 933	44, 558
Education	33, 431	61, 271	100, 835	105, 318	108, 488	8, 023	14, 705	24, 200	25, 276	26, 037
New fixed investment	166, 876	249, 478	261, 598	278, 200	305, 287	77, 739	118, 221	123, 137	131, 743	145, 216
Machinery and equipment	50, 864	82, 622	110, 614	116 365	128 878	18, 921	33, 792	47, 343	50, 502	56, 835
Construction	116, 012	166, 856	150, 984	161, 835	176, 409	58, 818	84, 429	75, 794	81, 241	88, 381
Defense and space	87, 187	108, 495	90, 127	91, 367	92, 104	(47, 953)	60, 352	46, 961	47, 788	48, 885
Administration	44, 363	63, 912	122, 211	127, 724	136, 855	7, 231	10, 418	19, 920	20, 819	22, 307
Other	20, 190	23, 964	9, 961	16, 582	9, 519	12, 861	14, 786	5, 916	9, 949	5, 721
Inventory change	12, 713	17, 225	−14, 884	10, 204	13, 544					
Net exports	2, 596	4, 312	23, 286	7, 444	−4, 722					
Military assistance	4, 881	2, 427	1, 559	−1, 066	697					
GNP	879, 531	1, 252, 465	1, 607, 211	1, 700, 124	1, 782, 169	560, 463	773, 244	954, 774	1, 019, 872	1, 071, 264

TABLE A–3.—U.S.S.R.- AND U.S.-WEIGHTED RUBLE-DOLLAR RATIOS, SELECTED YEARS

	Soviet-weighted ruble-dollar ratios					U.S.-weighted ruble-dollar ratios				
	1955	1965	1975	1976	1977	1955	1965	1975	1976	1977
Consumption	0.403	0.418	0.444	0.443	0.444	0.739	0.706	0.676	0.682	0.686
Food	.719	.760	.786	.783	.784	.946	.956	.948	.951	.947
Soft goods	.751	.737	.718	.718	.711	1.144	1.126	1.125	1.133	1.133
Durables	.718	.719	.813	.781	.782	1.525	1.490	1.402	1.405	1.407
Services excluding health and education	.186	.192	.213	.215	.217	.318	.311	.304	.302	.300
Housing	.103	.103	.103	.103	.103	.144	.144	.114	.114	.114
Utilities	.277	.277	.227	.277	.277	.370	.370	.370	.370	.370
Personal transportation	.226	.226	.226	.226	.226	.190	.190	.190	.190	.190
Personal communications	.313	.313	.313	.313	.313	.353	.353	.353	.353	.353
Personal care and repair	.353	.353	.353	.353	.353	.509	.509	.509	.509	.509
Recreation	.185	.185	.185	.185	.185	.144	.144	.144	.144	.144
Automobile services	.647	.647	.647	.647	.647	.667	.667	.667	.667	.667
Miscellaneous	.215	.215	.215	.215	.215	.302	.302	.302	.302	.302
Health	.107	.111	.114	.114	.115	.364	.364	.364	.364	.364
Wages	.080	.080	.080	.080	.080					
Materials	.433	.433	.433	.433	.433					
Education	.163	.153	.155	.155	.154	.240	.240	.240	.240	.240
Wages	.145	.145	.145	.145	.145					
Materials	.365	.365	.365	.365	.365					
Investment	.368	.352	.367	.364	.362	.466	.474	.471	.474	.476
New fixed	.371	.353	.370	.368	.366					
Machinery and equipment	.218	.227	.266	.266	.266	.372	.409	.428	.434	.441
Construction and other	.455	.452	.459	.459	.459	.507	.506	.502	.502	.501
Capital repair	.337	.337	.337	.337	.337					
Administration	.151	.151	.151	.151	.151	.163	.163	.163	.163	.163
Defense and space[1]	NA	.422	.465	.473	.481	.550	.556	.521	.523	.531
GNP	.395	.383	.404	.403	.404	.637	.617	.594	.600	.601

[1] The U.S.-weighted ruble-dollar ratio for 1955 is extrapolated from 1965–77 trends. See app. B. sec. C.

TABLE A–4.—U.S.S.R. AND UNITED STATES: GNP

[In million 1976 dollars [1]]

	1955		1965		1975		1976		1977	
	U.S.S.R.	United States	U.S.S.R.	United States	U.S.S.R.	United States	U.S.S.R.	United States	U.S.S.R.	United States
Consumption	189, 589	560, 915	316, 193	806, 616	512, 231	1, 123, 314	539, 379	1, 186, 251	533, 752	1, 238, 404
Food	73, 599	159, 998	108, 209	200, 017	156, 859	230, 337	159, 224	241, 981	162, 970	250, 723
Soft goods	18, 511	67, 806	36, 137	98, 198	64, 839	136, 217	67, 592	140, 206	70, 579	144, 630
Durables	3, 472	66, 771	8, 319	93, 471	22, 619	143, 161	24, 550	160, 460	26, 961	175, 072
Household services	35, 584	194, 448	63, 760	283, 380	113, 688	401, 723	138, 836	420, 338	125, 878	437, 078
Housing	18, 781	62, 602	28, 983	98, 918	38, 410	153, 678	39, 316	160, 472	40, 295	167, 200
Utilities	3, 565	25, 284	7, 536	36, 056	14, 741	48, 649	15, 579	50, 747	16, 286	51, 865
Personal transportation	6, 153	7, 587	16, 700	8, 284	36, 166	9, 205	38, 279	9, 426	39, 910	9, 727
Personal communications	1, 193	5, 600	2, 358	10, 435	5, 114	20, 539	5, 435	22, 184	5, 770	23, 455
Personal care and repair	3, 666	28, 197	4, 973	32, 934	12, 259	28, 777	13, 121	29, 354	13, 856	30, 587
Recreation	10, 287	11, 716	16, 179	15, 940	20, 553	20, 866	19, 676	21, 598	19, 749	23, 511
Automotive services	214	26, 738	443	40, 244	1, 809	64, 596	2, 110	65, 949	2, 671	66, 783
Miscellaneous	1, 817	26, 724	2, 921	40, 569	4, 876	55, 413	5, 320	60, 608	6, 075	63, 950
Health	24, 692	38, 461	38, 091	70, 279	52, 522	111, 041	53, 548	117, 947	54, 719	122, 413
Education	43, 360	33, 331	69, 298	61, 271	94, 079	100, 835	95, 629	105, 318	97, 639	108, 488
New fixed investment	76, 429	166, 876	174, 136	249, 478	268, 148	261, 598	341, 630	278, 200	354, 133	305, 287
Machinery and equipment	20, 956	50, 864	59, 488	82, 622	117, 915	110, 614	128, 467	116, 365	134, 678	128, 878
Construction	47, 449	116, 012	96, 443	166, 856	167, 894	150, 984	173, 163	161, 835	176, 938	176, 409
Defense and space	NA	87, 187	78, 441	108, 495	119, 869	90, 172	124, 716	91, 367	126, 643	92, 104
Administration	38, 995	44, 363	47, 039	63, 912	71, 738	122, 211	74, 080	127, 724	76, 502	136, 855
Other	63, 720	20, 190	33, 406	23, 964	8, 746	9, 661	9, 220	16, 582	9, 243	9, 519
GNP	355, 331	879, 531	624, 980	1, 252, 465	991, 649	1, 607, 211	1, 028, 575	1, 700, 124	1, 060, 391	1, 782, 169

[1] The sum of end-use components of Soviet GNP valued in dollars does not equal the dollar value of aggregate GNP, nor do the values of end-use components (e.g., consumption) equal the sum of subcomponents. This is the result of using geometric average ruble-dollar ratios to convert ruble values to dollar values. Nevertheless, the individual end-use components are not adjusted to agree with the total because the United States-U.S.S.R. comparisons shown are believed to give the best available summary description of relative size.

Appendix B

The End-Use Comparisons: Coverage and Methods

Comparisons of U.S. and Soviet GNP by major end uses—consumption, investment, administration, defense, and other outlays—were presented above. Each of these expenditure categories and their ruble dollar ratios are described below.

A. Consumption

Consumption includes all household outlays on goods and services plus current government expenditures on health and education. In the U.S.S.R. the state is responsible for practically all outlays for education while in the U.S. households have a significant share. Total consumption is in turn divided into six subcategories: food, soft goods, durables, personal services, health, and education.

Ruble-dollar ratios for consumption are taken from a forthcoming study of consumption based on 1976 price ratios for 250 individual consumer goods and services. The food ratio is an average of ratios for 18 groups of food products. The ruble side of the food ruble-dollar ratios consists of weighted average prices of food sold in state retail stores, and on collective farm markets. Food produced and consumed on farms is also included, valued at average prices received by farmers for urban marketings. The dollar side of the food ratios consists of comparable weighted average prices including sales tax. Ratios are compiled for 15 groups of soft goods and for 14 groups of durables. For each benchmark year, group ratios are aggregated using—alternatively—U.S. and Soviet outlays in that year expressed in 1976 prices as weights.

Overall ratios for food, soft goods, and durables differ somewhat among benchmark years because of the changing physical composition of purchases. To reflect these changes in the aggregate ratios, the group ratios in 1976 prices were aggregated with expenditure weights of each benchmark year expressed in 1976 prices. Table A–3 shows that year-to-year differences in aggregate ruble-dollar ratios are not large.

U.S. data for benchmark years in 1976 prices are readily available for weighting group ratios. Ruble data for benchmark years are derived by moving 1976 expenditure weights for subcategories of consumption (bread, meat, and the like) with indexes based on 1970 prices. This approach should give acceptable results. Relative Soviet prices within categories of consumption probably have not changed sufficiently during 1970–76 to rule out the use of 1970-based indexes.

In matching commodities to obtain price ratios, the major criterion was the ability of the product to perform the function for which it was intended rather than its material content or specifications. Esthetic properties and matters of taste were largely ignored. To find matching prices for the Soviet man's two-piece suit, for example, the U.S. product chosen was similar in general characteristics—design, type and weight of fabric and intended use. The fiber content was not necessarily identical to the Soviet model nor were the details of design and construction. The two suits needed only to be approximately equal with respect to comfort, durability, and craftsmanship.

Despite careful matching on a performance basis, the problem of relative quality still exists. The task of matching qualities was eased somewhat by having 20 Soviet food products and 150 other consumer goods evaluated by U.S. manufacturers of like products. The Soviet products were purchased in the U.S.S.R. and given to U.S. producers who identified U.S. products that they believed corresponded most closely to the Soviet items. Occasionally the Soviet items were so poor that an appropriate price match could not be found in a regular U.S. product line. Thus, in some cases, goods sold in the U.S. as "seconds" or irregulars provided the best match.

Expert evaluation substantially reduces the quality problem for soft goods and durables. For most of the food items it was necessary to make an arbitrary price reduction of 5–20 percent on U.S. prices where their Soviet counterparts were judged inferior. Soviet meat, for example, compares especially unfavorably with its U.S. counterpart.

Comparisons of personal services are made for housing, utilities, personal transportation, personal communications, automobile services (gas, oil, and maintenance), recreation, personal care and repair, and miscellaneous services.[a]

[a] For the U.S. miscellaneous services cover mainly financial services that have no counterpart in the U.S.S.R. The miscellaneous category was converted using an average ruble-dollar ratio for all services.

Establishing standard specifications for personal services is more difficult than for consumer goods. Accounting for quality differences is especially difficult. Although Soviet services are generally inferior in quality to their U.S. counterparts, no overall adjustment has been made.

Ruble-dollar ratios for personal services are based on national average prices for individual services such as monthly telephone service, a city bus ticket, a hotel room, and the like. An estimate of privately supplied services has been included on the Soviet side of the comparisons. Prices of privately supplied services have been included in the ruble-dollar ratios for these services. Privately rendered services amount to about 2 billion rubles and consist of repair services for housing, clothing, shoes, and other goods.[32] Slightly more than half of privately rendered services are allocated to housing as maintenance outlays. The remainder is counted with repair and personal care and amounts to 12.5 percent of these outlays.

The weak link in the services comparison is housing. There is no Soviet counterpart for the U.S. single family housing that comprises the bulk of housing in the U.S. The ruble-dollar ratio for housing is based on national average rental rates per square meter. The ruble price does not include the large Soviet subsidies on housing. For the U.S., average rental rate is derived from the relationship between U.S. rents and various housing characteristics presented in the United Nations-sponsored international comparisons.[33] The U.N. study isolated the effects on rent of such variables as date of construction, plumbing facilities, and number of rooms. The average rental in the U.S. deemed reasonably comparable to the rate for an "average" Soviet apartment is for a two-room apartment in a multiple unit in deteriorating condition. The unit is assumed to have been built in the 1950–55 period and to have no bathroom, a shared bathroom, or a private bath with flush toilet only. For the U.S.S.R., the only information available is a national average rental rate per square meter.[34] The ruble-dollar ratio for housing used in this paper is the weighted sum of ratios for rent per square meter and for maintenance. Ratios for maintenance are based on prices of building materials such as plywood, Portland cement, and paint. An estimate of labor charges is included. In the U.S.S.R., maintenance outlays in 1976 accounted for 36 percent of total housing expenditures. In the U.S., maintenance amounted to only 10 percent of housing outlays.

Ruble-dollar ratios for health and education are based on inputs—wages and current material purchases.[35] No tangible measure of output of these services exists that can be priced in a comparison. The drawback of the input method is that it ignores capital inputs and implies equal productivity in U.S. and Soviet health and education or that a correction can be made for unequal productivity. The input method also assumes equal quality of service. Soviet health and education are cerainly inferior both in productivity and quality to their U.S. counterparts. No correction has been made for these differences.

For health, average annual wages were compared for 9 categories of workers: physicians, dentists, nurses, pharmacists, technologists, technicians, practical nurses, and orderies. Average annual wages are estimated from Soviet data on basic wage rates for these fields. Basic wage rates are raised to compensate for dual job-holding to approximate more closely average annual earnings. Wage ratios are aggregated using both U.S. and Soviet expenditure weights. The two aggregate wage ratios vary little. In both countries, approximately one third of wage outlays are for physicians and about 15 percent are for aides, orderlies, and the like. Differences are more pronounced for other employment categories. Practical nurses and registered nurses together account for 32 percent of U.S. wage outlays. Their Soviet counterparts, feldshers and nurses, account for 42 percent of Soviet wage outlays in health. The final wage ratios are used to convert total wage expenditure from rubles to dollars and vice versa.

Current material purchases in health are assumed to consist of food, soft goods, and utilities. Soviet weights for the three major categories come from U.S.S.R. state budget data; for the United States, the 1967 input-output table provides

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[32] CIA A (ER) 75–76, op. cit., p. 42.

[33] Irving Kravis, et al., A System of International Comparisons of Gross Product and Purchasing Power.

[34] CIA A (ER) 75–76, op. cit., uses 1.46 rubles per square meter per year cited from a 1972 Soviet source.

[35] Charges for fixed capital services are excluded on both sides. In the United States, the soaring costs of increasingly sophisticated hospital equipment used for diagnosis and treatment has been a major cause of the rise in health expenditures. Present comparisons understate the U.S. advantage in health care because ruble-dollar ratios for medical equipment are almost certain to be higher than those for wages or hospital supplies.

outlays of state and local governments on health and hospitals. Ruble-dollar ratios applied to food purchased in the health sector exclude alcohol and tobacco. Purchases of utilities services are converted using the ratios for household outlays for utilities. The soft goods ratio assumes that Soviet and U.S. purchases of soft goods in the health sector have identical physical composition. Dollar outlays for six groups of soft goods are converted to rubles using U.S. weighted ruble-dollar ratios. The structure of the ruble outlays is used in turn to aggregate the Soviet-weighted dollar-ruble ratios.

Comparisons of education rely on a method like that used for health. The scarcity of Soviet data permitted comparisons for only two categories of employment—primary-secondary education and higher education. Ratios for material purchases in education were derived from the same sources using the same methods as those for material outlays on health.[36]

B. Investment

Comparisons are made for gross fixed investment in machinery, equipment, and construction. Investment comparisons exclude inventory change, net additions to livestock herds, and stockpiling, which are included in other outlays.

Capital repair outlays are the sum of Soviet outlays on noncurrent repair of fixed assets. Unlike current maintenance outlays, capital repair outlays are not written off as current costs but are capitalized. The book value of the asset is raised to reflect this type of repair which is supposed to extend the service life of the asset.

Half of Soviet outlays on capital repair have been excluded in U.S.-U.S.S.R. comparisons of new fixed investment. This compromise is adopted because repair outlays are rarely capitalized in the United States for tax reasons while in the U.S.S.R. capital repair is an accepted alternative to new investment and represents an increment in the value of fixed capital.

Ruble-dollar ratios for machinery and equipment are taken from a forthcoming study that compares U.S. and Soviet machinery prices for a sample of 245 items. Soviet prices were found in a series of 150 price handbooks published during 1972–73 for use in revaluing fixed capital for the U.S.S.R.'s 10-year capital census. The handbooks provided purchaser's prices of July 1, 1967. The machinery sample was selected to include custom-made items, mass production items, and items incorporating conventional and advanced technology.

As with consumer goods, matching of U.S. and Soviet machinery relied on performance rather than physical dimensions. Prices and technical descriptions for U.S. machinery were compiled by Battelle Columbus Laboratories.[37] Adjustments to reflect the generally lower quality and smaller productive capacity of Soviet machinery are incomplete, however. In addition, no adjustment has been made to offset the implicit understatement of the U.S.-weighted ruble-dollar ratio that results from the lack of price matches for the many items of machinery that the U.S.S.R. does not produce or produces only with great difficulty.[38]

The machinery sample was used to derive Soviet-weighted ruble-dollar ratios for 21 categories of machinery. The Soviet category weights used to derive a single ratio for all machinery were taken from the 1972 input-output table.[39] U.S. weights for 36 categories of machinery were derived from their relative importance in the 1972 U.S. wholesale price index.

Machinery ratios were originally compiled in 1967 rubles and 1972 dollars. Because the GNP comparisons are in 1976 prices, the machinery ratios had to be adjusted. Dollar price indexes for private purchases of producer durables are readily available in U.S. GNP accounts. Moving 1967 ruble prices to 1976 was far more troublesome. Official Soviet indexes of machinery prices, which report a 2.5 percent decline in average machinery prices in 1968–76 are believed to understate increases in Soviet machinery prices. One Western study, for example, estimates inflation in Soviet machinery prices at about 3 percent per year over the

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[36] For a complete discussion of the many difficulties in making international comparisons of health and education, see Irving Kravis et al., op. cit., pp. 94–104.

[37] Unpublished.

[38] The article in this volume by James Grant (Soviet Machine Tools: Lagging Technology and Rising Imports) discusses the tendency of ruble-dollar ratios for machine tools to rise as complexity increases.

[39] Vladimir Treml, et al., "The 1972 Soviet Input-Output Table and the Changing Structure of the Soviet Economy," in this volume.

last 10 years.[40] Since no reliable ruble price index is available, machinery ratios are expressed in 1967 rubles and 1976 dollars. Furthermore, no attempt was made to correct official data on investment in machinery and equipment for price changes. Investment in machinery and equipment is expressed in investment prices of 1969 and is therefore, compatible with the ruble-dollar ratios. Soviet investment data in 1976 prices were rejected because they imply that investment prices declined between 1969 and 1976.

The ruble-dollar ratios for construction are based on a sample of 277 construction projects representing a broad cross section of construction. The individual ratios were grouped into 8 construction categories to mesh with categories used in each country's published data on construction expenditures. Construction ratios also rely on the U.S.S.R.'s 1972–73 capital census handbooks, which provided simplified formulas for cost per square meter of construction of various sizes and specifications. These ruble costs were adjusted upward by 20 percent to allow for cost overruns.

Soviet construction quality is decidedly inferior. Many aspects of inferiority relate only to appearance. Other aspects reflect the Soviet attitude toward maintenance. The quality problem was handled by arranging the comparisons so that the highest quality Soviet construction was matched with average and poor quality U.S. construction. This procedure is abritrary and does not eliminate the problem although the correction moves in the proper direction.

Ruble-dollar ratios for the various categories of machinery and equipment and construction were weighted with 1955, 1965, and 1976 expenditure weights to derive overall ratios for new fixed investment. The overall ratios take into account the shifting composition of outlays over time. Ample data are available to convert U.S. private purchases of producer durables in 1955, 1965, 1975, and 1977 to 1976 prices. The distribution of Soviet investment in machinery by type for other years in 1976 prices is not readily available. Instead, deliveries of machinery to the column in the 1959 and 1966 Soviet input-output tables representing investment, capital repair, inventory change, and military uses were used to derive weights for 1955 and 1965. Although these values reflect both changes in price and quantity between 1959 and 1972, using these weights is preferable to using the same aggregate ratio to convert Soviet machinery outlays to dollars for all benchmark years.

Ruble-dollar ratios for Soviet construction, originally estimated in 1970 prices, were updated to 1976 prices for this paper. A price index for Soviet construction was derived by comparing the estimated value of construction in current prices with the construction component of investment in 1976 prices. The ruble-dollar ratio for construction and ruble values for investment in 1955, 1965, and 1975 are updated to 1976 prices using this index. Table A–3 shows U.S. and Soviet-weighted ruble-dollar ratios for investment .

Data on capital repair outlays are available in Soviet sources for some years and estimated for other years. The dollar-ruble ratio used to convert capital repair outlays to dollars is a simple average of ratios for machinery and equipment and construction.

C. Defense and Space

Defense outlays in both countries include outlays on military equipment, construction, personnel (excluding transfer payments in the form of pensions), maintenance, RDT&E, and defense-related atomic energy programs. Outlays on space programs comparable to those funded by NASA have been added.

This study uses U.S. defense outlays and price deflators from U.S. GNP accounts. Our figures for U.S. defense outlays in 1965 and 1975–77 in 1976 prices differ from deflated defense outlays derived from the U.S. budget, and the Five-Year Defense Program, which are used by the intelligence community for comparisons of U.S. and Soviet military activities. The difference is partly explained by the substantial difference in the two data bases. Defense outlays in U.S. GNP accounts are the sum of actual disbursements in the calendar year as reported by the U.S. Department of the Treasury. Deflated budget outlays shown below are derived by converting budget obligations to estimated actual outlays using Department of Defense spendout rates. In addition, the GNP and budget estimates have slightly different coverage. Budget estimates include outlays for defense-related activities of the Coast Guard while GNP data do not.[41] GNP ac-

[40] James E. Steiner, Inflation in Soviet Industry and Machine-building and Metalworking (MBMW), 1960–1975. CIA SRM 78–10142. 28 July 1978.

[41] Outlays for Coast Guard-like activities are also included in ruble and dollar estimates of Soviet defense spending.

counts exclude net interest paid, grants-in-aid to state and local governments, and the increase in monetary advances (less payables) for defense purchases. These spending categories may be included in the budget data. Finally, much of the discrepancy arises from differences between the price deflators associated with the GNP accounts and those estimated by the Department of Defense. Both estimates of U.S. defense spending are shown below.

	1955	1965	1975	1976	1977
U.S. defense and space outlays in billion 1976 dollars:					
Budget data	NA	112.0	90.0	90.0	90.0
GNP data	87.2	108.5	90.1	91.4	92.1

U.S.-weighted ruble-dollar ratios for defense and space, based on budget definitions, were prepared especially for this paper for 1965, and 1975–1977.[42] The figures for the ruble cost of U.S. defense programs according to the GNP definition were derived by multiplying the dollar values from U.S. GNP accounts by these U.S.-weighted ruble-dollar ratios:[43]

	1955	1965	1975	1976	1977
Estimated ruble-dollar ratios for defense and space (U.S. weights):					
Defense	(0.55)	0.540	0.522	0.524	0.532
Space programs		.700	.500	.500	.500
Weighted average	(.55)	.556	.521	.523	.531

The resulting ruble values for U.S. defense programs, although nominally in 1976 prices, are actually a hybrid of 1970 and 1976 prices. U.S. (and Soviet) ruble figures for military research, testing and evaluation as well as personnel costs were calculated in 1976 ruble prices. Reliable price indexes were lacking to move remaining expenditures, which account for more than half the total in recent years to 1976 prices.[44]

Data for Soviet defense spending in 1976 rubles are available for 1965 and 1975–77.[45] Dollar costs of Soviet defense programs are also available for these years.[46] Soviet defense spending has not yet been estimated for 1955 on the same basis as the estimates for 1965 and 1975–77. Ruble outlays are implicitly included in the residual GNP category "other outlays." The entire residual is converted to dollars using (1) the overall Soviet-weighted dollar-ruble ratio derived from dollar and ruble totals for consumption, investment and administration, and (2) the defense dollar-ruble ratio for 1965. The two ratios are weighted together assuming arbitrarily that defense accounts for two-thirds of the residual. Soviet-weighted 1976 ruble-dollar ratios for defense and space are shown in the following tabulation.

	1955	1965	1975	1976	1977
Estimated ruble-dollar ratios for defense and space (Soviet weights):					
Defense	NA	0.412	0.454	0.464	0.472
Space programs	NA	.600	.667	.667	.667
Weighted average	NA	.422	.465	.473	.481

[42] Unpublished.

[43] The ratio for 1955 is an arbitrary estimate based on the trends in the ratios for 1965 and 1975. All ratios are calculated from unrounded data.

[44] The use of ruble-dollar ratios that reflect ruble prices other than those for 1976 should not bias the comparisons greatly; the ratios are applied to components of GNP that are valued in the same pre-1976 prices.

[45] CIA SR78–10121, Estimated Soviet Defense Spending: Trends and Prospects, June, 1978. Data in this publication for 1975–77 were updated to 1976 rubles for the present study; 1965 data are unpublished. In the publication cited, Soviet defense spending is expressed as a range; the values in this paper are the midpoints of the ranges.

[46] CIA SR79–10004, A Dollar Cost Comparison of Soviet and U.S. Defense Activities, 1968–1978; 1965 data are unpublished. In the publication cited, Soviet defense spending is expressed as a range; the values in this paper are the midpoints of the ranges.

D. Administration

For the U.S.S.R. this category is the sum of estimated outlays on general agricultural programs, the forest economy, state administrative bodies at all levels, and municipal and related services (including police). For the U.S., this category is a residual of current government outlays on goods and services not classified elsewhere. Some of the large categories of administration expenditure are central administration and management, public safety, natural resources, and agriculture. The total for the two countries may not be entirely comparable, and Soviet outlays may be understated. The U.S.S.R. is notoriously secretive about such matters as expenditures for police and fire protection, for example.

Ruble-dollar ratios for administration are based on inputs of manpower and materials. The dollar side of the wage ratio is based on the average salary of federal civilian employees and state and local government employees not employed in education. The ruble side of the wage ratio is the average annual salary of employees in Soviet administration categories listed above.

Current material outlays in administration are assumed to consist of food, soft goods, and utilities. The category ratios are taken from consumption comparisons. U.S. weights are derived from 1967 input-output data on state and local purchases for general government. Soviet weights are derived from the 1966 Latvian input-output table which lists purchases for Administration and Roads.[47] The U.S.S.R. state budget does not give a breakdown of current purchases for Administration. Total budget purchases are heavily weighted with food outlays in health and education and therefore not representative of Administration. The Latvian data are old, but probably present a reasonably accurate estimate of the structure of purchases for Administration.

E. Other Outlays

For the U.S.S.R., other outlays are the difference between total GNP and the sum of consumption, investment, defense, and administration.[48] Total GNP in 1976 prices for the benchmark years is derived by moving 1976 GNP backward and forward with an index of GNP by sector of origin in 1970 prices. Conceptually, other outlays in Soviet GNP consist of net exports, inventory change, and any statistical discrepancy. Livestock inventories have been transferred to other outlays from investment.

A portion of state budget revenue derives from accounting profits of foreign trade organizations that buy imports and sell them domestically at a profit. Some of the profits are offset by losses incurred in selling exports abroad at a loss. To measure only domestic productive activity, net accounting profits are excluded from value added. Since total GNP is measured by moving 1976 GNP with an index of GNP by sector of origin that excludes these profits, they must also be excluded from the components of GNP by end use. Insufficient data exist to allocate accounting profits of foreign trade organizations to individual end use categories; total profits are therefore included as a negative item in other outlays.

Accounting profits are estimated for 1976 as 25 percent of residual state budget revenues. The revenue residual is the difference between total state budget revenue from the socialist economy and the sum of identified sources of these revenues. Three-fourths of the residual is arbitrarily assigned to current charges. The remaining share is assumed to represent accounting profits of foreign trade organizations.[49] Foreign trade earnings for other years are estimated by moving the 1976 figure backward and forward with the official Soviet index of foreign trade turnover in constant prices.

For the U.S., other outlays include net exports, inventory change, and foreign military assistance. Total GNP in 1976 prices is the sum of consumption, investment, defense, administration, and other outlays.

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[47] M. Shmulder et al. Dinamika mezhotraslevyykh i mezhrespublikanskikh ekonomicheskikh svyazey Latviyskoy SSR. Riga, 1971, p. 139.

[48] For the year 1955 other outlays also include defense.

[49] In theory, the 25 percent share also includes income from sale of state property, amounts recovered from pilferage and other irregular payments to the budget. No effort has been made to separate these from foreign trade income. For a full discussion of the issues involved see A. S. Becker, Soviet National Income, 1958–1964. (Berkeley, University of California Press), 1969, pp. 367–370 and CIA A(ER) 75–76, op. cit., p. 47.

Ruble-dollar conversion ratios for other outlays are the overall ratios implied in each benchmark year for the sum of consumption, investment, defense, and administration.[50] The following tabulation shows the ratios used.

	1955	1965	1975	1976	1977
Overall ratio:					
Soviets weights	0.403	0.383	0.404	0.403	0.402
U.S. weights	.637	.617	.594	.600	.601

[50] The treatment of other outlays in Soviet GNP for 1955 is explained in the discussion of defense outlays, sec. C, above.

SOVIET INDUSTRY: RECENT PERFORMANCE AND FUTURE PROSPECTS

(By F. Douglas Whitehouse and Ray Converse*)

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SUMMARY

After 25 years of sustained high rates of growth, fueled by even larger increases in new capacity, Soviet industry is entering a period of increasing strain. Rising costs of raw materials, impending energy shortages, slowing growth in labor and capital resources, and sluggish productivity—all point to a major slowdown in industrial growth from now through much of the 1980s. Indeed the lackluster performance of this section during the past three years, whether gauged

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by Western measures or Soviet official statistics, suggests that some of these problems already are beginning to take their toll.

Since 1975, heavy industry has slowed sharply and, with it, the wherewithal to maintain rapid rates of growth simultaneously in investment goods, defense hardware, and consumer durables. Shortfalls in the production of key industrial commodities—especially steel, construction materials, and machinery have been a major factor in this slowdown. In the energy sector, growth in oil output and coal production also is slowing. Growth in these products since 1975 has been the lowest in the post-World War II period, reflecting an approach to resource management that has emphasized short-term exploitation at the expense of maximum lifetime recovery. Moreover, the Soviet record in bringing new capacity on stream during the last three years has been dismal. And this has delayed the introduction of labor-and materials-saving technology which, in turn, is hampering current efforts to conserve resources.

To some extent, the recent decline in industrial growth reflects increasing tension between demand for and supply of labor, capital, and natural resources. But more important, it reflects the Soviet failure to use resources more efficiently. While productivity has never been the primary engine of Soviet industrial growth, in recent years declining productivity has constrained growth. Thus, Soviet leaders are under increasing pressure to reconcile industrial capabilities with resource constraints. As yet, however, no clear strategy has emerged. Instead the leadership seems to have adopted a crisis management approach: throwing a larger share of investment resources into the hard-pressed energy and ferrous metals sectors to maintain the flow of raw materials to the rest of the industry and to other sectors of the economy. With ever rising capital costs in extractive industries and smaller increments to total investment, however, a continuation of this approach could squeeze the investment resources of other claimants. This may increase tension within the leadership over civilian vs. military resource allocation decisions, the more so as marginal changes in resource allocations take on increasing importance in the 1980s.

Even without this complication, resource allocation decisions are not likely to get any easier for industrial planners in the years ahead. The greater role of Siberia as the source of future increases in raw materials means that investment projects will be more costly and their payoff further away. Thus, Soviet planners will have to make judgments about the cost-benefit ratios of alternative projects whose major benefits and unknown costs may lie chiefly in externalities that are as yet dimly perceived. To the extent that planners continue to apply short-run criteria to long-run investment decisions, industrial and economic growth is likely to fall still further in the 1980s and beyond.

I. Introduction

Soviet industrial production—the traditional mainstay of growth in GNP—has slowed abruptly in reecnt years, from an average annual growth of about 6 percent in 1971–75 to less than 4 percent in 1976–78. Production of an unprecedented number of commodities fell short of target in the latter period. The output of industrial materials increased by less than 3 percent per year, with record low growth rates posted in

ferrous metals, construction materials, electric power and crude oil. Although recurrent shortages are endemic in the Soviet economy, the stringencies encountered during the last three years have been unusually severe reflecting problems which have become mutually reinforcing and which likely will constrain industrial growth even more severely in the years ahead.

Therefore, the purpose of this paper is: (1) to present an overview of the indexes used to measure change in Soviet industrial production; (2) to describe recent trends in the output of major industrial branches and the conditions underlying these trends; and (3) to assess current Soviet growth strategy, its conflicts, and its potential.

II. The Revised Index of Industrial Production: An Overview

Reliable measures of change in the level of Soviet industrial production over time are needed both to compute gross national product and to analyze trends within the economy. While the Soviet government publishes official indexes of gross value of ouput (GVO) for total industry and several components, Western scholars have widely recognized the upward bias of these official measures. Specifically, double-counting and disguised inflation—the latter entering the indexes via the mechanism of new-product pricing—have been cited as major sources of distortion in the official indexes.[1]

The Office of Economic Research of the CIA maintains independent indexes of Soviet industrial production that attempt to minimize the distortions caused by double-counting and disguised inflation. Revisions in these indexes and in their methodological basis have occurred from time to time and have been set forth in previous JEC compendia. Since their appearance in the 1973 JEC compendium, the most significant revisions to these indexes include:[2]

The substitution of 1970 value-added weights in place of 1968 weights for the branches of industry.

The use of 1 July 1967 or later prices for all portions of the index. Formerly, consumer nondurables and some producer durables relied on 1955 producer prices.

Expansion of the product sample and disaggregation of some products previously treated as homogenous to allow for changes in the output mix over time.

The aggregation of products into input-output sectors and the use of an input-output table to reduce double-counting resulting from intra-branch transactions.

The transfer of consumer automobiles from producer durables to consumer durables.

Construction of the producer durables index by combining the relevant machinery sectors with estimated 1970 value-added

[1] The writings of Rush V. Greenslade are especially prolific on these points. In particular, see "Industrial Production Statistics in the U.S.S.R.," in Vladimir G. Treml and John P. Hardt, Soviet Economic Statistics, 1972, pp. 155–194, "Industrial Production in the U.S.S.R." (with Wade Robertson) in *Soviet Economic Prospects for the Seventies*, June 27, 1973, pp. 270–282, and "The Real Gross National Product of the U.S.S.R., 1950–75," in *Soviet Economy in a New Perspective*, Oct. 14, 1976, pp. 269–300.

[2] Greenslade and Robertson, "Industrial Production in the U.S.S.R.," op. cit. The current set of revisions constitute a major methodological change in the index, the full details of which will be elaborated in a forthcoming CIA publication. The indexes published in Greenslade, "The Real Gross National Product of the U.S.S.R., 1950–1975," op. cit., represent an intermediate step in the present set of revisions.

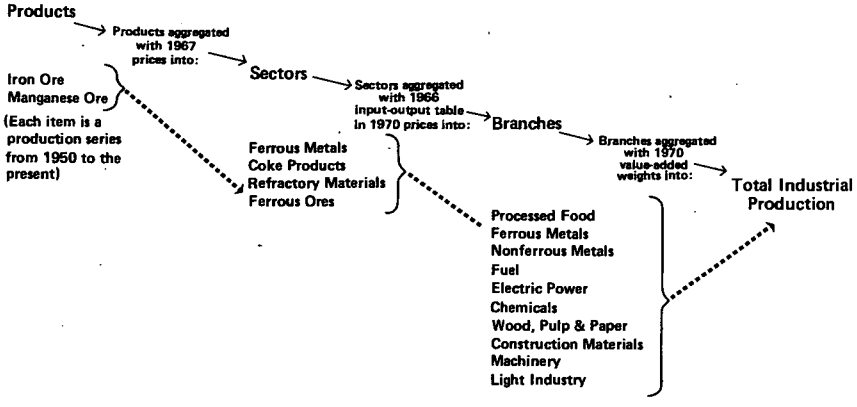
weights. Formerly, the producer durables index was derived by the summation of the gross output of all machinery products included in the sample.

The construction of an index of consumer durables parallel to that of producer durables.

The index of industrial production is patterned after the Federal Reserve Board index of U.S. industrial production, with some modifications (see figure 1). The backbone of the index is its product sample with more than 300 time series for individual items. Using 1 July 1967 enterprise wholesale prices as weights, the product sample is aggregated into 58 of the 75 sectors included in the 1966 input-output table in 1970 prices derived by Treml and Guill.[3] The resulting time series are used to represent the movement of each sector's GVO.

A Birds-Eye View of Index Structure

Figure 1



The 58 sector GVOs are then combined into ten major branches corresponding to the industrial branches reported in the annual Soviet statistical abstract (*Narodnoye khozyaystvo SSSR*).[4] For each branch (except machinery, discussed below) an input-output table, comprised of the rows and columns of those sectors included in the branch, was derived from the 1966 table in 1970 prices and used to net out intra-branch transactions. The remaining values of each sector's output (i.e., deliveries to all sectors outside the branch plus final demand) are summed to provide the value of branch output net of intra-branch consumption. A schematic diagram of this methodology is given in Appendix A. Indexes of net branch outputs are then aggregated with 1970 value-added weights to form the index of total industrial production.[5]

Machinery is an exception. Because the Soviets report production data for a sample of machinery products that more closely represent final demand than GVO, value-added weights, derived from the 1966

[3] Vladimir G. Treml and Gene D. Guill, "Conversion of the 1966 Producer's Price Table to a New Price Base," in Vladimir G. Treml, ed. *Studies in Soviet Input-Output Analysis*, pp. 197–281.

[4] Ferrous metals; nonferrous metals; fuel; electric power; chemicals; wood, pulp, and paper; construction materials; machinery; light industry; and processed food.

[5] For details on the derivation of the 1970 value-added weights see *CIA, U.S.S.R.: Gross National Product Accounts, 1970*, A (ER) 75–76, November 1975, p. 85.

input-output table in 1970 prices, are used to aggregate the production indexes of 21 machinery sectors. To allocate the value added to producer and consumer durables separately in each machinery sector, the share of value-added accounted for by consumer durables was assumed equal to the share of final demand delivered to private consumption. The remaining value-added was assumed to represent producer durables production.

The resultant index of total industrial production for 1950–1978 is shown together with the branch indexes in Appendix B. Growth rates for total industry and selected key branches are presented in table 1 for both the synthetic indexes described here and the official Soviet index of GVO. Differences in growth between the official Soviet indexes and our synthetic ones reflect mainly differences in the degree of double-counting and disguised inflation inherent in the two measures. The official Soviet index includes intermediate products which are used as inputs to other "final" products and thus are counted more than once in the production process. The synthetic index sharply limits the degree of double-counting by (1) use of input-output to eliminate intra-branch transactions and (2) use of value-added weights to aggregate the branch indexes.[6] The official Soviet index also includes the inflationary effect of "new, product pricing" which tends to bias real growth.[7] The synthetic index, on the other hand, relies on a large sample of physical quantities and 1967 prices to minimize the impact of inflation.

As shown in table 1, the synthetic indexes generally grow more slowly than the official ones, and the gap between them does not appear to be time dependent.[8] Moreover, the largest gaps between the official and synthetic indexes occur in the two branches that probably are subject to the most bias from disguised inflation, i.e., machinery and chemicals and petrochemicals. This suggests that the synthetic indexes are somewhat successful in eliminating the distortions in the official series.

TABLE 1.—U.S.S.R.: COMPARISON OF SYNTHETIC INDEXES OF INDUSTRIAL PRODUCTION WITH OFFICIAL SOVIET INDEXES

[Average annual rates of growth; in percent]

	1951–55	1956–60	1961–65	1966–70	1971–75	1976–78	1951–78
Total industry:							
Synthetic	10.6	9.8	6.6	6.3	5.9	3.8	7.4
Official	13.1	10.4	8.6	8.5	7.5	5.1	9.1
Difference [1]	2.5	.6	2.0	2.2	2.6	1.3	1.7
Ferrous metals:							
Synthetic	10.7	7.5	6.9	4.9	3.8	2.2	6.3
Official	12.1	8.8	8.0	5.7	5.1	3.0	7.4
Difference [1]	1.4	1.3	1.1	.8	1.3	.8	1.1
Nonferrous metals:							
Synthetic	12.8	6.9	7.7	8.1	5.9	2.1	7.6
Official	NA	NA	NA	NA	NA	NA	NA
Difference [2]	NA	NA	NA	NA	NA	NA	NA

See footnotes at end of table.

[6] Some double-counting no doubt remains in the synthetic indexes because a limited number of products enter the sample in value terms or as indexes of values.

[7] New product pricing is a phenomenon whereby new or marginally improved products are introduced into the index at a higher price than that warranted by either the cost of the improvement or the products' utility.

[8] A time dependent gap could indicate a change in the degree of double-counting or the rate of disguised inflation—a positive correlation suggesting that there is a systematic increase in double-counting or the rate of disguised inflation and a negative correlation suggesting the opposite.

TABLE 1.—U.S.S.R.: COMPARISON OF SYNTHETIC INDEXES OF INDUSTRIAL PRODUCTION WITH OFFICIAL SOVIET INDEXES—Continued

[Average annual rates of growth; in percent]—Continued

	1951–55	1956–60	1961–65	1966–70	1971–75	1976–78	1951–78
Fuels:							
Synthetic	9.4	8.9	6.1	5.0	5.0	3.6	6.5
Official	10.1	8.5	6.5	5.7	5.9	3.6	6.9
Difference[1]	.7	[3] −.4	.4	.7	.9	[4] 0.0	.4
Electric power:							
Synthetic	13.1	11.4	11.5	7.9	7.0	5.0	9.6
Official	14.4	13.1	12.3	9.0	7.1	5.4	10.5
Difference[1]	1.3	1.7	.8	1.1	.1	.4	.9
Chemicals and petrochemicals:							
Synthetic	11.2	10.7	11.5	8.6	8.6	4.7	9.5
Official	17.3	12.0	14.4	12.2	10.6	6.8	12.6
Difference[1]	6.1	1.3	2.9	3.6	2.0	2.1	3.1
Wood, pulp, and paper:							
Synthetic	7.5	5.9	2.6	2.7	2.5	.1	3.8
Official	8.3	7.8	5.0	5.5	5.2	2.4	5.9
Difference[1]	.8	1.9	2.4	2.8	2.7	2.3	2.1
Construction materials:							
Synthetic	15.5	14.5	5.1	5.6	5.1	1.5	8.2
Official	17.6	17.6	9.1	8.6	7.5	3.3	11.0
Difference[1]	2.1	3.1	4.0	3.0	2.4	1.8	2.8
Total machinery:							
Synthetic	11.9	12.2	7.8	7.0	8.1	5.8	9.0
Official	16.7	14.2	12.4	11.7	11.6	9.1	12.8
Difference[1]	4.8	2.0	4.6	4.7	3.5	3.3	3.8
Light industry:							
Synthetic	8.6	8.0	3.0	7.1	2.6	2.7	5.5
Official	12.3	6.9	2.6	8.6	4.6	3.9	6.6
Difference[1]	3.7	[3] −1.1	[3] −.4	1.5	2.0	1.2	1.1
Processed food:							
Synthetic	10.0	8.8	5.8	5.9	4.2	.7	6.
Official	10.0	7.9	7.2	5.9	5.0	2.0	6. 2
Difference[1]	0	[2] −.9	1.4	0	.8	1.3	6
							4

[1] The difference equals the growth rate of the official index less the growth rate of the synthetic index. Thus, a positive sign indicates that the synthetic series is growing slower than the official series and a negative sign vice versa. t

[2] The U.S.S.R. Central Statistical Administration does not publish a branch index for nonferrous metals because mos production data related to that branch are considered classified information.

[3] Some of the official indexes may have grown less rapidly than the synthetic indexes during this period as a result of the sovnarkhozy (council of the national economy) reform of 1957–65. During this period, most industrial ministries were replaced by regional councils of the national economy. The regional organization concept fostered vertical integration with a corresponding relative deceleration in the growth of gross value of output. This impacted more severely on consumer goods as many regional organizations were loathe to expand consumer goods output beyond the needs of their particular region. In fact, decrees had to be promulgated to mitigate the adverse impact on consumer goods production. See Alex Nove, "The Soviet Economic System," pp. 40–41, 70–75, 87–92, for full discussion of the sovnarkhoz reform.

[4] The synthetic and official indexes for fuels grew at an identical rate for the 1976–78 period probably because of differences in the coverage of the 2 indexes for 1978. The official figure includes all fuel, while owing to the preliminary nature of the data, the synthetic index covers only oil and gas condensate, natural gas, and coal; excluded are some slow growing fuels such as peat and oil shale.

III. Recent Trends in Industrial Production

Soviet industrial growth over the last three years has been slower than in any other period since World War II whether measured by the synthetic indexes or Soviet official statistics. A lag in steel output has begun to slow machinery production, a key factor in promoting technological progress and productivity gains. In turn, the slowdown in machinery production is affecting growth in new capacity. After some 25 years of sustained growth at rates generally in excess of 6 percent per annum, fueled by even larger increments to new capacity, Soviet industry's relatively poor performance in 1976–78 has forced the leadership to scrap major segments of the Tenth Five-Year Plan (1976–80) and to settle for short-run solutions to long-term problems, particularly with respect to energy.

A. Energy Production

Much of the U.S.S.R.'s capacity to sustain industrial growth depends on exploitation of its energy resources both for domestic use and to earn hard currency. But production of fuels, particularly oil and coal, is becoming more difficult and costly. As a result, growth in energy production has been slowing since the mid 1970s (table 2).

TABLE 2.—U.S.S.R.: GROWTH IN PRIMARY ENERGY PRODUCTION

[Average annual rates of growth; in percent]

	1971–75	1976	1977	Preliminary 1978
Primary energy [1]	5.0	5.0	4.9	4.3
Crude oil and condensate	6.9	5.8	5.1	4.7
Natural gas	7.9	10.8	7.9	7.6
Coal	2.4	1.5	1.5	.2
Other [2]	1.0	−3.8	8.9	7.3

[1] Expressed as the sum of the above components measured in standard coal equivalents.
[2] Minor solid fuels (peat, shale, and fuelwood), hydroelectric power, and nuclear electric power.

The basic problem, manifest most clearly in the declining growth of oil production, is rooted in the traditional Soviet approach to resource management—"damn the reserves-to-production ratio; full speed ahead." For the past half century, the unimpeded availability of energy resources has fueled the U.S.S.R.'s extensive growth model, and Soviet leaders have maximized the short-term exploitation of these resources with little or no thought to their potential depletion. Not only have natural resources been underpriced (in terms of scarcity), but the perverse Soviet incentive system has rewarded overfulfillment of short-sighted production goals, regardless how much of the resource may have been wasted, or rendered unusable, in the process.[9] When efficiency in extraction was considered at all, it usually has been in terms of maximizing labor productivity—an indicator that generally declines as resource deposits get deeper or more difficult to work.

Oil.—In oil, the Soviet approach has led to: (1) an emphasis on development over exploration, with the result that new discoveries are failing to keep pace with output growth; (2) overproduction of existing wells and fields through rapid water injection and other methods of recovery, with the result that less of the oil in place is ultimately recovered; and (3) new capacity requirements that soon will run beyond the Soviet Union's capability to supply.

Although the U.S.S.R. has abundant potential oil reserves in the Arctic, East Siberian, and offshore areas, development of such reserves is at least a decade away. At present, and for the foreseeable future, almost all Soviet oil output will have to come from existing fields and from new fields in existing producing regions. Production from fields in the western part of the country (the Urals-Volga region, the Caspian region, and Central Asia) is coming increasingly from greater depths and from in-fill drilling which allows more intensive exploitation of already tapped reservoirs. In most of these fields, production is declining. Moreover, most of the oil-producing fields in the

[9] For an extensive treatment of the role of Soviet incentives, see Berliner, *The Innovation Decision in Soviet Industry, 1976.*

Urals-Volga region are in late stages of production so that declines in production will continue in the years ahead. All growth in output, therefore, must come from West Siberia, where the inhospitable climate, difficult terrain, and vast distances greatly complicate operations.

Since 1975, more than one-half of West Siberian oil output and nearly one-fourth of national production came from the giant Samotlor field on the middle Ob'. Although new fields are being discovered in West Siberia, no giant ones comparable to Samotlor have been found. Moreover, the U.S.S.R. does not have the drilling capability to pursue adequate development and exploration programs simultaneously. Depletion of existing reserves has meant that more and more rigs have had to be allocated to development drilling so that new wells in old fields could help compensate for declining output per well. Development drilling requirements are continuing to rise rapidly, further hampering efforts to step up exploratory drilling.[10]

Natural gas.—In contrast to oil, growth in natural gas production increased substantially in 1976–78. In all three years the annual output goals for natural gas were overfulfilled, something that had never happened previously. This unprecedented three-year expansion resulted primarily from new fields coming onstream in West Siberia and the completion of pipelines to principal consuming regions in the Urals and European U.S.S.R.

Maintaining such growth, however, will be difficult. The cost and physical difficulty of developing the major untapped Soviet gas reserves exploitable over the next decade—located in northern Tyumen' Oblast—is unprecedented in the history of the world's oil and gas industries and poses problems not previously encountered either in the U.S.S.R. or in the West. Meanwhile, combined gas production from the country's non-West Siberian gas regions may have peaked in 1978 and, if so, will begin declining this year, forcing West Siberia to cover increasingly large losses in national output.[11]

Coal.—The output of coal failed to reach production targets each year during 1976–78. As with oil, many of the coal deposits in European U.S.S.R. are nearing exhaustion and are becoming more costly and difficult to work. Indeed, old mines in the Moscow and Donetsk basins have been closing at an accelerating rate. Output has been declining in the Moscow basin for several years, but 1977 marked the first year since 1961 that output decreased substantially in the Donbas.[12] Moreover, any efforts to increase production in this basin now will be prohibitively expensive. The mines are among the deepest in the world, contain high concentrations of methane gas, and are not amendable to mechanization because of the limited thickness of the coal seams.[13]

Expansion of the coal industry is planned in Siberia where most of the coal will be strip-mined and burned in on-site powerplants. However, apart from the Baykal-Amur railroad, the costly infrastructure necessary to exploit Siberian coal or transport the energy produced has not been built. The technology for efficient long distance transmis-

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[10] For additional details on current situation in the oil industry see J. Richard Lee and James R. Lecky "Soviet Oil Developments" in this volume.

[11] For additional details on the prospects of the Soviet gas industry, see CIA ER 78–10393, U.S.S.R. : Development of Gas Industry, July 1978.

[12] This basin accounts for about one-third of the U.S.S.R.'s total raw coal production and about one-half of the supply of metallurgical grade coal. I Zlobenko, *Ekonomika Sovetskoy Ukrainy*, No. 8, 1972, pp. 20–24 ; and *Izvestiya*, Feb. 11, 1976, p. 1.

[13] Coal mines in the Donbas are more than twice as deep as U.S. coal mines. I. N. Fokina (ed.), *Ugol'naya promyshlennost SSSR za 60 let*, Moscow 1977, pp. 36–38.

sion of coal-based electric power from Siberia to the Western U.S.S.R. probably won't be available until the 1990s. Serious problems also remain in developing boilers that can efficiently burn low grade Siberian coal.

Electric power.—Responding mostly to the slower growth in overall economic activity, annual growth in electric power production averaged an all time low of 4 percent in 1977–78 and will remain well below the near 7 percent annual increases achieved in the early seventies. However, in addition to the slowing demand there is evidence of greater strain in electric power supply. An imbalance between additions to power plant capacity and increases in output has reduced reserve capacity and the reliability of power supply. During 1971–75, electric power output rose 40 percent while power plant capacity increased only 31 percent. Subsequently in 1976 capacity rose by only 5 percent whereas output increased 7 percent, further straining available capacity. Brownouts and power fluctuations in the networks have been reported, especially in hours of peak demand. To curb consumption of electric power in peak periods, new tariffs were introduced for industry; the tariff for above-limit use was set at 10 times the basic rate for electric power and twice the basic rate for heat.

In addition to lagging growth in new capacity, adequate supplies of fuel for thermal power plants are becoming more difficult to obtain in the energy-short European U.S.S.R. Since hydro-power potential is limited because of the vast distances between potential water resources and the centers of industrial concentrations, Soviet planners regard nuclear power as the most promising source of growth in electricity production in this region. However, the nuclear program is lagging badly and is unlikely to have much impact until well into the 1990s.

B. Ferrous Metals

Growth in steel production slowed sharply in 1976–78 because of inadequate investment in steelmaking facilities and insufficient supplies of high-quality raw materials (table 3). A steady decline in the quality of Soviet iron ore has forced the diversion of investment funds to ore-mining and ore-beneficiating projects. While tight supplies of iron ore and coking coal have hampered production of pig iron in recent years, a shortage of scrap has contributed to the slowdown in crude steel production.[14]

TABLE 3.—U.S.S.R.: GROWTH IN FERROUS METALS OUTPUT

[Average annual rates of growth; in percent]

	1971–75	1976	1977	Preliminary 1978
Ferrous metals	3.8	2.7	1.1	2.9
Iron ore	3.6	2.7	.3	1.8
Pig iron	3.7	2.3	1.9	3.4
Crude steel	4.1	2.5	1.3	2.9
Finished rolled steel	4.1	2.8	.7	2.8
Steel pipe	5.1	5.3	1.3	2.8

[14] Indeed, during 1977–78 the pressure on industrial enterprises to meet quotas for turning in scrap was so intense that managers were known to turn in as scrap new machinery never installed or used. *Krokodil*, No. 11, 1978.

Construction of new steelmaking capacity has lagged badly, and most of the potential for squeezing additional output from existing plants has already been tapped. Much of the existing capacity for rolled sheet steel is very old and technically obsolete. Major deficiencies exist in equipment for the production of cold-rolled sheet, tinplate, high quality transformer sheet, and other coated steels. The continuing failure to produce the desired assortment of products, especially large diameter pipe, and casing and drill pipe has contributed to lags in pipeline construction and exploratory drilling for oil and gas. As a result, the U.S.S.R. has had to rely increasingly on imports to meet its domestic needs at a substantial cost in hard currency.[15]

TABLE 4.—U.S.S.R.: GROWTH OF SELECTED MACHINERY ITEMS

[Average annual rates of growth; in percent]

	1971–75	1976	1977	Preliminary 1978
Machine building and metal working	8.1	5.9	5.9	5.5
Chemical equipment	11.1	8.2	7.1	6.1
Petroleum equipment [1]	2.7	21.5	4.3	5.3
Metallurgical equipment	1.7	6.9	1.8	0
Agricultural machinery	12.2	6.5	5.0	7.6
Machine tools	2.7	.9	2.1	−.8
Forge presses	4.1	2.8	4.8	1.8
Electric motors	4.7	3.1	1.7	3.6
Generators	10.0	−2.9	7.8	1.7
Turbines	3.1	3.7	−3.1	2.6
Freight cars	3.7	2.9	−1.0	−4.1
Diesel locomotives	.4	4.7	−8.5	4.0
Electric locomotives	4.1	6.4	4.5	5.0

[1] Excluding air-cooling apparatus.

C. Machinery

Machinery production—the major source of investment goods, defense hardware, and consumer durables—continues to be the fastest growing branch of Soviet industry, albeit at a much reduced pace since the early 1970s (table 4). Shortfalls in domestic steel output have begun to impact on machinery production. Moreover, shortages of manpower in this labor-intensive sector combined with the inability to stimulate growth in labor productivity also has had an adverse impact. In turn, the slower growth in machine tools, generators, electric motors, and other equipment in 1976–78 could dampen rates of capacity expansion and modernization throughout the economy in the next few years. Declines in freight car and diesel locomotive production already have aggravated existing shortages in railroad rolling stock, contributing to disruptions in the supply and distribution of industrial commodities. On the other hand, an acceleration in the growth of petroleum equipment and, to some extent metallurgical equipment, reflects the high priority assigned to these sectors. Production of consumer durables also has slowed since 1975 reflecting less demand for the same assortment of goods and the need to concentrate resources on higher priority producers goods.[16]

[15] The U.S.S.R. spent $2.3 billion on steel imports from the West in 1976 and at least another $4 billion during 1977–78.

[16] For additional details on consumer demand for durables see Elizabeth Denton, "Soviet Consumer Policy: Trends and Prospects," elsewhere in this volume.

TABLE 5. U.S.S.R.: GROWTH OF CHEMICALS AND PETROCHEMICALS PRODUCTION

[Average annual rates of growth; in percent]

	1971–75	1976	1977	Preliminary 1978
Chemicals and petrochemicals	8.6	5.3	6.0	3.1
Mineral fertilizer	10.2	2.3	4.9	1.3
Plastics and resins	11.2	7.6	8.2	5.8
Sulfuric acid	9.1	7.3	5.4	6.1
Chemical fibers and yarns	8.9	6.8	6.7	4.0
Caustic soda	6.1	8.7	6.7	4.0
Automotive tires	8.3	5.8	5.3	2.8

D. Other Industries

Chemicals.—The usually fast growing chemicals branch also has contributed to the industrial slump since 1975. After averaging growth in excess of 8 percent per year in 1971–75, production increases in chemicals and petrochemicals slowed to an annual average less than 6 percent in 1976–77 and fell to nearly 3 percent in 1978 (table 5).[17] Delays in commissioning new capacity and the failure of the machinery sector to meet equipment requirements for new chemical plants have seriously impeded growth in this industry. The stock of unfinished chemical plant capacity increased in 1976–77 by about 50 percent compared with a 20 percent increase in all unfinished construction. In addition to delays in introducing new capacity, chemical production has been hampered by a shortage of skilled workers to man those new plants that have come onstream.

Construction materials.—Growth in construction materials output has dropped precipitously—from an average annual rate of 5 percent in 1971–75 to about 1½ percent in 1976–78. The decline in growth of cement—a key input to several other construction materials—has retarded growth in precast concrete and forced an absolute decline in asbestos cement roofing tiles (table 6). A prime cause has been the meager allocation of investment funds to this branch; during 1971–76 investment in construction materials grew at an annual rate of only 2 percent in contrast to 6½ percent per year for all industrial investment. In 1977, however, investment in construction materials rose by nearly 8 percent compared with less than 5 percent for all industry, reflecting efforts to: (1) modernize an aging stock of plant and equipment (much of which was constructed during the industrial boom of the 1950's); and (2) implement more energy efficient production processes.[18]

[17] Fertilizer production lagged badly in 1978; the 98 million tons produced represented the smallest annual increment (1.25 million tons) since 1960. Much of the blame can be ascribed to the Soviet failure to commission new capacity on schedule, but the production increase since 1975—7.8 million tons during a period when 14.4 million tons of new gross capacity came on stream—indicates that operational problems were more serious than in earlier periods. Although data on retirements of capacity are not released, indirect evidence does not suggest a recent increase in the rate of retirements.

[18] There have been numerous calls to convert cement production from the dominant wet process to the dry process. The dry process uses about one-fourth less total energy, but requires somewhat more electric power. The dry process plants, however, are more capital-intensive and converting the entire industry would require a massive investment program.

TABLE 6.—U.S.S.R.: GROWTH OF CONSTRUCTION MATERIALS PRODUCTION

[Average annual rates of growth; in percent]

	1971–75	1976	1977	Preliminary 1978
Construction materials	5.1	3.2	0.9	0.5
Cement	5.1	1.8	2.3	−.1
Precast reinforced concrete	6.2	4.0	2.1	.7
Asbestos-cement roofing tile	6.1	3.5	−9.5	−.5

Consumer nondurables.—The decline in growth of this sector during 1976–78 reflects mainly the impact of the disastrous harvest in 1975 on the production of processed foods. After falling by 4.5 percent in 1976, processed food production barely recovered its 1975 level the following year and only increased by 2 percent in 1978 (table 7). Soft goods production on the other hand continued to grow in 1976–78 at about the same average annual rate of increase posted in 1971–75, although the increases have been smaller each succeeding year reflecting both slower growth in raw materials and a drop in investment beginning in 1977.[19]

TABLE 7.—U.S.S.R.: GROWTH IN PROCESSED FOOD AND SOFT GOODS

[Average annual rates of growth; in percent]

	1971–75	1976	1977	Preliminary 1978
Processed food	4.2	−4.5	4.9	2.0
Meat	6.7	−24.1	9.0	4.2
Wholemilk products	3.7	−.8	3.8	1.6
Sugar	.3	−10.9	30.1	1.4
Canned goods	6.4	−.3	3.6	−1.6
Confectionary products	2.3	4.3	4.3	4.8
Light industry	2.6	3.9	2.5	1.8
Textiles	2.4	3.3	1.2	1.9
Knitwear	2.9	3.0	3.4	3.0
Leather footwear	.6	3.7	1.7	.5
Sewn goods	3.5	5.9	4.0	4.4

IV. Efficiency of Resource Use

To some extent the recent decline in industrial growth reflects increasing strain between the demands of a burgeoning industrial sector and readily available supplies of labor, capital, and natural resources. But more important, it reflects the Soviet failure to use resources more efficiently. While productivity has never been the primary engine of growth in the U.S.S.R. in recent years declining productivity has constrained growth (table 8).

As in the past, Soviet managers have tried to compensate for inadequate productivity gains by overfulfilling industrial employment plans. As a result, the size of the industrial labor force in 1977 already exceeded the 1980 plan. Perhaps more significant, annual increments to industrial employment, which constituted about one-fifth of the

[19] The decline in investment in both processed foods and soft goods in 1977 may well have been repeated in 1978 as a smaller increment to total investment was absorbed by huge increases in allocations to energy and ferrous metals (see Section V).

country's total employment growth during 1971–75, increased to one-third of the total in 1976–78. With smaller annual increases in the labor force over the next decade, a continuation of this trend could create labor shortages in other sectors of the economy.

A similiar situation may occur with respect to investment resources. The slowdown in production of machinery and other industrial commodities means smaller increments of investment goods to be divided among competing uses. Moreover, the return on investment is very low and the leadership's efforts to turn this around have been fraught with difficulties.

TABLE 8.—U.S.S.R.: AVERAGE ANNUAL RATES OF GROWTH IN INPUTS, OUTPUT, AND FACTOR PRODUCTIVITY IN INDUSTRY

[Average annual rates of growth; in percent]

	1971–75	1976	1977	Preliminary 1978
Total inputs[1]	4.8	5.1	4.5	4.1
Man-hours worked	1.5	2.2	1.7	1.2
Capital	8.7	8.2	7.7	7.3
Output	5.9	3.7	4.1	3.5
Factor productivity	1.0	−1.3	−.4	−.5

[1] Inputs of man-hours and capital are combined using weights of 52.4 percent and 47.6 percent, respectively, in a Cobb-Douglas (linear homogeneous) production function. These weights represent the distribution of labor costs (wages and social insurance deductions) and capital costs (depreciation and a 20 percent charge on gross fixed capital) in 1970, the base year for all indexes underlying the growth rate calculations.

As before, for more than a decade, the growth of investment and capital stock in Soviet industry has outstripped growth in both labor and output. The result has been rapidly diminishing returns to new capital stock and hence to investment.[20] The continued existence of diminishing returns means that new plant and equipment coming on-stream is very much like the old plant and equipment already operating, and/or that the potential of any new technology embodied in the new capital is not being realized. This situation prevails in much of Soviet industry despite huge imports of high level foreign technology.

Barriers to innovation and substitution of capital for labor are formidable. Managers still find it prudent to hoard workers as their bonuses are still tied to fulfilling plans. The resistance of enterprise managers to the introduction of new technology or equipment which might temporarily disrupt production processes and jeopardize plan fulfillment is notorious.[21] In addition, there is no automatic system for transferring resources from one use to another. Labor-intensive industries, for example, do not expand on demand from consumers but on command from planners. The effect of these rigidities is a tendency of the system to reproduce itself in the same mix of output and the same pattern of investment. Moreover, delays in planning, design, and construction of new production facilities inhibit the process of lowering the average age of capital stock and often render useless the new

[20] The notion of diminishing returns is closely related to the substitution of capital for labor. When capital grows more rapidly than labor, returns to capital do not have to decline if there is an offsetting change in the production method—i.e. technology. In practice most new technology is embodied in new capital stock, and most investment contains some degree of relatively new technology. In an efficient environment, this steady stream of new technology reorganizes production processes and thereby increases output while saving labor and raw materials.

[21] See Stanley Cohn, "Soviet Replacement Investment Policy," elsewhere in this volume.

machinery and equipment (both domestic and imported) which has been waiting (often for years and exposed to the elements) to be installed.

Thus, Soviet planners have been unable to halt the growing backlog of unfinished investment projects—"unfinished construction" in Soviet terminology—despite smaller increments to new investment and verbal campaigns to concentrate all efforts on projects nearing completion. Project completions continue to be frustrated by bottlenecks in the supply of components—particularly machinery—and a lack of incentive in construction organizations, where bonuses are still based largely on the value of work completed. Basic construction work has a high ruble value, but finishing work does not.[22] The growth in gross additions to new industrial capacity fell off sharply in 1976 and declined in 1977 (table 9). Meanwhile, the growth of unfinished construction accelerated in most branches of industry during 1976–77 (table 10) and, judging by recent Soviet press reports, probably also in 1978. The resultant backlog of uncompleted projects has tied up enormous sums of investment resources and contributed to a further decline in the productivity of investment.

TABLE 9.—U.S.S.R.: GROWTH IN GROSS ADDITIONS TO NEW FIXED CAPITAL

[Average annual rate of growth; in percent]

	1972–75	1976	1977
Industry	6.4	4.1	−2.1
Electric power	3.6	2.7	−13.6
Coal	4.1	−11.4	−2.3
Oil and gas	10.3	8.5	4.7
Ferrous metals	12.1	−9.0	3.7
Chemicals and petrochemicals	8.1	−3.8	−13.5
Machinery	7.3	22.6	−1.4
Wood, pulp, and paper	5.6	2.7	−5.5
Construction materials	3.9	−5.0	7.4
Light industry	4.6	2.3	5.8
Processed food	6.5	−5.0	−.5

Source: "Vestnik statistiki," No. 2, 1979, p. 76.

TABLE 10.—U.S.S.R.: GROWTH IN UNFINISHED CONSTRUCTION

[Average annual rate of growth; in percent]

	1971–75	1976	1977
Objects of productive significance[1]	8.3	9.7	10.9
Electric power	5.8	2.6	10.1
Coal	1.3	6.7	13.8
Oil and gas	11.1	9.5	10.6
Ferrous metals	8.7	8.4	10.0
Chemicals and petrochemicals	11.9	14.0	30.6
Machinery	12.8	−.8	4.7
Wood, pulp, and paper	7.8	6.9	16.6
Construction materials	5.3	1.7	−1.1
Light industry	3.4	18.3	2.3
Processed food	2.7	6.2	3.6

[1] While the bulk of this category consists of industrial projects, agricultural, construction, and some transportation and communication projects are also included.

Source: Narodnoye khozyaystvo SSSR v 1977, p. 362.

[22] V. Krasovskiy, "Investitsionny kompleks: planirovanie i rezervy," in *Voprosy ekonomiki*, No. 1, 1979, pp. 59–69.

The inability to bring new capacity onstream more rapidly has delayed the introduction of labor- and materials-saving technology, thus hampering the U.S.S.R.'s efforts to conserve resources. This is becoming particularly important in the case of energy. Because the energy consumption structure in the U.S.S.R. is dominated by heavy industry, major gains in energy-efficiency have to be obtained largely by upgrading industrial technology—a very time-consuming, capital intensive process—or by major shifts away from heavy industry and toward light industry and services, a shift contrary to the view of dominant Soviet interest groups.[23] However, even sharp reductions in the present backlog of unfinished construction and uninstalled equipment may do little to provide a more energy-efficient capital stock since only now are Soviet planners beginning to call for the design and production of more energy-saving equipment.

The Soviets must also come to grips with growing regional imbalances in the sources of labor, capital, and natural resources. From now until the late 1980s increments to the labor force will come almost exclusively from the Moslem areas of Central Asia and the Transcaucus republics (figure 2).[24] However, most of the growth in natural resources, especially energy, is occurring east of the Urals, while the bulk of capital goods is still produced mainly in the European areas of the country. Thus, problems in supply and distribution, which have continually plagued industrial enterprises, may become more acute. At a minimum, the already over-taxed transportation system will play an even more crucial role than in the past in bringing goods and services together at the right time and in the right place. This, in turn, will increase the demand for fuels as well as machinery to modernize and increase the stock of transportation equipment.[25]

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[23] Soviet output of highly energy-intensive products such as iron, steel, and cement is substantially larger than comparable U.S. output. For example, iron and steel production in the U.S.S.R. account for nearly 13 percent of energy consumption compared with only about 3 percent in the U.S. Because the most energy-intensive sectors in the U.S.S.R. are construction and heavy industry, reduction in the growth of their output would cut into future production and reduce the long-term growth rate of the economy as a whole. Whitehouse and Kazmer, "Output Trends: Problems and Prospects," in Holland Hunter, *The Future of the Soviet Economy: 1978–85*, 1978, pp. 7–31.

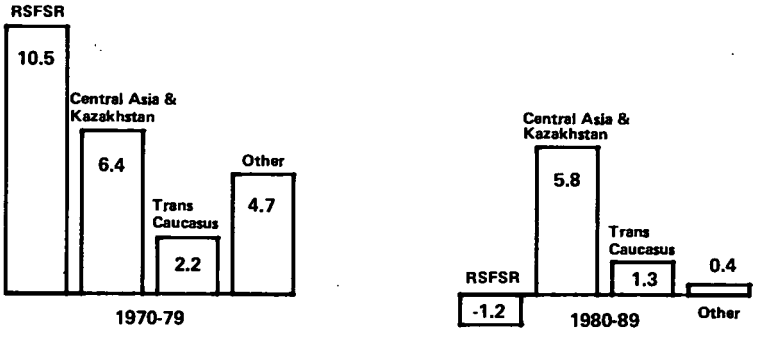
[24] For a detailed discussion of regional differences in labor supply see Murray Feshbach, "Prospects for Massive Outmigrations From Central Asia During the Next Decade," elsewhere in this volume.

[25] During the past three years according to Soviet critics the transportation system, particularly the railroads, have turned in a poor performance compared to earlier periods. See for example, D. Zotov, "Razvitie transportnoy system strany" in *Planovoye khozyaystvo*, No. 6, 1978, pp. 17–26, and articles by I. Pavlovsky in *Sotsialisticheskaya industriya*, Aug. 6, 1978, p. 2, and Pravda, March 29, 1978.

Figure 2

USSR: Regional Distribution of Increments to Population of Working Age

(Million Persons)



V. Current Strategy for Growth: Mixed Signals

Soviet industry is facing a period of continued slow growth and its planners, a period of rising frustrations. No clear strategy has emerged for dealing with the problems that are building in size: slowing growth in energy and metals production, smaller increments to investment and labor resources, regional imbalances in labor, capital, and natural resources, and declining returns to investment. Instead, the leadership has been temporizing on policy decisions; reacting rather than redressing. In terms of energy production, for example, Moscow has responded to short-term needs for oil with a crisis management approach; rushing more men and equipment into West Siberia to step up drilling and recovery operations at the expense of sharper production declines in some of the older producing regions.

TABLE 11.—U.S.S.R.: AVERAGE ANNUAL RATES OF GROWTH IN INVESTMENT[1]

[In percent]

	1971–75	1976	1977	1978[2]	1979 plan[2]
Total economy	6.9	4.5	3.6	5.2	2.7
Oil	8.8	6.9	9.4	7.5	25.4
Gas	11.5	3.3	11.3	70.6	−16.7
Coal	2.6	2.2	8.2	37.6	15.4
Ferrous metals	6.8	3.6	4.6	43.3	−11.6
Agriculture	9.7	4.2	3.4	3.6	[3] 1.2
All other	5.8	4.7	3.0	−.8	3.8

[1] Sources: Narkhoz 1977, p. 354.
[2] Ekonomicheskaya gazeta, Nos. 3, 4, 5, and 8, 1979.
[3] Pravda, Nov. 30, 1978.

Devoting more resources to Siberian energy development and to problem sectors such as steel, however, may mean reduced allocations to others. Indeed, data on investment allocations last year as well as plans for 1979, though scanty, suggest this is happening. Investment in gas, and coal jumped abruptly in 1978, and large increases are planned this year in oil and coal (table 11).[26] The hard-pressed steel industry also is being favored in investment allocations which in 1978–79 will have increased at an average annual rate of 16 percent. However, as in the case of investment in the gas industry, this represents a very large jump last year followed by a planned decline in 1979. Year-to-year shifts such as these may continue for some time as the needs of individual sectors are met from more limited investment resources and as more emphasis is placed on reducing growth in unfinished construction.

The current investment allocations in favor of energy are consistent with Brezhnev's strategy for priority development of these sectors. Since the December 1977 Central Committee Plenum, Brezhnev has consistently favored a heavy commitment of resources to oil and gas production in West Siberia (specifically in Tyumen oblast). Because of the severe environmental conditions here, the accompanying demands for pipe and equipment will place increasing strain on the steel and machinery sectors. Moreover, by stressing development of Tyumen oil and gas, Brezhnev has heightened the need for a broad range of sophisticated on-shore and off-shore technology.

Thus, unless a major increase in purchases of Western technology and equipment is being contemplated, domestic machine building also should receive more emphasis in resource allocations, if not this year, then soon.[27] In addition to increased demand for energy related equipment, the 1976–80 industrial plans (which in large part represent a carry-over from the 1971–75 plan) still emphasize the modernization and mechanization of existing plant and equipment; first, by concentrating investment resources in those branches of industry which provide basic machine tools and technologically advanced equipment for the modernization of plant and equipment throughout the industrial sector, and second, by increasing the mechanization and automation of labor-intensive auxiliary processes (such as materials handling, loading-unloading, and warehousing) which currently absorb more than one-third of the U.S.S.R.'s total industrial employment.[28] So far, however, little success has been achieved; in part because the performance of the machinery sector—critical to the fulfillment of these goals—has not measured up to expectations,[29] and in part because planners misjudged the cost in capital and labor resources required to maintain growth in production of energy and other industrial raw materials.

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[26] In contrast, the level of investment in both food and soft goods industries declined in 1977 and may have dropped again in 1978.

[27] Gosplan has reportedly cut back on the 1979 investment originally slated for the machine tool industry in the 10th five year plan. *Izvestiva,* Mar. 14, 1979.

[28] For additional details on this point see Stanley Cohn, op. cit.

[29] The machinery sector itself must undergo substantial renovation before it can begin to turn out the large quantities of high quality equipment needed to upgrade the other industrial sectors. Machinery production currently is plagued by a technologically outdated machine tool stock, more than one-third of which is used just to repair older machines and to produce spare parts. A detailed description of problems in the machine tool industry is contained in J. Grant, "Soviet Technology Gap and Dependence on the West: The Case of Machine Tools," elsewhere in this volume.

Capital costs, especially in extractive industries, have been rising rapidly due to the declining quality and quantity of easily accessible raw materials and, in turn, to the increased reliance on more sophisticated and more costly recovery and beneficiating techniques.[30] The need to transport these commodities over much greater distances—often from areas such as Tyumen oblast where little or no transport facilities yet exist—also is pushing up capital expenditures (figure 3).

Continued expansion of military hardware systems adds yet another dimension of stress to Soviet industrial resources—particularly in the machinery and metals sectors. Judging from Moscow's efforts to increase defense spending throughout the Warsaw Pact last year and Brezhnev's speeches since November 1978, production of military goods still seems to be the frontrunner in the leadership's resource allocation priorities.

A continuation of Brezhnev's current emphasis on oil and gas development in Tyumen oblast together with increased industrial development in other eastern regions could squeeze the U.S.S.R.'s investment resources to the point where cries of anguish may be heard from other high level claimants. Already there have been indications that Brezhnev's current strategy may not have the wholehearted support of the Politburo. Kosygin, for example, in his recent election speech for the Supreme Soviet, invoked the "dynamic and proportional" slogan approved in 1976 as the guide to investment policy in the 10th Five-Year Plan.[31] In the present context this may reflect a caution against abrupt shifts in prevailing resource allocation patterns which might lead to serious inter-branch and inter-regional imbalances.[32] Kosygin also appears to disagree with the energy production strategy laid down by Brezhnev at the December 1977 Plenum. In contrast to Brezhnev's long-term reliance on Tyumen oil and gas, Kosygin emphasizes nuclear power and coal.

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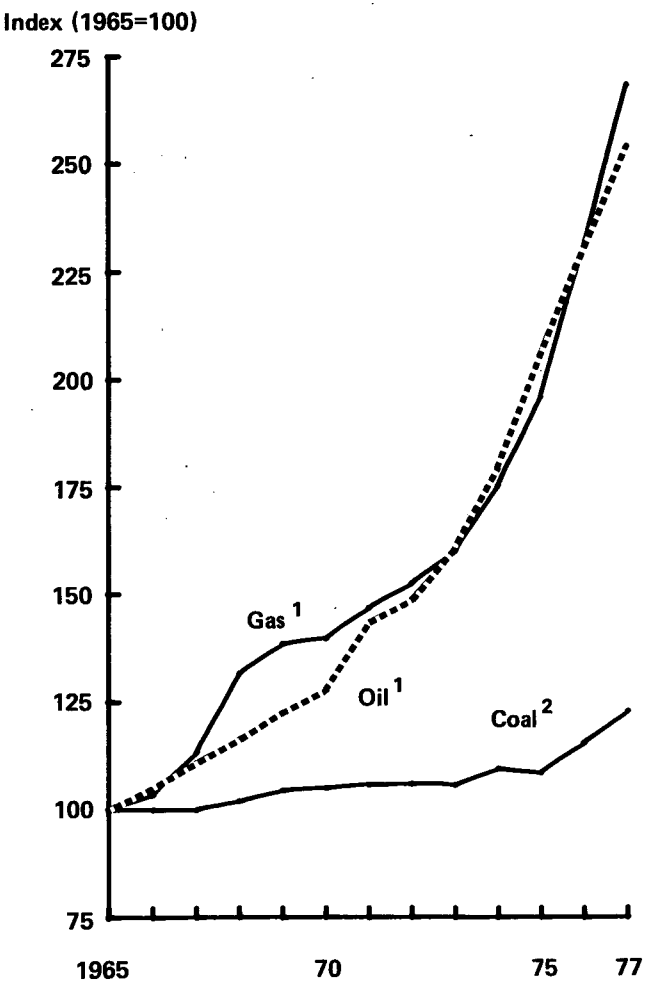
[30] V. K. Senchagov *Faktory rosta pribyli i metody ikh analyiza,* 1977, pp. 138–140. Also see *Kommunist,* No. 18, 1978, pp. 5–14.

[31] The election speeches of Kosygin and Brezhnev are contained in *Pravda,* Mar. 2 and 3, 1979 respectively.

[32] A strong argument in favor of the balanced approach to growth, and frankly critical of the present system, was recently published by V. N. Kirichenko, Director of the Scientific Research Economic Institute attached to Gosplan, in *Planovoye khozyaystvo,* No. 2, 1979, pp. 42–51.

Figure 3

USSR: Growth in Average Distance of Transport for Selected Fuels



1. By pipelines.
2. By rail.

Even without these apparent differences within the leadership, resource allocation decisions are not likely to get any easier for industrial planners in the years ahead. First, growth in total investment will continue to slow as long as the machinebuilding and metal working sectors that turn out capital goods are on the wane.[33] More important, the U.S.S.R.'s dependence on the resources of Siberia—where costs are high, labor is short, and infrastructure is often nonexistent—means investment projects will be more costly and their payoff further away. Thus, Soviet planners will have to make judgments about the cost-benefit ratios of alternative projects whose major benefits and unknown costs may lie chiefly in externalities that are as yet dimly perceived. To the extent that planners remain obsessed with applying short-run criteria to long-run investment decisions, industrial growth is likely to fall still further in the 1980s and beyond.

Appendix A

The following diagram demonstrates how the branch production indexes are computed by using the input-output table:

	Sectors as consumers				Other inter-industry shipments	Final demand	Gross value of output
	Ferrous ores	Ferrous metals	Coke products	Refractory materials			
Sectors as producers:							
Ferrous ores	a_{11}	a_{12}	a_{13}	a_{14}	b_{11}	b_{12}	c_1
Ferrous metals	a_{21}	a_{22}	a_{23}	a_{24}	b_{21}	b_{22}	c_2
Coke products	a_{31}	a_{32}	a_{33}	a_{34}	b_{31}	b_{32}	c_3
Refractory materials	a_{41}	a_{42}	a_{43}	a_{44}	b_{41}	b_{42}	c_4

NOTES

a_{ij}: These coefficients represent the proportion of gross output of setcor i that is consumed by sector j. For example a_{12} is the share of the ferrous ores GVO consumed by the ferrous metals sector. Where i and j are equal, e.g., a_{41}, that is the share of refractory materials output consumed by that sector in its own production process.

b_{ij}: The value of sector i's output that is shipped outside the ferrous metals branch. The 1st column is shipments to other productive sectors in the economy; the 2d column is shipments to household and government consumption, investment, defense, and exports.

c_i': The gross value of output of sector i.

The a_{ij} values are derived from the 1966 input-output table in 1970 prices. The c_i values over time are estimated from the product samples included in the indexes. The b_{ij} values represent extra-branch consumption and are the values to be used for the branch index.

Specifically computed the sum of the b_{ij} values for all i sectors is the basis for the ferrous metals branch index in any year t.

Algebraically: $\left\{\sum_{i=1}^{4} \sum_{j=1}^{2} b_{ij}\right\}_t$

[33] The 8.2 percent increase slated for machinery production this year seems unrealistic given the ragged performance of this sector for the past 3 years and the uncertain supply of metals and energy.

Appendix B

SOVIET INDUSTRIAL PRODUCTION INDEXES

[1970=100]

	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959
Industrial materials	21.64	24.31	26.48	28.81	31.93	35.59	38.55	42.13	46.65	51.14
Ferrous matals	23.51	26.27	29.63	32.33	35.53	39.14	42.05	44.49	47.63	51.76
Nonferrous matals	18.31	20.74	23.34	26.03	28.49	33.44	35.46	37.45	39.53	42.74
Fuels	24.35	26.61	28.48	30.47	33.61	38.09	42.44	47.22	51.47	54.99
Electric power	12.48	14.20	16.25	18.33	20.49	23.10	26.03	28.51	32.00	35.97
Chemical and petrochemicals	13.58	15.03	16.32	18.02	20.28	23.08	25.67	28.01	31.91	34.76
Wood, pulp, and paper	40.28	45.76	47.74	50.02	54.74	57.86	59.83	64.03	70.21	76.71
Construction materials	14.65	16.92	19.23	22.29	25.77	30.18	33.34	39.04	46.49	53.27
Total, machinery	15.70	16.71	18.56	21.70	24.23	27.50	31.24	36.58	41.65	46.08
Including:										
Producer durables	15.59	16.53	18.33	21.36	23.72	26.73	30.45	35.82	40.90	45.17
Consumer durables	10.82	12.00	13.62	16.37	19.40	23.73	26.09	28.38	30.73	34.97
Consumer nondurables	25.21	28.91	30.36	33.38	36.27	39.34	43.61	46.76	50.69	56.16
Light industry	27.55	31.85	32.12	35.21.	38.91	41.71	45.83	48.61	53.08	57.63
Processed food	23.01	26.17	28.72	31.67	33.79	37.13	41.54	45.03	48.46	54.78
Total, industry	20.36	22.68	24.61	27.33	30.22	33.64	37.10	41.18	45.77	50.42

	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
Industrial materials	54.69	57.97	61.81	65.93	70.71	75.54	80.13	85.50	89.82	93.75
Ferrous metals	56.29	60.54	64.91	69.11	74.03	78.59	83.23	87.87	91.98	95.25
Nonferrous metals	46.76	51.02	55.15	59.44	64.03	67.84	74.57	81.48	89.13	95.03
Fuels	58.22	60.94	64.52	69.77	74.11	78.42	83.21	87.61	90.67	94.70
Electric power	39.65	44.46	50.16	55.80	62.03	68.26	73.48	79.13	86.09	92.90
Chemical and petrochemicals	38.41	42.01	46.69	51.12	57.62	66.29	72.61	79.87	85.18	90.38
Wood, pulp, and paper	77.01	76.98	78.75	81.92	85.68	87.49	87.69	91.90	93.99	95.57
Construction materials	59.33	63.52	66.57	68.23	71.50	76.11	81.72	87.44	90.57	92.31
Total, machinery	48.93	52.87	58.94	62.06	66.78	71.19	74.63	80.67	88.76	94.39
Including:										
Producer durables	47.87	50.94	57.87	61.67	66.62	71.45	74.66	80.61	88.69	93.61
Consumer durables	38.88	43.51	48.75	53.00	56.91	61.21	67.13	75.12	83.71	91.58
Consumer nondurables	58.87	61.18	64.08	66.39	67.50	73.11	78.33	85.01	90.45	94.11
Light industry	61.19	62.61	64.23	65.83	68.81	70.86	76.82	83.35	89.69	94.50
Processed food	56.70	59.85	63.93	66.92	66.28	75.21	79.73	86.56	91.16	93.75
Total, industry	53.59	56.90	61.30	64.75	68.81	73.65	77.98	83.82	89.59	94.03

	1970	1971	1972	1973	1974	1975	1976	1977	1978 preliminary
Industrial materials	100.00	105.58	110.61	116.62	122.95	129.98	134.59	138.40	141.74
Ferrous metals	100.00	103.79	106.95	111.02	115.43	120.28	123.52	124.86	128.53
Non-ferrous metals	100.00	106.59	112.30	118.90	127.26	133.30	136.98	140.44	141.71
Fuels	100.00	104.80	109.94	115.32	121.05	127.92	132.28	137.55	142.18
Electric power	100.00	108.12	115.80	123.62	131.88	140.58	150.29	155.65	162.69
Chemical and petrochemicals	100.00	108.05	115.02	125.14	137.33	150.89	158.37	167.91	173.19
Wood, pulp, and paper	100.00	102.75	104.70	107.40	109.30	113.19	113.07	113.54	113.36
Construction materials	100.00	106.04	111.26	117.63	122.91	128.43	132.50	133.71	134.36
Total, machinery	100.00	109.96	116.85	128.36	138.33	147.39	156.12	164.25	174.36
Including:									
Producer durables	100.00	110.33	117.91	128.89	139.85	150.54	160.42	170.48	NA
Consumer durables	100.00	112.36	127.33	143.90	159.44	173.36	184.04	196.95	NA
Consumer nondurables	100.00	104.79	107.28	108.90	114.77	118.28	117.58	121.93	124.21
Light industry	100.00	104.97	105.96	109.19	111.65	113.71	118.11	121.02	123.15
Processed food	100.00	104.62	108.52	108.64	117.68	122.56	117.09	122.79	125.20
Total, industry	100.00	106.87	112.03	119.02	126.46	133.49	138.45	144.12	149.15

THE 1972 INPUT-OUTPUT TABLE AND THE CHANGING STRUCTURE OF THE SOVIET ECONOMY

(By Dimitri M. Gallik, Gene D. Guill, Barry L. Kostinsky, and Vladimir G. Treml*)

CONTENTS

I. The 1972 Input-Output Table

A preliminary version of the reconstructed Soviet 1972 input-output table in purchasers' prices was published in the last Joint Economic Committee compendium on the Soviet economy.[1] This paper presents a substantially improved and expanded version of that table. Many of the estimates in this new version have been improved on the basis of data obtained since the earlier version was published. In addition, the

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[1] Treml et al., "The Soviet," 1976, pp. 332–376.

new table offers a detailed breakdown of the value-added quadrant, including separate identification of turnover taxes and subsidies, and an employment vector has been added.

Besides the improved purchasers' prices table, this paper also presents a variant in producers' prices. Input-output tables in purchasers' prices are considered inferior for most analytical purposes because variations in transportation and distribution costs, taxes, and subsidies tend to distort the real pattern of commodity flows. Under the pricing and accounting conditions prevalent in the U.S.S.R. the effects of these factors are quite marked in many industries.[2] For example, in the 1972 purchasers' prices table the share of consumption in the gross output of the automobile industry was about 30 percent, while in the producers' prices variant this proportion drops to 15 percent. In addition, tables in purchasers' prices display a greater degree of instability over time because the additional elements in the prices of goods change at rates that are different from the rates of change in product flows. Despite the advantages of tables in producers' prices, all the Soviet national tables produced to date have been constructed in terms of purchasers' prices (apparently because the Soviet statistical system does not have producer price data readily available). For this reason, it is necessary first to reconstruct the table in purchasers' prices and then convert it to producers' prices.

The complete three-quadrant tables in purchasers' and producers' prices are presented in comparable format in appendix A. Each table has 56 producing sectors in the first quadrant. A brief commodity description of these sectors is given in appendix table III. The table in producers' prices has two additional rows and columns in the first quadrant. The rows show taxes and fees paid (row 57) and subsidies received (row 58) by each sector on its purchases of material inputs. These rows do not appear in the purchasers' prices table because the taxes, fees, and subsidies recorded there are part of the prices of the individual flows in that table. In the process of converting the table to producers' prices, they are removed from the individual flows and are reallocated to the new rows of the first quadrant. In this way, they remain part of the total material costs of each sector but no longer distort the rest of the flows in the table. The additional columns are meaningless in the first quadrant but are used in the value-added quadrant to record the total values of taxes, fees, and subsidies (see below).

The cost of transportation and communications (T&C, row 54) and trade and distribution (T&D, row 55) services are reallocated in a similar manner. Rather than creating new rows, however, the T&C and T&D rows are redefined and recalculated for the producers' prices table. In the purchasers' prices table the values of these services are doublecounted: they appear once in each sector's column as part of its costs, and they are simultaneously included in each sector's row as part of the price at which its output is sold. The conversion to producers' prices eliminates this doublecounting by removing these costs from each sector's row. The T&C and T&D rows are redefined to show the distribution costs paid by each sector as part of the prices of its material inputs.

[2] The differences between purchasers' and producers' prices in the Soviet Union are discussed at length in Treml et al., "Conversion," 1973, pp. 1–2 and 45–50.

The final-demand quadrants of both tables include a single consumption vector which encompasses both private and public consumption and a residual vector called other final demand which includes net accumulation, the foreign trade balance (exports minus imports), and losses. Because the services included in the T&C and T&D sectors are defined to be only those used within the productive sphere, these sectors sell nothing directly to final demand in the purchasers' prices table. In the producers' prices table the T&C and T&D entries in final demand are analogous to those in the first quadrant; they are the distribution costs paid as part of the prices of purchases by final consumers. The taxes, fees, and subsidies shown in the final-demand quadrant of the producers' prices table are, similarly, those paid or received by final consumers on their material purchases. Because all the elements that are removed from the individual sales in final demand are reallocated within the quadrant, the totals for all final-demand vectors are the same in both tables.

The value-added quadrants of both tables show depreciation, wages, and social security payments. These factor costs do not change in the conversion process. The depreciation row consists of payments made by enterprises on depreciation account plus the value of capital assets written off the books even if not fully depreciated. The wages row includes wages, premia, bonuses, and payments to workers from the material incentive fund, as well as payments-in-kind in agriculture. The social security row consists of payments made by enterprises into state social security funds. In the purchasers' prices table the turnover taxes, other fees, and subsidies rows (61, 62, and 63) are the values of these elements incurred on the sales of each sector's output. The other fees row includes radio users' fees paid by private purchasers of radios and televisions and surcharges paid by agricultural purchasers on certain types of machinery and equipment spare parts. The subsidies row includes subsidies on sales of machinery, fertilizer, and other commodities to agriculture and subsidies on sales of agricultural raw materials to light industry.[3] There does not appear to be any rational explanation of the anomaly that purchases of agricultural machinery are subsidized but purchases of spare parts for this machinery incur surcharges.[4] In the producers' prices table the turnover taxes, other fees, and subsidies rows (63, 64, and 65) are zero in the producing sector columns because these elements have been removed from the sales of these sectors. However, in order to keep input-output totals consistent with national income values, the totals for these elements are retained in the value-added quadrant in the new columns (57 and 58). The residual row of value added, called other income, consists primarily of profits, but may also include such things as interest on short-term loans, penalties and court fines, and costs of training personnel.

The gross value of output (GVO) of each sector in the producers' prices table equals its GVO in purchasers' prices minus T&C and

[3] It should be pointed out that not all subsidies in the Soviet economy are accounted for in these tables. Apparently, production of children's clothing is also subsidized but the value of this subsidy is probably quite small relative to the total magnitudes of value-added and consumption in the sewn goods sector. The well known subsidization of residential housing is quantitatively much more important, but in Soviet input-output methodology this subsidy is not recorded in the three-quadrant framework and it is therefore neither identified nor adjusted for here.

[4] See Treml, Agricultural, 1978, for a discussion of subsidies and surcharges in agriculture.

T&D costs, taxes, and fees, plus subsidies. For the economy as a whole the total GVO is reduced only by the value of T&C and T&D costs. Because the taxes, fees, and subsidies which were eliminated from the value added of the producing sectors are retained in the value-added total, they are still included in the total GVO for the economy.

A single element of the fourth quadrant is shown in the reconstructed tables. This is the value of depreciation in the nonproductive sphere, which includes depreciation on private housing and capital assets used in nonproductive services, such as passenger transportation.

The employment vector, which is appended to both tables, shows average annual employment for each of the 56 producing sectors. The fixed capital stock row, also given in both tables, records fixed assets in "book value," that is, in the prices recorded in the books in the year the assets were acquired.

Since the Soviets publish only segments of their input-output tables, concealing many key elements, the process of reconstruction is long and intricate, involving literally hundreds of separate estimates that must be integrated and balanced. The estimating methodology varies with the amount and kind of data available. Some of the estimating procedures are simple and direct, others are complex and lengthy; they cannot be described in a paper of this scope. Basically, the procedure followed is to determine the primary parameters of the table, confirm and test these estimates in as many ways as possible, and fit other estimates into the framework thus established. With all this, there still are a number of important problems that have not yet been resolved or have been only partially resolved.

One of the more vexing problems is the lack of data on defense-related industries and military expenditures. Neither the published segments of the first quadrant nor the other statistical and descriptive literature on Soviet input-output tables provide any information on the parameters or location of defense industries in the tables. It appears that the principal industries are treated as follows. The shipbuilding industry, which produces both civilian and military vessels and is considered to be part of the defense industry complex, is hidden by aggregation with other means of transportation in the transportation machinery and equipment sector. The radio and electronic industry, which also produces both civilian and military goods, is defined as a separate sector but no data for it are published. The aircraft and armaments industries are never mentioned in the literature, and their location is not known. Since the values in Soviet input-output tables correspond to the various national income accounts, it must be concluded that these industries are not deleted from the tables but are concealed by aggregation with other sectors. Since the magnitudes of the values so concealed are quite high,[5] such aggregation must result in significant distortions in the parameters of the civilian sectors involved.

Information on other military expenditures in the final-demand quadrant is also scant, but enough is known to indicate the location of

[5] According to CIA testimony to Congress, about one-third of the product of the machine-building and metalworking branch of the economy is earmarked for military purposes (see U.S. Congress, Joint Economic Committee, Allocation, 1978, p. 20).

the major elements. Military personnel expenditures for food, clothing, and other consumption items are included with private consumption. Material costs related to maintenance of military facilities, current operations of the armed forces, and research and development are included in state consumption. Procurement of armaments and other military hardware is recorded in the gross investment column. The sum of these material costs of the Soviet defense effort probably amounts to about 15 percent of the total final demand.[6] As in the case of other "nonproductive" services, the wages of military personnel do not appear in the final-demand quadrant. In Soviet input-output methodology, such expenditures belong in the fourth quadrant, but this has never been calculated for any of the Soviet tables.

Another important problem in the reconstruction of Soviet input-output tables lies in the valuation of exports and imports. In Soviet input-output methodology, foreign trade flows are recorded in domestic prices, but the data are never published. Foreign trade statistics are regularly published in considerable detail by the Ministry of Foreign Trade, but these data are not valued in domestic prices. Instead, they are given in so-called "foreign trade prices," that is, in foreign currency values converted to rubles at official exchange rates. Since these rates are fixed by government fiat and bear no relation to the true exchange value of the ruble, the published foreign trade values also bear no relation to the domestic values of the commodities exchanged, and the differences are substantial.

Although net foreign trade in domestic values is incorporated in both the input-output tables presented in this paper, it is not separately identified but is included in the other final demand column as a balance (exports minus imports). Work on estimating the domestic value of exports and imports for the 1972 table has not yet been completed. Some of the main components have been determined, however, and these are shown in table 1.

TABLE 1.—THE VALUE OF SOVIET FOREIGN TRADE IN DOMESTIC AND FOREIGN TRADE PRICES, 1972

[In millions of rubles]

	Exports			Imports		
	In domestic prices (D)	In foreign trade prices (F)	Ratio D/F	In domestic prices (D)	In foreign trade prices (F)	Ratio D/F
Total	17,819	12,735	1.40	31,375	13,309	2.36
Industry	17,043	12,189	1.40	28,013	11,918	2.35
Agriculture	708	410	1.73	3,217	1,340	2.40
Other branches	68	68	1.00	145	51	2.84

Source: Authors' unpublished working notes.

This characteristic of Soviet foreign trade statistics appears to be widely misunderstood; even Soviet economists often use data in foreign trade prices in analyses where domestic values should be used. One of the measures frequently used to assess the degree of a nation's dependence on foreign trade is the ratio of its foreign trade turnover

[6] This is a rough estimate based on CIA testimony in ibid., p. 19 and on data in Schroeder and Severin, "Soviet," 1976, p. 653.

(exports plus imports) to its national income. This should properly be done with data of the same valuation on both sides of the calculation. In the Soviet case, use of the published foreign trade data yields results greatly different from those derived on the basis of domestic value data. The share of foreign trade turnover in national income as derived from input-output data rose from 12 percent in 1966 to about 16 in 1972. When the turnover is measured in foreign trade prices, the proportion is only about half that.[7] As the Soviet Union becomes increasingly more involved in world trade, the ratio of its foreign trade to its national income becomes greater and more important.[8]

There are many other problems associated with the reconstruction of Soviet input-output tables. It is believed, however, that these have been resolved adequately enough so that the tables can be used in many types of analysis. One such—an analysis of changes in the structure of the Soviet economy over time—is the subject of the next part of this paper.

II. Structural Change in the Soviet Economy

This part presents the summary results of an analysis of structural change in the Soviet economy using the reconstructed ex post input-output tables in producers' prices for 1959, 1966, and 1972.[9] To perform this analysis, a number of adjustments in the initial data were required to improve comparability. First, the 1959 and 1966 tables were rebased from current prices of those years to 1972 prices. Then, some sectors were aggregated to reduce the tables to a comparable format. Some differences in the classification of specific commodities still remained even at the more aggregate level, but it is believed that the quantities involved are not large enough to have any significant effects on the results. Finally, there are discrepancies between the original tables in the definitions of a few industries that could not be eliminated or reduced to an insignificant level. It was therefore necessary to exclude the data for these industries from some of the exercises in this analysis. Despite these adjustments, some degree of noncomparability still remains, hence the results of this analysis must be interpreted with caution.

Table 2 shows some of the principal parameters of the Soviet economy in each of the three input-output years and the rates of change in these parameters. All of the output values in this table have been deflated to 1972 prices. The fixed capital data are given in terms of "book value," a mixture of current prices of the years in which the assets were acquired.

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[7] See, for example, International Bank of Reconstruction and Development, World, 1976, pp. 414–415.

[8] Preliminary indications suggest that in 1977 this proportion rose to over 20 percent. When the forthcoming Soviet 1977 table is reconstructed, we will be able to estimate it more precisely.

[9] For reasons of space, only a brief summary can be presented here. For a complete description of the methodology, the underlying data, and the detailed analysis, see Guill, Structural, 1979.

TABLE 2.—SUMMARY STATISTICS FROM THE 1959, 1966, AND 1972 RECONSTRUCTED SOVIET INPUT-OUTPUT TABLES IN 1972 PRODUCERS' PRICES

Item	1959	1966	1972	Average annual rate of growth, percent	
				1959–66	1966–72
Gross output (billions of 1972 rubles)	304.2	464.2	682.1	6.23	6.63
Final demand (billions of 1972 rubles)	147.2	214.8	307.0	5.54	6.13
Intermediate output (billions of 1972 rubles)	157.0	249.4	375.1	6.84	7.03
Employment (millions of work-years)	76.6	84.4	86.6	1.40	.43
Fixed capital (billions of rubles)	164.1	298.1	498.5	8.90	8.95

One of the striking features of the economy highlighted by these statistics is the high and increasing proportion of intermediate output in total production. In each period, intermediate output grew at a faster rate than either final demand or gross output, its proportion rising from 52 percent in 1959 to 54 percent in 1966 and 55 percent in 1972. By contrast, a similar analysis of the U.S. economy showed the share of intermediate output holding quite steady at a level slightly below 50 percent during the period 1939–1961.[10] The increasing rate of growth in intermediate output in the Soviet economy relative to final demand is undoubtedly due in part to shifts in the relative importance of individual industries and to increasing specialization, but it also suggests some decline in production efficiency.

Also noteworthy is the sharp drop in the rate of increase in employment in the period 1966–1972 as compared to 1959–1966. The data in table 2 present an incomplete picture of employment in the U.S.S.R. since they include only "productive" employment and not "nonproductive" services, the proportion of which in total employment has been continuously increasing. However, there was not any sharp change in the rate of growth of this proportion at any time during the entire period 1959–1972.[11] Thus, the sharp decline in the rate of growth of "productive" employment reflects primarily the trend in the growth of the labor force.

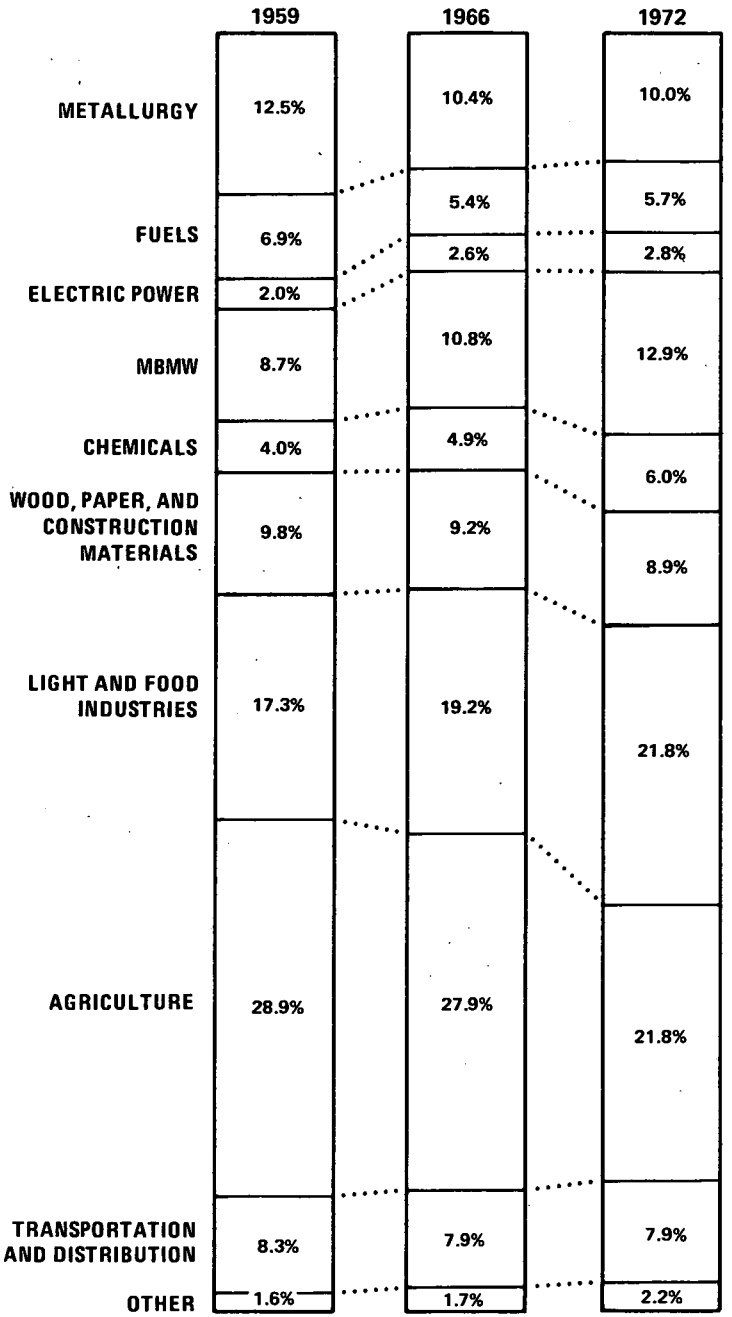
The stock of fixed production capital increased at a high and steady rate throughout the period, reflecting the high rate of capital formation in the Soviet Union and probably some inflation in the prices of capital goods.

Viewed from the perspective of a traditional input-output model, the changes in total production and factor input levels shown in table 2 reflect the effects of changes in the structural relationships among producing sectors in the Soviet economy and also changes in the level and composition of final demand. In order to isolate the effects of structural change and investigate the changes in input requirements associated with changes in the relationships among producing sectors, we first choose a specific vector of final demand and assume that the level and composition of this bill of goods did not change. Then we examine the intermediate outputs required to produce this same vector of final demand with the input-output structures of different years. The input-output model is particularly suited for this purpose because it provides a measure of total input requirements (direct plus indirect coefficients) that takes into account the interdependencies among industries. By comparing the intermediate outputs required to do the same job we can separate the effects of changes in the structure of industry from changes in the final demands made on the economy.

[10] Carter, Structural, 1970, pp. 33–34.
[11] See Nar. khoz. 72, p. 502, and Nar. khoz. 62, p. 451.

Figure 1.

INTERMEDIATE OUTPUT REQUIREMENTS TO PRODUCE 1972 FINAL DEMAND WITH 1959, 1966, AND 1972 TECHNOLOGY



In the analysis presented here, calculations were made to determine the intermediate outputs required to produce the 1972 vector of final demand with 1959, 1966, and 1972 technologies. The results are summarized in figure 1. First, it should be noted that total intermediate requirements changed very little over this period as a result of changes in the structure of the economy. In other words, the total volume of material output required to produce the same bill of final goods remained at approximately the same level despite changes in technology. The approximate constancy of intermediate input requirements has been noted in studies of other economies and is usually explained as reflecting the offsetting effects of such factors as increasing specialization, technological change, and greater efficiency in the use of material inputs. On the one hand, technological progress and greater efficiency should result in reduction in the inputs required, while on the other, implementation of new technology usually increases specialization and may actually result in an increase in intermediate inputs. These factors apparently tend to cancel each other.

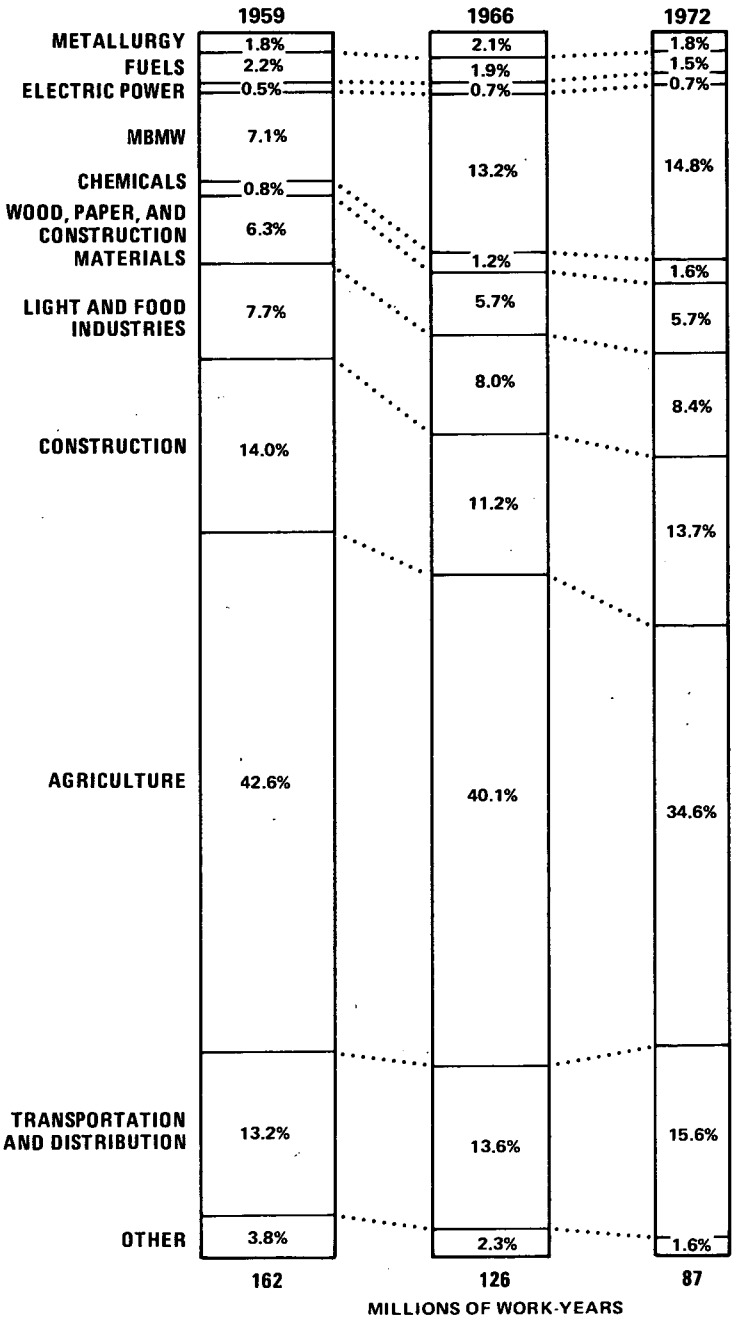
Although structural change had little effect on the level of total intermediate requirements, there was considerable variation in the requirements from different industries, as can be seen from figure 1.[12] There was a steady and substantial increase in the requirements from machine-building and metalworking (MBMW), the chemicals group, and the light and food industries. Requirements for electric power rose sharply in the 1959–1966 period and increased further in 1966–1972 but at a much lower rate. On the other hand, requirements for the output of the wood, paper, and construction materials group declined steadily. Metallurgy requirements also declined—considerably during 1959–1966 and less so in 1966–1972. Agricultural requirements held nearly level in the first period and declined substantially in the second. Requirements for the transportation and distribution services declined somewhat in the first period and levelled off in the second. Fuel requirements dropped rather sharply in 1959–1966 but then increased slightly in 1966–1972.

More detailed analysis reveals considerable variation within these groupings also (for reasons of space the detailed data are not presented here). For example, within the fuel producing sector there was a marked decline in the requirements for coal and peat and a corresponding increase in the use of oil. A large part of the increase in MBMW requirements was accounted for by the energy and power equipment, machine tool, precision instruments, and chemical equipment industries, although most machinery industries registered some increase. In the chemicals group, the most significant increases were attributable to the basic chemistry, synthetic resins and plastics, and synthetic fiber industries, while those producing organic synthetic products and rubber products declined. Similarly, the decrease in the wood, paper, and construction materials group occurred largely in wood products, while requirements for construction materials rose steadily throughout the period. Most of the decrease in agricultural requirements was attributable to the products of animal husbandry, and in the transportation and distribution group the trade and supply services registered a slight but steady decline throughout the entire period. Although most of the change in requirements for intermediate output occurred slowly, in some industries there were rather dramatic shifts.

[12] It should be noted that the important construction sector is not represented in figure 1. This is due to the fact that by the conventions of Soviet accounting construction produces only for investment in the final-demand quadrant and makes no intermediate deliveries.

Figure 2.

LABOR REQUIRED TO PRODUCE 1972 FINAL DEMAND WITH 1959, 1966, AND 1972 TECHNOLOGY



The effects of structural change on requirements for the primary inputs of labor and capital were also analyzed. Figure 2 traces the change in labor requirements to produce 1972 final demand with 1959, 1966, and 1972 technology. In this figure, the width of the bars represents total labor requirements,[13] while the distribution of the required labor is shown vertically. Unlike the requirements for intermediate product inputs, total labor requirements changed drastically, declining throughout the period and especially in 1966–72. Nearly twice as much labor would have been required to produce 1972 final demand with 1959 technology as was in fact required in 1972. In absolute terms more than half the decrease was attributable to agriculture and another 25 percent to the construction and transportation and distribution sectors. In relative terms, the most striking changes are the increase in MBMW requirements and the decrease in agriculture. The electric power, chemicals, light and food, and transportation and distribution groups also increased relatively, while fuels and wood, paper, and construction materials declined.

This analysis provides statistical confirmation of the general rise in labor productivity in the Soviet economy. Not surprisingly, the agricultural sector contributed heavily to this rise. Nearly 40 million more agricultural workers would have been required to produce the 1972 bill of final goods with 1959 technology than were required in 1972—130 percent more, and even with 1966 technology over 20 million (67 percent) more would have been needed. The changes in the wood and paper industries and in transportation were nearly the same in proportion (though far less in numbers). Other sectors that exhibited large decreases in labor requirements were construction, construction materials, textiles and apparel, and food processing.

A surprising conclusion from this analysis is that the MBMW and chemicals groups apparently contributed little or nothing to the overall rise in labor productivity, especially in the period 1959–66. In MBMW, the use of 1966 technology to produce 1972 final demand would have required about 40 percent more labor than with 1959 technology. And although this requirement declined between 1966 and 1972, it still was higher in 1972 than it would have been in 1959. These results would appear to give credence to the perennial Soviet complaint of the high proportion of auxiliary workers in these industries and the low productivity of these workers. The trends for the chemicals group were similar but not as pronounced. It may be that forced expansion of high-technology industries caused this phenomenon, since the individual industries that appear to be the principal culprits were electrotechnical equipment, precision instruments, and chemical equipment in the MBMW group, and basic chemistry in the chemicals group.

Changes in the requirements for fixed capital are shown in figure 3. As in figure 2, the width of the bars here is proportional to the total required to produce 1972 final demand in each of the three years. This total increased substantially in each period, reflecting the growing capital intensity and declining capital productivity in the Soviet economy. In relative terms, as shown by the vertical distribution in figure 3, the MBMW and electric power groups increased the most. Virtually all individual industries increased their capital requirements, the primary exceptions being the coal industry, production of

[13] Note that in conformity with the Soviet concept of net material product, the data in figure 2 incorporate only "productive" labor.

some types of heavy machinery such as energy and power equipment and mining and metallurgical machinery, organic synthetic products, and logging.

As noted above, the changes in total production and in the use of primary inputs shown in table 2 can be factored into effects of structural change, change in the composition of final demand, and change in the level of total final demand. The preceding analysis concentrated on structural change using a fixed vector of final demand. In table 3, the analysis is extended to include changes in the composition and level of final demand.

Figure 3.

FIXED CAPITAL STOCK REQUIRED TO PRODUCE 1972 FINAL DEMAND WITH 1959, 1966, AND 1972 TECHNOLOGY

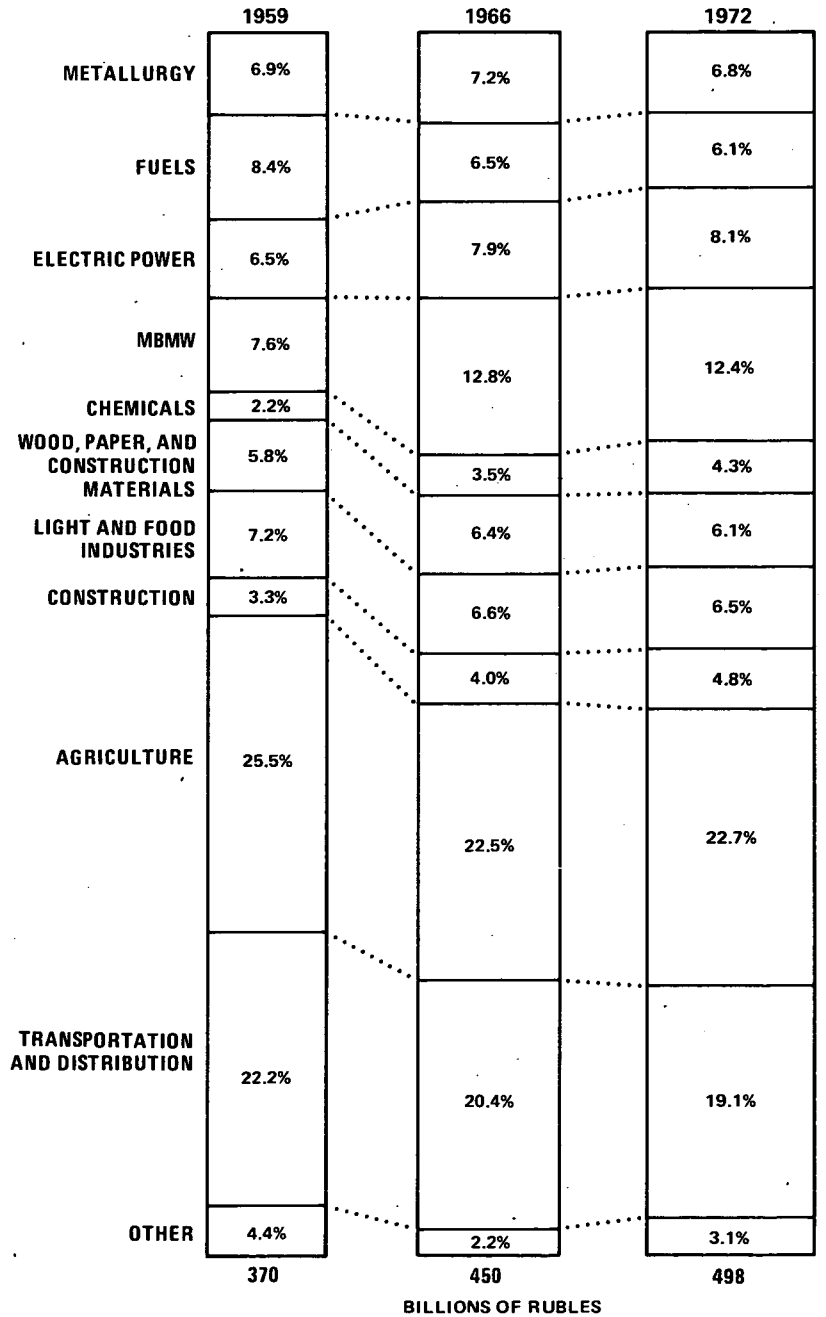


TABLE 3.—EFFECTS OF STRUCTURAL CHANGE, CHANGES IN THE COMPOSITION OF FINAL DEMAND, AND CHANGES IN THE LEVEL OF FINAL DEMAND ON TOTAL OUTPUT, LABOR REQUIREMENTS, AND CAPITAL REQUIREMENTS, 1959–66 AND 1966–72

	1959–66		1966–72	
	(a)	(b)	(a)	(b)
I. Change in total production (in billions of 1972 rubles)	160.0		217.9	
Components:				
(1) Structural change	8.8	9.6	−23.0	−2.0
(2) Composition of final demand	11.7	6.5	41.4	21.3
(3) Level of final demand	139.5	143.9	199.5	198.6
II. Change in labor requirements (in millions of work-years)	7.8		2.2	
Components:				
(1) Structural change	−18.1	−27.1	−22.9	−39.3
(2) Composition of final demand	1.8	3.9	−1.3	9.3
(3) Level of final demand	24.1	31.0	26.4	32.2
III. Change in capital requirements (in billions of rubles)	134.0		200.4	
Components:				
(1) Structural change	32.8	46.2	48.9	45.7
(2) Composition of final demand	23.9	26.1	2.4	46.0
(3) Level of final demand	77.3	61.7	149.1	108.7

The measures of structural change shown in the columns marked (a) were derived by calculating the change in output required to produce the final demand vector of year t+1 with the input-output technologies of years *t* and t+1. The effects of changes in the level and distribution of final demand shown in these columns were calculated by applying different final demand vectors to the technology matrix of year *t*. The measures of structural change shown in columns (b) were calculated by applying the technology matrices of years *t* and t+1 to the final demand vector of year *t*, while the fixed technology matrix of year t+1 was used to derive the effects of changes in the distribution and level of final demand.

Considering first the changes in total production, these figures show that structural change had a relatively modest impact on production levels in both periods. In other words, the total requirements for intermediate outputs (inputs) associated with the delivery of a given vector of final demand did not change much between 1959 and 1972. This finding reflects many offsetting factors which cannot be further distinguished in the input-output model. The most significant of these factors are thought to be increasing industrial specialization, technological change, and increased efficiency in the use of intermediate inputs. Changes in the composition of final demand also appear to have had a relatively minor effect on Soviet production levels in these periods. The rising level of final expenditures was clearly the most significant factor in affecting production levels in the economy. According to this analysis, this factor alone accounted for approximately 90 percent of the increase in total production in each of these periods.

The effects of these factors on labor requirements were more varied than in the case of total production. First, structural change resulted in a significant reduction in labor requirements in both 1959–1966 and 1966–1972. This reduction can be loosely attributed to increasing labor productivity. Changes in the composition of final demand resulted in a slight increase in labor requirements in the period 1959–1966; however, the effects of this factor are inconclusive for 1966–1972, because the different weighting schemes yield measures with different signs. The most significant factor in increasing labor requirements was the

rising level of final demand. In both periods, this growth was more than enough to offset the labor saving effects of structural change.

In respect to capital requirements, all three components of change resulted in increases. In contrast to its effect on labor requirements, structural change was a significant factor in increasing capital requirements. Once again, however, the most significant was the rising level of final demand. The change in the composition of final demand, although it did contribute to increasing capital requirements, was the least significant of the three factors.

It would seem that the analysis of intertemporal changes in material, labor, and capital inputs of the type described above should be of great interest to Soviet economists and planners. Strange as it may seem, however, in the voluminous Soviet literature on input-output analysis scant attention is paid to such changes.

One possible explanation for the neglect of one of the most promising areas of input-output analysis is the fact that the intertemporal changes observed on the basis of the three input-output tables suggest a general decrease in the economic efficiency of production in the U.S.S.R. A highly placed functionary of the Central Statistical Administration, and one of the foremost Soviet authorities on input-output analysis, M. R. Eydel'man, has repeatedly pointed out that, other things being equal, increasing economic efficiency means a reduction in the ratio of material cost to value added (i.e., reduction in the "material intensity of production" in Soviet terminology). However, the data in input-output tables show just the opposite trend, with ratios of material intensity rising steadily from 1959 to 1972. It may be noted parenthetically that U.S. input-output tables indicate almost no change in the ratio of material costs to value added in the 1958–1963 period and a marked decline in the periods 1963–1967 and 1967–1972. It is thus quite possible that, in the long Soviet tradition of suppressing statistics that reflect unfavorably on economic performance, the Central Statistical Administration has discouraged studies of coefficient changes or prohibited publication of the results.[14]

[14] Two articles that have just recently appeared may herald a change in this situation. One (Samokhvalov and Urinson, "Analysis," 1979, pp. 58–67) analyzes changes in input coefficients; the other (Voyeykova, "Determining," 1979, pp. 68–78) attempts to measure the effects of structural change on national income and the primary inputs. In both cases, however, the authors are somewhat vague in interpreting the results of their analyses.

Appendix A

Reconstructed 1972 Input-Output Tables

List of Abbreviations Used in Tables A–I and A–II

ABRASV	Abrasives.
AGRIC M+E	Tractors and agricultural machinery and equipment.
AUTOS	Automobiles.
BASIC CHEM	Basic chemistry products.
BEARNG	Bearings.
CONST MAT	Construction materials.
CONST M+E	Construction machinery and equipment.
DAIRY PROD	Dairy products.
ELEC POWER	Electric power and steam.
ELTECH+CABLE	Electrotechnical machinery and equipment and cable products.
EN+POW M+E	Energy and power machinery and equipment.
FISH PROD	Fish products.
FIXD CAPITAL	Fixed capital stock.
FLOUR+BREAD	Flour, bread, and confections.
FOREST	Forestry.
FURN+OTH WD	Furniture and other woodworking.
GLASS+PORC	Glass and porcelain products.
GVO	Gross value of output.
IND NEC	Industry not elsewhere classified.
INDMET PROD	Industrial metal products.
INTIND USE	Interindustry use.
LOGGNG	Logging.
MEAT PROD	Meat products.
METAL STRUCT	Metal structures.
METLWK M+E	Metalworking machinery and equipment.
MI+MET M+E	Mining and metallurgical machinery and equipment.
MINERL CHEM	Mineral chemistry products.
NATIONAL INC	National income.
OIL EXTRAC	Oil extraction.
OIL REF	Oil refining.
OTH LT IND	Other light industry products.
OTHER BRANCH	Other branches of material production.
OTHER CHEM	Other chemicals.
OTHER FD	Other final demand.
OTHER METWRS	Other metal wares.
PAINT+LAC	Paints and lacquers.
PEAT+SHALE	Peat and oil shales.
PRECIS INST	Precision instruments.
PUMPS+CHEM E	Pumps and chemical equipment.
RADIO+OTH MB	Radio-electronics and other machine-building.
REPAIR	Repair of machinery and equipment.
RUBBER PROD	Rubber and asbestos products.
SANIT ENG PR	Sanitary engineering products.
SAW+LUM PR	Sawmills and lumber products.
SOCSEC PAYMT	Social security payments.
SPECL M+E	Specialized machinery and equipment.
SYN RUBBER	Synthetic rubber.
TAXES+FEES	Turnover taxes and other fees.
TEXTLS	Textiles.
TOTAL FD	Total final demand.
TOTAL PURCH	Total purchases.
TRADE+DIST	Trade and distribution.
TRANS+COM	Transportation and communications.
TRANSP M+E	Transportation machinery and equipment.
WOOD CHEM	Wood chemistry products.

TABLE A-I THE RECONSTRUCTED 1972 SOVIET INPUT-OUTPUT TABLE IN PURCHASERS' PRICES
(IN MILLIONS OF RUBLES, EMPLOYMENT IN THOUSANDS OF WORK-YEARS)

SEQ NO.	110 ORDER NO.		METALL URGY 1	INDMET PROD 2	COAL 3	OIL EXTRAC 4	OIL REF 5	GAS 6	PEAT + SHALE 7	ELEC POWER 8	EN+POW M+E 9
1	1-4,6,7	METALLURGY	16226.4	986.3	69.1	6.0	28.9	2.0	5.2	26.0	341.3
2	5	INDMET PROD	92.0	30.5	31.1	1.6	1.6	.3	1.8	9.2	7.7
3	8	COAL	3209.1	6.6	3417.9	.0	.0	.0	.3	2378.3	1.3
4	9	OIL EXTRAC	2.7	.1	.5	104.4	4749.3	107.3	.0	38.0	.0
5	10	OIL REF	451.4	20.4	39.1	12.8	394.7	11.5	20.4	1581.6	12.1
6	11	GAS	560.9	12.6	.8	21.7	81.3	101.5	.2	1082.2	8.3
7	12,13	PEAT +SHALE	.9	.0	5.3	.0	.0	5.3	91.2	253.7	.1
8	14	ELEC POWER	1577.4	46.2	362.7	159.1	429.6	45.5	17.5	166.3	35.8
9	15	EN+POW M+E	7.8	.2	.8	.3	.3	.0	.4	36.2	51.5
10	16,17	ELTECH+CABLE	99.2	4.0	58.8	6.3	4.7	1.1	3.8	39.3	73.4
11	20-22	METLWK M+E	12.3	.3	.2	.2	.2	.0	.1	.2	3.6
12	23	TOOLS + DIES	35.4	4.5	10.1	3.0	1.6	.6	.9	6.9	6.0
13	24	PRECIS INST	11.4	.3	2.8	.9	3.0	.3	.2	8.5	19.1
14	25-27	MI+MET M+E	341.1	3.3	157.3	13.3	12.3	1.7	9.2	.0	.2
15	28,29	PUMPS+CHEM E	11.8	.1	1.9	1.0	4.7	1.3	.2	2.1	6.7
16	30-34,36	SPECL M+E	11.7	.3	1.7	.1	.1	.0	.2	.7	.8
17	35	CONST M+E	20.8	.0	1.8	.0	.0	.0	.2	.4	.1
18	37,38	TRANSP M+E	16.3	.1	1.5	.0	.0	.0	.9	.3	.3
19	39	AUTOS	37.5	1.0	2.5	1.0	2.3	.4	.9	7.1	12.5
20	40	AGRIC M+E	11.7	.0	2.2	.5	.2	.0	5.0	1.5	.9
21	41	BEARINGS	17.0	.9	2.1	.3	.5	.0	.7	1.4	5.7
22	18,19,42,43	RADIO+OTH MB	115.2	4.7	49.9	11.8	15.8	2.5	6.5	83.3	165.6
23	44	SANIT ENG E	4.2	.3	1.2	.1	.3	.0	.1	1.1	1.1
24	45	OTHER METWRS	37.9	2.0	10.8	.9	2.0	.5	.4	4.5	1.2
25	46	METAL STRUCT	6.8	.8	3.7	.0	.1	.0	.0	.2	.2
26	47	REPAIR	457.4	10.4	48.5	19.6	38.4	3.1	1.4	152.2	8.9
27	48	ABRASV	33.7	1.6	.6	.1	.2	.1	.1	.7	2.9
28	49	MINERL CHEM	17.8	.1	1.3	.1	1.5	.0	.5	.4	.6
29	50	BASIC CHEM	344.0	14.5	83.0	10.2	112.8	3.0	13.7	44.6	2.7
30	56	PAINT + LAC	22.1	1.3	4.6	1.6	2.2	.3	.4	5.1	3.8
31	54	SYN RUBBER	.3	.0	.0	.0	.0	.2	.0	.0	.0
32	57	RUBBER PROD	129.6	1.5	45.2	2.6	3.3	.6	2.3	9.7	4.9
33	51-3,55,58-9	OTHER CHEM	47.3	3.0	7.1	10.2	86.3	13.0	2.3	13.2	4.0
34	60	LOGGING	54.7	1.6	273.7	.7	.6	.1	2.0	4.2	1.6

35	61,62	SAW + LUM PR	90.7	22.1	90.0	1.0	5.0	.3	2.0	6.2	11.3
36	63,64	FURN +OTH WD	11.4	3.5	4.8	.8	1.0	.1	1.6	8.6	1.8
37	65	PAPER + PULP	27.7	3.6	2.2	8.9	3.9	1.6	.1	2.0	3.1
38	66	WOOD CHEM	17.5	.2	.0	.0	3.0	.3	.1	.2	.1
39	67-73	CONST MAT	57.2	3.3	56.2	1.7	3.7	.4	.9	12.6	2.3
40	74	GLASS + PORC	11.5	1.4	1.0	.5	1.8	.1	.1	1.8	.7
41	75-80	TEXTLS	40.9	87.5	5.9	2.9	4.2	.4	1.0	6.3	4.1
42	81	SEWN. GOODS	59.8	3.4	38.9	4.3	3.7	.7	2.4	12.1	3.0
43	82	OTH LT IND	12.5	.8	8.3	1.2	1.0	.3	.6	3.6	.9
44	83	FISH PROD	.5	.0	.0	.0	.1	.0	.0	.0	.0
45	84	MEAT PROD	2.1	.0	.0	.0	.1	.0	.0	.0	.0
46	85	DAIRY PROD	19.5	.9	2.0	.8	18.0	6.6	.1	3.5	.8
47	86	SUGAR	.1	.0	.3	.0	.0	.0	.0	.0	.0
48	87-89	FLOUR+BREAD	1.0	.0	.0	.0	.0	.0	.0	.0	.0
49	90-94	OTHER FOOD	23.5	3.1	4.3	.6	11.2	.2	.2	4.2	.6
50	95	IND NEC	54.0	2.3	34.0	3.5	12.1	1.4	2.0	64.0	5.2
51	96-100	CONSTRUCTION	.0	.0	.0	.0	.0	.0	.0	.0	.0
52	101,102	AGRICULTURE	2.7	.1	.9	.1	.0	.0	.1	.1	.1
53	103	FOREST	.0	.0	.0	.0	.0	.0	.0	.0	.0
54	104-106	TRANS + COM	2852.9	138.4	1843.9	1608.3	2022.0	1452.3	50.5	26.6	83.3
55	107-109	TRADE + DIST	684.6	37.5	335.1	.0	874.5	77.0	.0	.0	9.0
56	110	OTHER BRANCH	776.1	10.2	2.4	.3	.1	.2	.1	9.3	4.5
57		TOTAL PURCH	28772.0	1477.8	7130.0	2025.3	8944.2	1844.1	250.8	6120.2	915.7
58		DEPRECIATION	2462.2	77.8	1141.1	765.5	547.8	155.7	96.9	2172.0	89.2
59		WAGES	3650.5	257.5	3118.0	191.4	229.3	42.2	136.2	1025.3	328.7
60		SOCSEC PAYMT	288.4	20.3	280.6	16.1	19.3	3.5	12.2	67.7	21.7
61		TURNOVER TAX	17.0	52.0	.0	.0	5171.0	752.0	.0	580.0	.0
62		OTHER FEES	.0	.0	.0	.0	.0	.0	.0	.0	.0
63		SUBSIDIES	.0	.0	.0	.0	.0	.0	.0	.0	.0
64		OTHER INCOME	6930.1	181.7	819.2	3074.0	1180.1	1169.3	111.5	4065.2	231.7
65		NATIONAL INC	10886.0	511.5	4217.8	3281.5	6599.7	1967.0	259.9	5738.2	582.1
66		TOTAL OUTLAY	42120.2	2067.1	12488.9	6072.3	16091.7	3966.8	607.6	14030.4	1587.0
67		EMPLOYMENT	1575.0	117.9	1001.2	94.3	117.2	21.3	94.1	597.6	176.3
68		FIXD CAPITAL	32863.4	989.5	12740.7	10056.7	6830.3	1901.3	923.3	40552.1	1062.7

TABLE A-1 THE RECONSTRUCTED 1972 SOVIET INPUT-OUTPUT TABLE IN PURCHASERS' PRICES
(IN MILLIONS OF RUBLES, EMPLOYMENT IN THOUSANDS OF WORK-YEARS)

SEQ NO.	110 ORDER NO.		ELTECH +CABLE 10	METLWK M+E 11	TOOLS + DIES 12	PRECIS INST 13	MI+MET M+E 14	PUMPS+ CHEM E 15	SPECL M+E 16	CONST M+E 17	TRANSP M+E 18
1	1-4,6,7	METALLURGY	1986.1	184.3	250.2	244.6	598.0	384.1	511.0	140.1	647.7
2	5	INDMET PROD	88.4	10.8	3.9	17.6	21.3	14.2	37.0	10.1	46.9
3	8	COAL	11.7	1.8	1.2	3.9	8.0	3.3	5.8	1.4	7.0
4	9	OIL EXTRAC	.1	.1	.0	.1	.2	.0	.0	.0	.3
5	10	OIL REF	55.0	9.0	5.3	14.5	21.3	11.9	21.6	9.1	35.7
6	11	GAS	23.6	6.1	1.5	8.5	17.5	9.6	12.7	5.1	18.2
7	12,13	PEAT +SHALE	.9	.3	.1	.2	.2	.2	.1	.0	.1
8	14	ELEC POWER	142.0	43.3	25.0	62.0	64.7	44.8	62.9	24.7	96.7
9	15	EN+POW M+E	40.9	.3	.0	1.1	10.1	8.3	16.8	10.4	386.6
10	16,17	ELTECH+CABLE	1280.3	151.8	14.5	182.0	110.5	245.1	242.7	38.6	313.1
11	20-22	METLWK M+E	7.0	43.6	2.0	3.3	2.4	1.8	3.4	2.7	4.1
12	23	TOOLS + DIES	23.5	32.9	16.3	32.3	19.9	20.1	22.6	6.7	19.7
13	24	PRECIS INST	41.9	20.8	2.6	645.4	4.3	34.0	16.3	6.2	98.0
14	25-27	MI+MET M+E	.5	.0	.0	.4	79.5	.0	.1	.1	.1
15	28,29	PUMPS+CHEM E	3.8	8.7	.2	2.7	18.7	154.2	7.7	9.3	100.1
16	30-34,36	SPECL M+E	2.4	1.6	.1	.5	1.6	.5	138.2	5.0	46.3
17	35	CONST M+E	.1	.1	.0	1.0	.4	.0	1.3	52.4	.6
18	37,38	TRANSP M+E	.4	.0	.0	.4	2.6	.7	2.4	.7	364.5
19	39	AUTOS	45.5	1.0	.4	21.7	44.7	15.8	167.8	98.3	15.1
20	40	AGRIC M+E	18.3	.1	.1	.3	25.3	11.4	45.7	380.9	1.5
21	41	BEARINGS	31.1	22.0	3.3	21.6	31.0	6.7	40.7	12.7	40.6
22	18,19,42,43	RADIO+OTH MB	79.7	132.1	11.8	440.0	145.3	151.5	185.1	87.4	551.1
23	44	SANIT ENG E	1.8	.6	.1	1.2	.9	.6	1.5	.9	6.4
24	45	OTHER METWRS	24.7	5.5	3.8	17.5	8.8	10.7	17.4	4.8	21.4
25	46	METAL STRUCT	.6	1.8	.4	1.2	.7	.9	1.4	.2	1.0
26	47	REPAIR	17.9	3.4	1.7	9.7	8.6	3.3	7.6	3.3	17.2
27	48	ABRASV	8.0	5.5	10.3	7.4	3.7	2.2	4.3	1.2	4.4
28	49	MINERL CHEM	1.8	.0	.0	.8	.2	.0	.1	.1	.4
29	50	BASIC CHEM	56.2	2.4	2.7	20.8	6.3	12.8	5.8	2.8	18.6
30	56	PAINT + LAC	84.1	9.8	1.1	16.6	7.3	13.6	21.2	5.5	38.8
31	54	SYN RUBBER	71.5	.0	.0	.0	.7	.0	.1	.0	.0
32	57	RUBBER PROD	70.0	6.3	1.0	8.6	21.4	18.6	66.5	49.9	34.0
33	51-3,55,58-9	OTHER CHEM	466.8	6.3	4.3	67.4	6.3	59.2	19.3	3.2	36.4
34	60	LOGGING	4.8	11.5	.9	1.2	3.6	2.3	3.5	.8	8.9

35	61,62	SAW + LUM PR	77.2	28.6	10.3	48.0	15.6	26.7	40.2	7.6	66.6
36	63,64	FURN +OTH WD	9.6	2.2	1.3	11.2	1.6	5.5	35.3	1.0	21.2
37	65	PAPER + PULP	93.8	2.6	4.6	32.5	4.8	6.8	4.6	1.4	16.1
38	66	WOOD CHEM	5.6	.2	.0	.9	.1	.1	.3	.0	.5
39	67-73	CONST MAT	110.3	4.4	1.0	9.0	4.7	4.4	6.3	6.6	21.1
40	74	GLASS + PORC	53.2	.6	.2	23.3	2.1	8.6	2.4	1.7	6.2
41	75-80	TEXTLS	108.3	4.2	5.3	21.1	3.9	8.6	17.4	2.9	27.4
42	81	SEWN GOODS	16.1	4.8	2.3	9.7	6.6	6.0	9.4	3.3	14.2
43	82	OTH LT IND	5.5	1.5	.7	8.9	1.5	1.4	12.9	2.7	6.2
44	83	FISH PROD	.0	.0	.0	.0	.0	.0	.0	.0	.1
45	84	MEAT PROD	.2	.0	.0	.4	.1	.0	.1	.0	.3
46	85	DAIRY PROD	17.7	3.4	.6	6.3	4.8	3.3	3.8	3.9	4.2
47	86	SUGAR	.0	.0	.0	.0	.0	.0	.0	.0	.0
48	87-89	FLOUR+BREAD	.1	.0	.0	.0	.0	.0	.0	.0	.0
49	90-94	OTHER FOOD	10.0	.8	.4	6.3	.8	1.1	1.3	.4	4.0
50	95	IND NEC	59.5	8.5	2.0	27.0	10.1	15.1	21.4	15.8	38.3
51	96-100	CONSTRUCTION	.0	.0	.0	.0	.0	.0	.0	.0	.0
52	101,102	AGRICULTURE	.3	.0	.0	.2	.2	.2	.1	.0	.0
53	103	FOREST	.0	.0	.0	.0	.0	.0	.0	.0	.0
54	104-106	TRANS + COM	532.3	145.5	72.7	279.9	171.8	112.0	139.6	71.8	151.4
55	107-109	TRADE + DIST	169.6	43.3	39.7	157.0	27.5	87.9	52.9	14.9	10.3
56	110	OTHER BRANCH	5.6	5.3	.3	6.9	8.9	2.8	4.5	2.1	17.9
57		TOTAL PURCH	5966.3	979.7	506.2	2505.1	1561.1	1532.9	2043.1	1110.7	3387.5
58		DEPRECIATION	258.0	135.7	53.0	205.0	138.5	106.3	146.3	49.4	235.5
59		WAGES	1554.2	390.9	238.4	1425.3	465.1	425.3	635.8	213.7	822.7
60		SOCSEC PAYMT	104.1	30.1	18.4	109.7	35.8	32.7	49.0	16.5	63.3
61		TURNOVER TAX	262.0	.0	.0	492.0	.0	383.0	62.0	.0	.0
62		OTHER FEES	.0	.0	.0	.0	.0	.0	.0	.0	.0
63		SUBSIDIES	.0	.0	.0	.0	.0	.0	.0	-40.0	.0
64		OTHER INCOME	1749.4	555.0	295.8	1586.9	399.5	443.8	780.3	295.0	691.0
65		NATIONAL INC	3669.7	976.0	552.6	3613.9	900.4	1284.8	1527.1	485.2	1577.0
66		TOTAL OUTLAY	9894.0	2091.4	1111.8	6324.0	2600.0	2924.0	3716.5	1645.3	5200.0
67		EMPLOYMENT	834.3	210.1	127.8	765.0	249.6	228.1	341.5	114.9	442.0
68		FIXD CAPITAL	3256.7	1509.5	559.2	2403.8	1679.3	1338.2	1820.3	621.0	3105.3

TABLE A-I THE RECONSTRUCTED 1972 SOVIET INPUT-OUTPUT TABLE IN PURCHASERS' PRICES
(IN MILLIONS OF RUBLES, EMPLOYMENT IN THOUSANDS OF WORK-YEARS)

SEQ NO.	110 ORDER NO.		AUTOS 19	AGRIC M+E 20	BEARINGS 21	RADIO+OTH MB 22	SANIT ENG E 23	OTHER METWRS 24	METAL STRUCT 25	REPAIR 26	ABRASV 27
1	1-4,6,7	METALLURGY	1135.5	1364.6	168.9	2847.8	418.2	1168.8	809.6	978.9	40.5
2	5	INDMET PROD	106.6	62.9	17.5	133.3	10.4	96.6	25.4	88.0	.6
3	8	COAL	5.5	10.0	.3	38.2	3.7	16.0	1.6	86.4	2.1
4	9	OIL EXTRAC	.2	.2	.0	.7	.0	.0	.0	.4	.0
5	10	OIL REF	73.9	58.3	11.1	153.6	6.9	19.9	10.8	230.5	4.7
6	11	GAS	48.1	30.1	2.9	85.7	7.4	6.9	3.9	30.3	1.4
7	12,13	PEAT +SHALE	.3	1.0	.0	1.6	.6	.5	.0	.3	.0
8	14	ELEC POWER	165.6	182.8	28.5	374.6	25.9	62.4	45.4	291.6	21.1
9	15	EN+POW M+E	7.9	6.8	.0	42.3	1.4	.5	.2	85.7	.0
10	16,17	ELTECH+CABLE	121.9	160.6	4.3	1088.5	37.8	90.8	8.2	429.8	1.4
11	20-22	METLWK M+E	12.6	13.4	3.0	22.9	2.3	4.7	1.0	10.2	.1
12	23	TOOLS + DIES	65.0	71.4	6.6	123.6	4.2	29.5	2.3	48.7	1.2
13	24	PRECIS INST	13.3	10.0	.6	1887.7	7.7	16.0	.5	103.7	.2
14	25-27	MI+MET M+E	.3	.2	.0	.2	.0	.3	.1	40.4	.2
15	28,29	PUMPS+CHEM E	6.2	22.1	.3	69.6	3.9	2.7	.4	80.8	.2
16	30-34,36	SPECL M+E	2.4	1.5	.0	21.8	.9	1.5	2.0	24.2	.1
17	35	CONST M+E	.2	.0	.0	.0	.1	.3	.6	80.8	.0
18	37,38	TRANSP M+E	.1	.3	.0	.0	.0	.1	.5	142.3	.0
19	39	AUTOS	2472.6	63.0	.3	304.1	1.4	38.0	2.9	802.4	.2
20	40	AGRIC M+E	41.7	1707.5	.3	235.1	.1	13.7	5.3	1194.8	.1
21	41	BEARINGS	99.5	113.6	11.9	62.4	.8	3.2	.8	121.0	.2
22	18,19,42,43	RADIO+OTH MB	203.6	305.6	.0	8840.0	44.8	48.9	12.4	522.4	.0
23	44	SANIT ENG E	1.6	1.0	.1	29.2	83.4	4.1	3.4	5.5	.1
24	45	OTHER METWRS	63.3	84.1	6.8	496.0	10.2	97.8	4.4	130.1	.3
25	46	METAL STRUCT	.0	6.2	.0	6.2	.2	1.2	.9	4.7	.0
26	47	REPAIR	9.1	24.6	1.8	53.2	4.5	7.6	3.3	58.5	4.1
27	48	ABRASV	9.5	15.0	14.4	194.4	1.0	9.1	.9	10.1	93.6
28	49	MINERL CHEM	.2	.2	.0	5.0	.2	.4	.0	2.3	.6
29	50	BASIC CHEM	28.3	12.0	1.7	145.8	9.6	20.4	7.0	45.8	3.2
30	56	PAINT + LAC	70.6	60.7	.8	70.9	10.2	23.7	12.4	98.0	.6
31	54	SYN RUBBER	.0	.0	.0	.0	.0	1.8	.0	.0	.0
32	57	RUBBER PROD	756.8	320.8	3.0	435.7	8.0	36.5	2.3	208.1	.6
33	51-3,55,58-9	OTHER CHEM	53.2	18.2	3.0	434.8	10.7	55.7	1.9	57.2	7.6
34	60	LOGGING	8.6	3.6	.3	14.1	1.7	4.5	.9	18.5	.1

35	61,62	SAW + LUM PR	86.2	71.0	9.5	343.4	40.1	62.2	26.6	75.7	1.0
36	63,64	FURN +OTH WD	7.8	8.7	1.6	59.7	1.6	24.1	2.1	24.3	.2
37	65	PAPER + PULP	21.6	15.3	3.0	21.0	2.4	34.7	.8	16.5	3.6
38	66	WOOD CHEM	.1	.3	.0	9.5	.4	.5	.0	.4	.0
39	67-73	CONST MAT	10.1	7.4	1.3	126.5	4.2	7.9	4.3	59.1	1.4
40	74	GLASS + PORC	37.7	6.9	.4	83.7	7.0	13.6	.6	12.4	1.8
41	75-80	TEXTLS	38.4	28.6	4.5	307.3	2.8	38.8	1.4	61.6	31.8
42	81	SEWN GOODS	25.4	20.6	3.3	102.1	5.5	17.7	6.2	51.7	1.7
43	82	OTH LT IND	48.5	7.0	.7	61.0	1.4	30.6	1.5	29.8	1.4
44	83	FISH PROD	.0	.0	.0	.1	.0	.0	.0	.1	.0
45	84	MEAT PROD	.2	.1	.0	1.2	.0	.8	.0	.3	7.3
46	85	DAIRY PROD	7.1	8.4	3.7	51.7	5.0	4.0	.6	15.1	.4
47	86	SUGAR	.0	.1	.0	.1	.0	.0	.0	.0	.0
48	87-89	FLOUR+BREAD	.0	.0	.0	.2	.0	.0	.0	.0	.1
49	90-94	OTHER FOOD	2.5	8.1	.5	30.5	.9	4.2	1.3	6.3	1.5
50	95	IND NEC	89.6	62.9	1.9	.0	5.9	15.2	2.3	90.2	3.6
51	96-100	CONSTRUCTION	.0	.0	.0	.0	.0	.0	.0	.0	.0
52	101,102	AGRICULTURE	.1	.1	.0	.0	.1	.5	.0	.3	.0
53	103	FOREST	.0	.0	.0	.0	.0	.0	.0	.0	.0
54	104-106	TRANS + COM	453.8	370.8	77.9	545.1	64.1	127.6	82.6	31.7	14.7
55	107-109	TRADE + DIST	284.8	339.4	28.9	286.7	17.8	230.7	2.9	.0	.7
56	110	OTHER BRANCH	3.8	20.9	.4	25.0	1.7	13.5	.3	54.3	.1
57		TOTAL PURCH	6701.9	5708.9	426.0	20273.8	879.1	2510.7	1104.8	6562.2	256.4
58		DEPRECIATION	444.8	339.1	86.0	1820.0	46.0	122.7	62.9	772.2	18.4
59		WAGES	1344.7	1401.6	248.1	8043.6	253.4	1212.6	299.7	4110.4	53.7
60		SOCSEC PAYMT	103.5	107.9	19.1	530.9	19.5	93.4	23.1	316.5	4.1
61		TURNOVER TAX	1821.0	.0	.0	598.0	.0	728.0	.0	.0	.0
62		OTHER FEES	175.0	555.0	20.0	410.0	.0	.0	.0	.0	.0
63		SUBSIDIES	-100.0	-428.0	.0	.0	.0	.0	.0	.0	.0
64		OTHER INCOME	981.9	281.1	95.0	4067.2	259.5	532.6	349.0	3271.6	94.2
65		NATIONAL INC	4326.1	1917.6	382.2	13649.7	532.4	2566.6	671.8	7698.5	152.0
66		TOTAL OUTLAY	11472.8	7965.6	894.2	35743.5	1457.5	5200.0	1839.5	15032.9	426.8
67		EMPLOYMENT	722.1	752.8	133.2	4318.9	135.9	626.3	160.8	2206.8	28.6
68		FIXD CAPITAL	5130.6	3754.2	841.7	22958.0	631.4	1590.4	961.4	11247.4	241.4

TABLE A-I THE RECONSTRUCTED 1972 SOVIET INPUT-OUTPUT TABLE IN PURCHASERS' PRICES
(IN MILLIONS OF RUBLES, EMPLOYMENT IN THOUSANDS OF WORK-YEARS)

SEQ NO.	110 ORDER NO.		MINERL CHEM 28	BASIC CHEM 29	PAINT + LAC 30	SYN RUBBER 31	RUBBER PROD 32	OTHER CHEM 33	LOGGIN G 34	SAW + LUM PR 35	FURN + OTH WD 36
1	1-4,6,7	METALLURGY	6.5	339.3	213.7	72.4	18.0	341.6	15.4	64.1	43.0
2	5	INDMET PROD	6.8	12.4	.8	.0	45.8	4.7	22.3	37.8	58.7
3	8	COAL	.4	23.9	3.9	.0	2.9	14.6	3.5	17.9	18.4
4	9	OIL EXTRAC	.0	.4	.0	.0	.1	.0	1.9	.0	.0
5	10	OIL REF	24.3	71.2	15.6	97.0	44.6	260.9	287.7	83.5	28.9
6	11	GAS	6.9	168.6	4.6	.0	8.5	162.2	.0	10.7	10.8
7	12,13	PEAT +SHALE	.0	3.0	.0	.0	1.5	2.6	.0	17.1	11.3
8	14	ELEC POWER	44.9	635.3	13.2	189.3	109.3	534.2	38.9	174.7	60.8
9	15	EN+POW M+E	.5	11.8	.0	.0	.1	.2	3.0	1.2	.3
10	16,17	ELTECH+CABLE	4.8	45.5	.9	10.0	6.3	18.3	7.9	17.2	8.0
11	20-22	METLWK M+E	.1	1.2	.1	.8	.6	2.7	.9	13.1	2.8
12	23	TOOLS + DIES	.8	5.6	.6	.0	7.6	6.1	8.5	16.8	7.8
13	24	PRECIS INST	.3	14.3	.2	.0	1.0	9.5	.5	1.4	.6
14	25-27	MI+MET M+E	6.7	1.2	.1	.0	4.1	.5	.0	.0	.0
15	28,29	PUMPS+CHEM E	.9	21.4	.6	1.9	16.4	34.9	.6	1.4	.9
16	30-34,36	SPECL M+E	.3	1.2	.1	.0	1.0	17.6	36.8	11.8	1.7
17	35	CONST M+E	.6	.3	.0	.0	.0	.1	1.8	.1	.0
18	37,38	TRANSP M+E	.5	.8	.0	1.9	.1	.1	7.3	.3	.1
19	39	AUTOS	2.2	6.0	.6	.0	5.7	2.8	69.2	13.6	5.0
20	40	AGRIC M+E	.8	7.0	.0	.0	.2	.3	48.6	4.2	1.5
21	41	BEARINGS	.5	16.1	.1	.0	.8	1.7	2.6	2.5	.7
22	18,19,42,43	RADIO+OTH MB	45.7	587.5	6.6	.0	77.5	302.4	2.7	7.3	2.5
23	44	SANIT ENG E	.2	1.7	.1	.0	.3	1.5	.3	2.9	.8
24	45	OTHER METWRS	.4	19.1	14.6	.0	18.9	29.6	13.9	60.9	113.3
25	46	METAL STRUCT	.0	.4	.0	.0	.0	.0	.1	2.4	.8
26	47	REPAIR	4.2	50.8	6.8	4.1	7.4	79.4	47.6	23.0	6.8
27	48	ABRASV	.1	1.0	.1	.0	.3	1.5	.5	4.5	20.0
28	49	MINERL CHEM	7.7	362.2	11.9	5.7	5.3	65.5	.0	.1	.1
29	50	BASIC CHEM	28.7	704.4	38.0	83.9	31.7	521.8	1.3	15.5	4.8
30	56	PAINT + LAC	.7	26.8	367.9	7.9	26.2	53.8	2.7	44.5	146.8
31	54	SYN RUBBER	.0	.0	.0	1.5	1415.2	.0	.0	.0	16.4
32	57	RUBBER PROD	10.0	34.9	.6	1.1	104.3	32.5	43.3	14.5	14.3
33	51-3,55,58-9	OTHER CHEM	18.3	286.0	239.9	400.8	888.0	2550.4	2.5	114.7	113.9
34	60	LOGGING	1.1	2.3	.4	.0	.6	2.0	209.6	2969.6	173.5

35	61,62	SAW + LUM PR	1.3	57.4	14.6	.0	14.0	34.5	57.5	1313.4	1045.2
36	63,64	FURN +OTH WD	1.3	6.7	1.7	.0	1.6	28.5	6.5	29.6	58.6
37	65	PAPER + PULP	1.2	86.2	8.0	.0	8.6	404.5	1.1	25.7	26.0
38	66	WOOD CHEM	.6	38.4	46.9	45.9	12.8	32.2	.2	2.5	.7
39	67-73	CONST MAT	.8	70.8	3.8	.1	25.3	18.2	12.6	36.6	6.4
40	74	GLASS + PORC	1.3	7.9	6.4	.5	1.7	103.4	1.1	11.2	134.1
41	75-80	TEXTLS	1.4	96.7	1.2	.0	424.6	325.5	7.2	28.4	373.9
42	81	SEWN GOODS	1.7	29.7	1.4	2.9	16.4	21.2	42.6	22.7	13.7
43	82	OTH LT IND	.5	7.2	.3	.0	11.7	10.3	12.1	4.4	13.5
44	83	FISH PROD	.0	9.5	.0	.0	.0	11.4	.0	.1	.0
45	84	MEAT PROD	.0	5.8	.4	.0	.1	19.2	.1	6.2	3.7
46	85	DAIRY PROD	5.9	20.0	1.3	.0	8.6	31.2	.6	7.5	6.9
47	86	SUGAR	.0	.7	.0	.0	.0	18.5	.0	.0	.0
48	87-89	FLOUR+BREAD	.0	1.4	.1	.0	.1	5.7	.1	.3	.4
49	90-94	OTHER FOOD	.7	62.8	547.9	34.8	12.1	198.1	.8	5.5	2.2
50	95	IND NEC	.5	9.8	6.1	.0	7.7	21.7	5.0	37.1	17.8
51	96-100	CONSTRUCTION	.0	.0	.0	.0	.0	.0	.0	.0	.0
52	101,102	AGRICULTURE	.0	2.7	.2	.0	.1	26.9	5.4	9.3	.6
53	103	FOREST	.0	.0	.0	.0	.0	.0	436.4	.0	.0
54	104-106	TRANS + COM	148.5	525.7	134.5	114.9	179.8	406.1	1537.7	1100.8	212.4
55	107-109	TRADE + DIST	.0	287.4	63.1	17.9	61.4	609.2	93.0	310.6	216.6
56	110	OTHER BRANCH	.2	6.0	2.4	.0	3.7	52.1	3.1	2.0	4.1
57		TOTAL PURCH	391.8	4796.4	1782.1	1095.3	3640.6	7434.4	3105.0	6703.2	3012.1
58		DEPRECIATION	91.7	670.4	27.8	102.0	121.4	583.7	403.7	395.6	135.9
59		WAGES	132.6	817.5	87.0	92.2	383.3	1120.1	2054.3	1495.0	1076.1
60		SOCSEC PAYMT	11.1	68.7	7.3	7.7	32.2	94.0	96.6	70.3	50.5
61		TURNOVER TAX	.0	15.0	.0	.0	336.0	741.0	12.0	40.0	73.0
62		OTHER FEES	.0	.0	.0	.0	.0	.0	.0	.0	.0
63		SUBSIDIES	.0	-560.0	.0	.0	.0	.0	.0	.0	.0
64		OTHER INCOME	170.8	1260.8	372.5	195.3	950.0	2488.7	669.3	1078.7	836.1
65		NATIONAL INC	314.5	1602.0	466.8	295.2	1701.5	4443.8	2832.2	2684.0	2035.7
66		TOTAL OUTLAY	798.0	7068.8	2276.7	1492.5	5463.5	12461.9	6340.9	9782.8	5183.7
67		EMPLOYMENT	58.2	444.4	47.7	49.6	218.1	623.5	956.6	892.2	677.1
68		FIXD CAPITAL	1352.1	9038.1	407.3	1363.2	1546.2	7636.3	3481.2	4251.1	1563.1

TABLE A-1 THE RECONSTRUCTED 1972 SOVIET INPUT-OUTPUT TABLE IN PURCHASERS' PRICES
(IN MILLIONS OF RUBLES, EMPLOYMENT IN THOUSANDS OF WORK-YEARS)

SEQ NO.	110 ORDER NO.		PAPER + PULP 37	WOOD CHEM 38	CONST MAT 39	GLASS + PORC 40	TEXTLS 41	SEWN GOODS 42	OTH LT IND 43	FISH PROD 44	MEAT PROD 45
1	1-4,6,7	METALLURGY	21.2	.6	1183.2	46.5	19.3	2.2	25.5	53.2	37.8
2	5	INDMET PROD	4.2	.1	164.3	3.6	19.5	1.5	10.2	12.6	2.6
3	8	COAL	98.4	2.4	378.6	4.8	35.3	11.6	12.6	19.7	21.0
4	9	OIL EXTRAC	.0	.0	.7	.0	.1	.0	.2	.1	.3
5	10	OIL REF	47.8	4.8	633.8	61.1	47.0	8.1	28.2	319.0	24.5
6	11	GAS	13.2	.5	361.1	51.4	31.1	2.6	8.6	.9	17.9
7	12,13	PEAT +SHALE	3.6	.3	17.1	.9	5.5	.6	1.7	.1	.3
8	14	ELEC POWER	149.7	2.7	667.3	49.1	345.3	46.8	64.1	25.9	96.4
9	15	EN+POW M+E	.5	.0	3.9	.1	1.7	.1	.1	11.1	.2
10	16,17	ELTECH+CABLE	6.4	.2	58.2	5.2	24.4	5.7	6.1	9.2	4.3
11	20-22	METLWK M+E	.7	.0	3.9	.2	.3	.0	.4	.2	.1
12	23	TOOLS + DIES	2.2	.1	16.9	2.6	7.7	2.9	3.9	12.6	1.7
13	24	PRECIS INST	1.2	.0	5.5	1.0	2.6	.3	.7	3.6	.6
14	25-27	MI+MET M+E	.0	.0	15.6	.0	.0	.0	.0	.0	.0
15	28,29	PUMPS+CHEM E	1.2	.1	6.4	.2	.6	.1	.8	5.1	4.2
16	30-34,36	SPECL M+E	16.8	.0	117.0	2.2	111.2	16.2	12.2	8.9	4.1
17	35	CONST M+E	.0	.0	29.9	.1	.0	.0	.0	.0	.0
18	37,38	TRANSP M+E	.2	.0	2.8	.1	.1	.0	.0	42.5	.1
19	39	AUTOS	1.2	.1	36.4	1.5	3.8	3.6	1.5	3.6	5.9
20	40	AGRIC M+E	.2	.0	13.0	.3	.8	.1	.1	.9	.3
21	41	BEARINGS	1.5	.0	9.5	.5	2.7	.2	.5	1.0	.4
22	18,19,42,43	RADIO+OTH MB	3.2	.1	177.1	20.7	.0	.0	.0	56.7	17.2
23	44	SANIT ENG E	.4	.0	17.0	9.9	1.5	.4	.8	.3	.5
24	45	OTHER METWRS	4.2	.1	49.7	2.9	21.9	21.0	28.6	65.0	11.0
25	46	METAL STRUCT	.0	.0	5.9	.0	.1	.0	.2	.1	.0
26	47	REPAIR	18.1	1.0	161.6	28.2	27.9	8.5	9.1	107.7	8.2
27	48	ABRASV	.6	.0	5.0	4.6	1.0	.3	2.1	.2	.2
28	49	MINERL CHEM	27.4	.0	1.9	14.2	.6	2.2	1.5	.0	.1
29	50	BASIC CHEM	78.3	6.3	97.7	96.3	47.5	.4	46.9	5.8	22.5
30	56	PAINT + LAC	3.5	.2	48.9	5.6	8.7	3.5	22.7	7.2	3.8
31	54	SYN RUBBER	.0	.0	7.1	.0	.0	.0	160.0	.0	.0
32	57	RUBBER PROD	4.5	.1	101.5	4.3	32.3	47.5	32.4	13.2	2.7
33	51-3,55,58-9	OTHER CHEM	29.1	18.1	129.9	39.2	2056.7	89.6	366.8	12.7	28.4
34	60	LOGGING	570.8	160.3	46.3	6.9	4.9	1.1	49.5	6.5	4.7

35	61,62	SAW + LUM PR	18.3	1.8	156.2	51.9	17.0	12.0	29.3	140.2	75.6
36	63,64	FURN +OTH WD	6.0	.8	20.3	7.3	41.3	8.5	18.2	16.0	7.4
37	65	PAPER + PULP	652.5	1.3	104.1	19.5	62.3	29.9	73.1	63.4	27.0
38	66	WOOD CHEM	44.4	29.5	6.7	.3	2.0	.1	15.7	2.2	.3
39	67-73	CONST MAT	17.9	.3	3631.6	26.2	16.7	4.5	6.8	7.6	9.4
40	74	GLASS + PORC	3.7	.4	28.1	70.3	3.1	9.5	3.4	2.0	2.8
41	75-80	TEXTLS	73.1	.1	61.3	10.2	24123.2	11598.4	1245.8	158.5	17.3
42	81	SEWN GOODS	4.2	.3	67.8	6.7	26.1	26.0	11.4	30.6	30.9
43	82	OTH LT IND	17.6	.1	16.3	1.5	76.6	970.1	3339.4	9.2	6.9
44	83	FISH PROD	.0	.0	.3	.1	.5	.0	12.8	3201.0	5.4
45	84	MEAT PROD	7.3	.0	1.6	.3	1.7	.0	369.8	3.7	6312.8
46	85	DAIRY PROD	4.8	.1	24.8	4.2	7.8	.7	7.6	3.4	35.3
47	86	SUGAR	.0	.0	.0	.0	.6	.0	2.1	7.7	4.1
48	87-89	FLOUR+BREAD	.1	.0	.2	.0	3.4	.0	.2	5.4	29.9
49	90-94	OTHER FOOD	6.2	.2	26.3	1.0	32.5	2.2	21.3	119.1	50.0
50	95	IND NEC	12.5	1.7	37.1	2.6	20.1	9.6	4.3	47.1	77.4
51	96-100	CONSTRUCTION	.0	.0	.0	.0	.0	.0	.0	.0	.0
52	101,102	AGRICULTURE	.0	.0	3.8	.3	7985.5	.8	948.7	14.3	23436.7
53	103	FOREST	.0	.0	.0	.0	.0	.0	.0	.0	.0
54	104-106	TRANS + COM	245.4	11.6	5881.1	164.3	561.3	190.2	121.6	468.8	115.8
55	107-109	TRADE + DIST	201.1	1.4	232.6	153.1	1331.2	876.6	662.3	338.3	1902.8
56	110	OTHER BRANCH	66.1	.2	46.4	3.7	17.4	3.1	91.1	2.1	11.3
57		TOTAL PURCH	2491.5	247.9	14921.3	987.7	37192.4	14019.3	7882.9	5446.2	32481.1
58		DEPRECIATION	384.4	10.4	1377.5	97.5	546.9	102.6	100.5	644.6	98.1
59		WAGES	378.4	18.7	3779.5	447.2	8861.5	2381.8	1168.1	1113.4	533.0
60		SOCSEC PAYMT	17.8	.9	230.5	27.3	194.6	162.0	79.4	75.7	36.2
61		TURNOVER TAX	97.0	.0	145.0	212.0	11836.0	.0	3889.0	.0	.0
62		OTHER FEES	.0	.0	.0	.0	.0	.0	.0	.0	.0
63		SUBSIDIES	.0	.0	.0	.0	-1900.0	.0	-100.0	.0	-11200.0
64		OTHER INCOME	485.4	36.3	2254.4	541.2	4130.1	2425.0	535.4	420.1	1298.0
65		NATIONAL INC	978.6	55.9	6409.4	1227.7	17122.2	4968.8	5571.9	1609.2	-9332.8
66		TOTAL OUTLAY	3854.5	314.2	22708.2	2312.9	54861.5	19090.7	13555.3	7700.0	23246.4
67		EMPLOYMENT	218.1	10.5	1949.5	250.9	3855.6	1789.6	710.6	357.3	343.5
68		FIXD CAPITAL	3367.1	101.1	16207.0	1165.0	7163.2	2061.7	1538.5	6328.9	2005.1

TABLE A-I THE RECONSTRUCTED 1972 SOVIET INPUT-OUTPUT TABLE IN PURCHASERS' PRICES
(IN MILLIONS OF RUBLES, EMPLOYMENT IN THOUSANDS OF WORK-YEARS)

SEQ NO.	110 ORDER NO.		DAIRY PROD 46	SUGAR 47	FLOUR+ BREAD 48	OTHER FOOD 49	IND NEC 50	CONSTR UCTION 51	AGRICU LTURE 52	FOREST 53	TRANS + COM 54
1	1-4,6,7	METALLURGY	45.9	31.1	14.7	81.1	834.5	3806.7	55.0	.8	78.6
2	5	INDMET PROD	2.5	1.9	3.2	6.8	65.0	375.7	42.6	.9	66.8
3	8	COAL	54.5	21.7	64.9	50.4	71.9	139.7	198.6	.9	153.9
4	9	OIL EXTRAC	.0	1.2	.0	1.0	.5	18.3	.0	.0	22.1
5	10	OIL REF	40.4	86.7	33.0	90.6	200.1	1492.4	2240.0	19.8	2672.0
6	11	GAS	10.5	16.5	33.8	33.2	83.3	40.0	12.6	.0	55.0
7	12,13	PEAT +SHALE	1.9	.9	.9	1.5	3.9	15.7	103.2	.0	1.8
8	14	ELEC POWER	82.7	22.8	99.1	135.2	224.7	517.5	317.3	2.3	820.0
9	15	EN+POW M+E	.6	.4	.5	.4	5.2	38.0	.0	.0	3.7
10	16,17	ELTECH+CABLE	4.3	4.1	8.2	8.6	29.5	1534.3	66.8	.0	63.3
11	20-22	METLWK M+E	.1	.1	.3	.2	1.2	14.2	6.1	.0	.5
12	23	TOOLS + DIES	1.9	1.6	5.2	7.3	4.3	101.3	55.5	5.6	24.0
13	24	PRECIS INST	1.1	1.4	1.2	4.4	8.6	55.7	6.0	.0	12.2
14	25-27	MI+MET M+E	.0	.0	.0	.2	1.2	261.0	.0	.0	.0
15	28,29	PUMPS+CHEM E	2.6	1.2	.7	1.6	4.2	38.0	5.4	.0	6.7
16	30-34,36	SPECL M+E	20.5	7.3	20.7	18.2	5.1	94.3	.0	.0	21.6
17	35	CONST M+E	.0	.1	.0	.0	1.3	209.1	5.4	.0	4.3
18	37,38	TRANSP M+E	.1	.1	.0	.1	4.5	8.2	.0	.0	171.8
19	39	AUTOS	5.4	1.9	2.1	5.5	31.3	350.3	311.4	7.1	389.9
20	40	AGRIC M+E	.3	2.2	.2	.8	27.7	164.3	996.6	10.2	10.7
21	41	BEARINGS	.5	.7	.8	1.1	4.8	16.2	19.3	.0	17.9
22	18,19,42,43	RADIO+OTH MB	20.6	22.1	40.2	53.5	10.0	420.5	24.7	21.0	73.6
23	44	SANIT ENG E	.8	.2	.5	.9	1.2	1188.8	.0	.0	3.1
24	45	OTHER METWRS	10.1	1.4	10.7	64.9	8.4	558.4	556.8	1.0	26.5
25	46	METAL STRUCT	.0	.0	.0	.1	.3	1797.1	.0	.0	.0
26	47	REPAIR	13.6	7.7	20.3	26.6	6.8	916.2	1841.6	.0	192.6
27	48	ABRASV	.2	.2	.2	.2	1.9	16.7	12.6	.0	2.5
28	49	MINERL CHEM	.1	1.2	.0	2.5	7.4	.0	59.6	.0	.0
29	50	BASIC CHEM	10.0	4.2	2.6	74.8	116.8	146.6	1722.9	3.8	27.8
30	56	PAINT + LAC	3.2	3.0	5.3	12.5	50.2	652.1	27.1	.0	56.1
31	54	SYN RUBBER	.0	.0	.0	.2	.0	.0	.0	.0	.0
32	57	RUBBER PROD	6.3	2.8	3.8	8.7	3.1	328.2	326.9	.0	571.4
33	51-3,55,58-9	OTHER CHEM	11.3	3.1	7.8	152.6	375.6	243.2	320.1	.0	15.0
34	60	LOGGING	3.2	1.5	2.8	4.8	37.9	599.7	180.9	2.8	48.5

35	61,62	SAW + LUM PR	25.8	5.4	97.0	208.1	35.9	3770.4	276.4	2.0	89.7
36	63,64	FURN +OTH WD	2.9	2.5	7.2	12.5	3.9	227.6	88.3	.0	58.8
37	65	PAPER + PULP	64.1	9.5	118.1	193.9	300.0	88.5	15.7	.3	14.5
38	66	WOOD CHEM	.2	.1	.1	4.9	.0	4.2	7.6	.0	1.4
39	67-73	CONST MAT	6.2	31.1	7.1	11.9	161.9	17213.7	211.1	3.1	36.9
40	74	GLASS + PORC	29.4	.8	2.4	142.8	28.6	450.9	26.0	.0	10.5
41	75-80	TEXTLS	10.5	19.5	18.0	405.9	487.2	176.0	159.9	.0	83.5
42	81	SEWN GOODS	10.0	9.6	32.4	20.3	20.5	384.1	185.6	5.7	97.9
43	82	OTH LT IND	3.2	1.2	5.2	5.0	5.1	69.8	71.1	.0	28.6
44	83	FISH PROD	.1	.0	12.4	19.1	18.3	.0	398.0	.0	.0
45	84	MEAT PROD	3.4	.7	63.9	451.9	40.7	7.3	191.8	.0	.0
46	85	DAIRY PROD	1613.6	.3	357.9	71.5	12.9	5.8	608.7	.0	.0
47	86	SUGAR	181.5	1201.5	1227.9	831.8	19.5	.0	151.6	.0	.0
48	87-89	FLOUR+BREAD	14.8	.0	5423.6	82.4	856.8	1.1	2758.1	.0	.1
49	90-94	OTHER FOOD	38.3	8.7	1062.8	7541.5	54.8	103.0	168.3	.0	13.5
50	95	IND NEC	24.2	15.4	98.3	119.9	426.6	144.3	3350.8	2.5	49.5
51	96-100	CONSTRUCTION	.0	.0	.0	.0	.0	.0	.0	.0	.0
52	101,102	AGRICULTURE	9442.6	2412.6	9114.7	5993.8	2327.9	49.9	23937.3	10.9	5.1
53	103	FOREST	.0	.0	.0	.0	.0	.0	.0	.0	.0
54	104-106	TRANS + COM	197.3	149.1	443.6	959.8	140.0	93.9	1362.1	15.5	25.9
55	107-109	TRADE + DIST	1158.3	859.1	2210.2	4396.8	421.9	.0	4555.2	.0	.0
56	110	OTHER BRANCH	4.0	1.9	60.5	20.5	48.0	178.9	130.3	.0	.0
57		TOTAL PURCH	13185.6	4980.3	20747.0	22344.8	7642.9	39127.8	48168.9	116.2	6129.8
58		DEPRECIATION	136.2	155.5	191.1	365.5	919.0	3568.0	6901.0	58.0	4698.0
59		WAGES	511.9	207.9	1065.8	1079.6	2089.8	25750.0	50645.0	594.0	9071.0
60		SOCSEC PAYMT	34.8	14.1	72.5	73.5	137.9	1589.0	2027.0	28.0	535.0
61		TURNOVER TAX	.0	2334.0	2313.0	21581.0	1025.0	.0	.0	.0	.0
62		OTHER FEES	.0	.0	.0	.0	.0	.0	.0	.0	.0
63		SUBSIDIES	-2800.0	-400.0	-350.0	-450.0	-709.0	.0	-411.0	.0	.0
64		OTHER INCOME	1921.1	588.1	1537.5	3850.9	2294.4	7365.2	7372.1	-160.2	9096.2
65		NATIONAL INC	-332.2	2744.1	4638.8	26135.0	4838.1	34704.2	59633.1	461.8	18702.2
66		TOTAL OUTLAY	12989.6	7879.9	25576.9	48845.3	13400.0	77400.0	114703.0	636.0	29530.0
67		EMPLOYMENT	330.1	149.3	803.9	754.1	1140.0	11920.0	29602.4	401.4	4968.5
68		FIXD CAPITAL	2310.9	2136.2	3351.4	5327.8	12440.7	23674.0	112665.0	726.0	64118.0

TABLE A-I THE RECONSTRUCTED 1972 SOVIET INPUT-OUTPUT TABLE IN PURCHASERS' PRICES
(IN MILLIONS OF RUBLES, EMPLOYMENT IN THOUSANDS OF WORK-YEARS)

SEQ NO.	110 ORDER NO.		TRADE + DIST 55	OTHER BRANCH 56	INTIND USE 57	CONSUM PTION 58	OTHER FD 59	TOTAL FD 60	GVO 61
1	1-4,6,7	METALLURGY	13.7	1.2	39036.9	1281.0	1802.3	3083.3	42120.2
2	5	INDMET PROD	7.6	2.1	1950.3	106.0	10.8	116.8	2067.1
3	8	COAL	98.6	3.9	10750.3	1590.0	148.6	1738.6	12488.9
4	9	OIL EXTRAC	.0	.0	5051.5	.0	1020.8	1020.8	6072.3
5	10	OIL REF	126.2	15.1	12401.4	1130.0	2560.3	3690.3	16091.7
6	11	GAS	21.9	1.4	3356.8	586.0	24.0	610.0	3966.8
7	12,13	PEAT +SHALE	5.1	1.2	564.6	51.0	-8.0	43.0	607.6
8	14	ELEC POWER	270.5	20.5	10364.6	3527.0	138.8	3665.8	14030.4
9	15	EN+POW M+E	.0	.1	800.5	.0	786.5	786.5	1587.0
10	16,17	ELTECH+CABLE	33.8	2.1	6806.1	1063.0	2024.9	3087.9	9894.0
11	20-22	METLWK M+E	.0	.5	208.9	.0	1882.5	1882.5	2091.4
12	23	TOOLS + DIES	9.6	1.7	937.9	212.0	-38.1	173.9	1111.8
13	24	PRECIS INST	5.0	1.7	3096.3	1270.0	1957.7	3227.7	6324.0
14	25-27	MI+MET M+E	.0	.0	951.4	.0	1648.6	1648.6	2600.0
15	28,29	PUMPS+CHEM E	11.5	.2	691.2	1142.0	1090.8	2232.8	2924.0
16	30-34,36	SPECL M+E	16.6	2.1	831.7	105.0	2779.8	2884.8	3716.5
17	35	CONST M+E	.6	.0	414.9	.0	1230.4	1230.4	1645.3
18	37,38	TRANSP M+E	.0	.0	776.1	44.0	4379.9	4423.9	5200.0
19	39	AUTOS	42.1	9.5	5479.6	3435.0	2558.2	5993.2	11472.8
20	40	AGRIC M+E	14.8	.0	5010.3	.0	2955.3	2955.3	7965.6
21	41	BEARINGS	1.5	.0	755.8	13.0	125.4	138.4	894.2
22	18,19,42,43	RADIO+OTH MB	108.4	.0	14318.8	4006.0	17418.7	21424.7	35743.5
23	44	SANIT ENG E	3.7	.1	1388.7	67.0	1.8	68.8	1457.5
24	45	OTHER METWRS	101.5	.2	2882.8	2212.0	105.2	2317.2	5200.0
25	46	METAL STRUCT	.0	.0	1846.9	.0	-7.4	-7.4	1839.5
26	47	REPAIR	123.7	.0	4728.8	617.0	9687.1	10304.1	15032.9
27	48	ABRASV	.1	.0	511.6	.0	-84.8	-84.8	426.8
28	49	MINERL CHEM	.0	.0	611.8	.0	186.2	186.2	798.0
29	50	BASIC CHEM	11.8	7.1	4990.9	130.0	1947.9	2077.9	7068.8
30	56	PAINT + LAC	42.0	2.0	2222.2	221.0	-166.5	54.5	2276.7
31	54	SYN RUBBER	.0	.0	1675.0	.0	-182.5	-182.5	1492.5
32	57	RUBBER PROD	20.1	1.3	4014.4	843.0	606.1	1449.1	5463.5
33	51-3,55,58-9	OTHER CHEM	28.7	50.4	10090.7	2989.0	-617.8	2371.2	12461.9
34	60	LOGGING	21.9	4.6	5547.7	448.0	345.2	793.2	6340.9

35	61,62	SAW + LUM PR	89.3	1.9	8907.0	142.0	733.8	875.8	9782.8
36	63,64	FURN +OTH WD	41.6	3.5	961.7	3772.0	450.0	4222.0	5183.7
37	65	PAPER + PULP	138.0	324.4	3200.6	313.0	340.9	653.9	3854.5
38	66	WOOD CHEM	1.0	.2	341.4	.0	-27.2	-27.2	314.2
39	67-73	CONST MAT	88.9	1.7	22197.5	435.0	75.7	510.7	22708.2
40	74	GLASS + PORC	85.0	.1	1448.7	897.0	-32.8	864.2	2312.9
41	75-80	TEXTLS	95.9	2.3	40873.0	17540.0	-3551.5	13988.5	54861.5
42	81	SEWN GOODS	143.2	2.5	1703.0	17509.0	-121.3	17387.7	19090.7
43	82	OTH LT IND	34.0	58.6	5031.9	11080.0	-2556.6	8523.4	13555.3
44	83	FISH PROD	30.7	.0	3720.6	3133.0	846.4	3979.4	7700.0
45	84	MEAT PROD	158.5	.1	7664.2	15115.0	467.2	15582.2	23246.4
46	85	DAIRY PROD	62.8	.1	3100.5	9681.0	208.1	9889.1	12989.6
47	86	SUGAR	33.5	.0	3681.6	5917.0	-1718.7	4198.3	7879.9
48	87-89	FLOUR+BREAD	127.6	.0	9313.2	18137.0	-1873.3	16263.7	25576.9
49	90-94	OTHER FOOD	250.7	.9	10495.0	41066.0	-2715.7	38350.3	48845.3
50	95	IND NEC	84.8	328.2	5610.4	7148.0	641.6	7789.6	13400.0
51	96-100	CONSTRUCTION	.0	.0	.0	.0	77400.0	77400.0	77400.0
52	101,102	AGRICULTURE	250.7	.0	85987.0	29059.0	-343.0	28716.0	114703.0
53	103	FOREST	.0	46.3	482.7	.0	153.3	153.3	636.0
54	104-106	TRANS + COM	195.5	303.3	29530.0	.0	.0	.0	29530.0
55	107-109	TRADE + DIST	.0	512.2	25285.0	.0	.0	.0	25285.0
56	110	OTHER BRANCH	129.2	6.5	1872.3	2528.0	244.7	2772.7	4645.0
57		TOTAL PURCH	3161.9	1721.8	436474.7	210560.0	126940.3	337500.3	773975.0
58		DEPRECIATION	1813.0	52.0	37300.0	14840.0	.0	14840.0	52140.0
59		WAGES	11118.0	1006.0	155197.0	.0	.0	.0	.0
60		SOCSEC PAYMT	500.0	48.0	8730.0	.0	.0	.0	.0
61		TURNOVER TAX	.0	.0	55567.0	.0	.0	.0	.0
62		OTHER FEES	.0	.0	1160.0	.0	.0	.0	.0
63		SUBSIDIES	.0	.0	-19448.0	.0	.0	.0	.0
64		OTHER INCOME	8672.1	1817.2	98994.3	.0	.0	.0	.0
65		NATIONAL INC	20290.1	2871.2	300200.3	.0	.0	.0	.0
66		TOTAL OUTLAY	25285.0	4645.0	773975.0	.0	.0	.0	.0
67		EMPLOYMENT	8243.0	667.1	86626.4	.0	.0	.0	.0
68		FIXD CAPITAL	31135.0	447.0	498478.0	.0	.0	.0	.0

TABLE A-II THE RECONSTRUCTED 1972 SOVIET INPUT-OUTPUT TABLE IN PRODUCERS' PRICES
(IN MILLIONS OF RUBLES, EMPLOYMENT IN THOUSANDS OF WORK-YEARS)

SEQ NO.	110 ORDER NO.		METALL URGY 1	INDMET PROD 2	COAL 3	OIL EXTRAC 4	OIL REF 5	GAS 6	PEAT + SHALE 7	ELEC POWER 8	EN+POW M+E 9
1	1-4,6,7	METALLURGY	14885.4	901.1	63.3	5.4	26.8	1.9	4.8	23.7	311.9
2	5	INDMET PROD	84.5	28.0	28.6	1.4	1.4	.3	1.6	8.4	7.1
3	8	COAL	2428.1	5.0	3417.9	.0	.0	.0	.2	1799.4	1.0
4	9	OIL EXTRAC	2.0	.0	.4	104.4	3469.4	78.4	.0	27.7	.0
5	10	OIL REF	193.8	8.8	7.0	9.3	287.9	8.4	6.1	1030.8	6.6
6	11	GAS	209.8	4.7	.4	21.7	81.3	101.5	.1	421.0	3.1
7	12,13	PEAT +SHALE	.8	.0	5.0	.0	.0	5.1	91.2	228.8	.1
8	14	ELEC POWER	1522.9	44.6	349.6	153.4	414.2	43.9	16.8	165.9	34.8
9	15	EN+POW M+E	7.3	.2	.8	.3	.3	.0	.3	34.1	48.5
10	16,17	ELTECH+CABLE	92.5	3.7	54.2	5.9	4.4	1.1	3.5	36.6	68.7
11	20-22	METLWK M+E	11.3	.3	.2	.2	.2	.0	.1	.1	3.3
12	23	TOOLS + DIES	31.7	4.0	9.1	2.7	1.4	.5	.9	6.2	5.4
13	24	PRECIS INST	10.6	.3	2.7	.9	2.8	.3	.1	8.0	18.0
14	25-27	MI+MET M+E	314.9	3.1	145.3	12.2	11.4	1.6	8.5	.0	.2
15	28,29	PUMPS+CHEM E	11.0	.1	1.8	.9	4.4	1.2	.2	2.0	6.3
16	30-34,36	SPECL M+E	11.1	.3	1.6	.1	.1	.0	.2	.7	.8
17	35	CONST M+E	19.7	.0	1.7	.0	.0	.0	.2	.3	.0
18	37,38	TRANSP M+E	15.8	.1	1.4	.0	.0	.0	.9	.3	.3
19	39	AUTOS	35.3	.9	2.4	.9	2.2	.4	.9	6.7	11.8
20	40	AGRIC M+E	10.6	.0	2.0	.4	.2	.0	4.5	1.4	.8
21	41	BEARINGS	14.9	.7	1.9	.3	.4	.0	.6	1.2	5.0
22	18,19,42,43	RADIO+OTH MB	113.1	4.6	49.0	11.6	15.5	2.5	6.4	81.8	162.6
23	44	SANIT ENG E	4.0	.2	1.2	.1	.2	.0	.1	1.0	1.0
24	45	OTHER METWRS	36.7	1.9	10.4	.8	1.9	.5	.4	4.4	1.2
25	46	METAL STRUCT	6.5	.8	3.5	.0	.1	.0	.0	.2	.1
26	47	REPAIR	456.4	10.4	48.4	19.6	38.3	3.1	1.4	151.9	8.9
27	48	ABRASV	32.5	1.5	.6	.1	.2	.1	.1	.7	2.8
28	49	MINERL CHEM	14.5	.1	1.0	.1	1.2	.0	.4	.4	.5
29	50	BASIC CHEM	304.3	12.8	73.4	9.0	99.8	2.7	12.1	39.4	2.4
30	56	PAINT + LAC	20.6	1.2	4.3	1.5	2.1	.3	.4	4.7	3.5
31	54	SYN RUBBER	.3	.0	.0	.0	.0	.1	.0	.0	.0
32	57	RUBBER PROD	123.8	1.4	43.2	2.5	3.2	.6	2.2	9.2	4.7
33	51-3,55,58-9	OTHER CHEM	45.7	2.9	6.8	9.8	82.4	12.4	2.2	12.7	3.9
34	60	LOGGING	40.8	1.2	204.0	.5	.4	.1	1.5	3.1	1.2
35	61,62	SAW + LUM PR	78.0	19.0	77.4	.9	4.3	.3	1.7	5.4	9.7

36	63,64	FURN +OTH WD	10.9	3.4	4.6	.8	.9	.1	1.5	8.2	1.7
37	65	PAPER + PULP	24.9	3.3	2.0	8.0	3.5	1.4	.1	1.8	2.8
38	66	WOOD CHEM	16.7	.2	.0	.0	2.9	.3	.1	.2	.1
39	67-73	CONST MAT	40.2	2.2	40.4	1.3	2.6	.3	.7	9.3	1.6
40	74	GLASS + PORC	10.5	1.3	.9	.5	1.7	.1	.1	1.6	.7
41	75-80	TEXTLS	43.2	93.1	6.3	3.2	4.6	.4	1.1	6.8	4.3
42	81	SEWN GOODS	58.4	3.4	38.0	4.2	3.6	.7	2.4	11.8	2.9
43	82	OTH LT IND	12.4	.8	8.2	1.2	1.0	.3	.5	3.6	.9
44	83	FISH PROD	.5	.0	.0	.0	.1	.0	.0	.0	.0
45	84	MEAT PROD	3.1	.0	.0	.0	.1	.0	.0	.0	.0
46	85	DAIRY PROD	23.8	1.1	2.4	1.0	22.0	8.1	.1	4.2	1.0
47	86	SUGAR	.1	.0	.2	.0	.0	.0	.0	.0	.0
48	87-89	FLOUR+BREAD	.9	.0	.0	.0	.0	.0	.0	.0	.0
49	90-94	OTHER FOOD	21.4	2.7	3.7	.5	9.5	.2	.2	3.9	.6
50	95	IND NEC	53.2	2.2	33.4	3.4	11.9	1.3	2.0	63.1	5.2
51	96-100	CONSTRUCTION	.0	.0	.0	.0	.0	.0	.0	.0	.0
52	101,102	AGRICULTURE	2.5	.1	.8	.1	.0	.0	.1	.1	.1
53	103	FOREST	.0	.0	.0	.0	.0	.0	.0	.0	.0
54	104-106	TRANS + COM	2183.2	87.3	129.7	8.0	1373.8	33.2	6.0	1219.3	45.4
55	107-109	TRADE + DIST	460.1	21.7	16.4	2.6	39.9	1.4	2.1	247.3	10.7
56	110	OTHER BRANCH	716.8	9.4	2.2	.3	.1	.2	.1	8.6	4.1
57		TAXES +FEES	369.2	13.2	42.4	5.5	16.2	1.6	12.6	386.9	6.0
58		SUBSIDIES	-9.2	-7.6	-1.1	-.5	-4.9	-1.6	.0	-1.5	-.5
59		TOTAL PURCH	25234.0	1301.7	4951.0	417.0	6047.9	315.3	200.3	6093.4	823.8
60		DEPRECIATION	2462.2	77.8	1141.1	765.5	547.8	155.7	96.9	2172.0	89.2
61		WAGES	3650.5	257.5	3118.0	191.4	229.3	42.2	136.2	1025.3	328.7
62		SOCSEC PAYMT	288.4	20.3	280.6	16.1	19.3	3.5	12.2	67.7	21.7
63		TURNOVER TAX	.0	.0	.0	.0	.0	.0	.0	.0	.0
64		OTHER FEES	.0	.0	.0	.0	.0	.0	.0	.0	.0
65		SUBSIDIES	.0	.0	.0	.0	.0	.0	.0	.0	.0
66		OTHER INCOME	6930.5	182.0	819.1	3074.0	1179.9	1168.8	111.5	4065.4	231.3
67		NATIONAL INC	10869.4	459.8	4217.7	3281.5	1428.5	1214.5	259.9	5158.4	581.7
68		TOTAL OUTLAY	38565.6	1839.3	10309.8	4464.0	8024.2	1685.5	557.1	13423.8	1494.7
69		EMPLOYMENT	1575.0	117.9	1001.2	94.3	117.2	21.3	94.1	597.6	176.3
70		FIXD CAPITAL	32863.4	989.5	12740.7	10056.7	4830.3	1901.3	923.3	40552.1	1062.7

TABLE A-II THE RECONSTRUCTED 1972 SOVIET INPUT-OUTPUT TABLE IN PRODUCERS' PRICES
(IN MILLIONS OF RUBLES, EMPLOYMENT IN THOUSANDS OF WORK-YEARS)

SEQ NO.	110 ORDER NO.		ELTECH +CABLE 10	METLWK M+E 11	TOOLS + DIES 12	PRECIS INST 13	MI+MET M+E 14	PUMPS+ CHEM E 15	SPECL M+E 16	CONST M+E 17	TRANSP M+E 18
1	1-4,6,7	METALLURGY	1814.8	168.6	228.6	223.5	546.5	351.0	467.1	128.1	591.8
2	5	INDMET PROD	81.2	9.9	3.5	16.2	19.6	13.0	34.0	9.3	43.1
3	8	COAL	8.8	1.3	.9	3.0	6.0	2.5	4.4	1.0	5.3
4	9	OIL EXTRAC	.1	.1	.0	.1	.1	.0	.0	.0	.2
5	10	OIL REF	30.1	4.9	2.9	7.9	11.7	6.5	11.8	5.0	19.5
6	11	GAS	8.8	2.3	.5	3.2	6.5	3.6	4.7	1.9	6.8
7	12,13	PEAT +SHALE	.9	.3	.1	.2	.2	.2	.1	.0	.1
8	14	ELEC POWER	137.9	42.0	24.3	60.2	62.8	43.5	61.1	24.0	93.8
9	15	EN+POW M+E	38.5	.2	.0	1.0	9.5	7.8	15.8	9.8	364.1
10	16,17	ELTECH+CABLE	1193.3	142.3	13.6	169.8	103.5	229.4	227.3	36.1	292.7
11	20-22	METLWK M+E	6.4	39.7	1.8	3.0	2.2	1.6	3.1	2.5	3.7
12	23	TOOLS + DIES	21.1	29.5	14.6	29.0	17.9	18.0	20.3	6.0	17.7
13	24	PRECIS INST	39.3	19.5	2.4	605.3	4.1	31.9	15.3	5.8	92.0
14	25-27	MI+MET M+E	.5	.0	.0	.3	73.4	.0	.0	.0	.1
15	28,29	PUMPS+CHEM E	3.5	8.1	.2	2.5	17.6	144.4	7.2	8.7	93.8
16	30-34,36	SPECL M+E	2.3	1.5	.1	.4	1.5	.5	132.1	4.7	44.3
17	35	CONST M+E	.1	.1	.0	1.0	.4	.0	1.3	49.6	.6
18	37,38	TRANSP M+E	.3	.0	.0	.4	2.5	.7	2.4	.6	353.6
19	39	AUTOS	42.8	1.0	.4	20.4	42.1	14.8	157.9	92.5	14.2
20	40	AGRIC M+E	16.6	.1	.1	.3	22.9	10.3	41.3	344.4	1.4
21	41	BEARINGS	27.3	19.3	2.9	19.0	27.2	5.8	35.7	11.2	35.6
22	18,19,42,43	RADIO+OTH MB	78.3	129.7	11.6	431.9	142.6	148.7	181.6	85.7	541.0
23	44	SANIT ENG E	1.7	.6	.1	1.2	.9	.6	1.5	.9	6.1
24	45	OTHER METWRS	23.9	5.3	3.7	17.0	8.5	10.3	16.8	4.6	20.7
25	46	METAL STRUCT	.5	1.7	.3	1.1	.6	.9	1.3	.2	.9
26	47	REPAIR	17.9	3.4	1.7	9.7	8.6	3.3	7.6	3.3	17.2
27	48	ABRASV	7.7	5.3	9.9	7.2	3.6	2.2	4.2	1.2	4.2
28	49	MINERL CHEM	1.5	.0	.0	.6	.1	.0	.1	.1	.3
29	50	BASIC CHEM	49.7	2.1	2.4	18.4	5.6	11.3	5.1	2.5	16.5
30	56	PAINT + LAC	78.7	9.2	1.1	15.5	6.8	12.7	19.8	5.1	36.3
31	54	SYN RUBBER	65.2	.0	.0	.0	.7	.0	.1	.0	.0
32	57	RUBBER PROD	66.9	6.0	.9	8.2	20.4	17.7	63.5	47.6	32.4
33	51-3,55,58-9	OTHER CHEM	449.9	6.1	4.2	64.9	6.1	57.0	18.6	3.1	35.0
34	60	LOGGING	3.6	8.6	.6	.9	2.7	1.7	2.6	.6	6.6
35	61,62	SAW + LUM PR	66.4	24.6	8.8	41.2	13.4	22.9	34.6	6.6	57.3

36	63,64	FURN +OTH WD	9.2	2.1	1.2	10.7	1.5	5.2	33.7	.9	20.3
37	65	PAPER + PULP	84.3	2.4	4.2	29.2	4.3	6.1	4.1	1.3	14.4
38	66	WOOD CHEM	5.3	.2	.0	.8	.1	.1	.3	.0	.5
39	67-73	CONST MAT	70.6	3.2	.7	6.3	3.3	3.1	4.5	4.4	13.9
40	74	GLASS + PORC	48.4	.6	.2	21.2	1.9	7.9	2.2	1.5	5.6
41	75-80	TEXTLS	115.5	4.5	5.4	22.5	4.2	9.0	18.2	3.0	28.9
42	81	SEWN GOODS	15.7	4.7	2.3	9.5	6.4	5.8	9.2	3.2	13.9
43	82	OTH LT IND	5.4	1.4	.7	8.8	1.5	1.4	12.8	2.7	6.1
44	83	FISH PROD	.0	.0	.0	.0	.0	.0	.0	.0	.1
45	84	MEAT PROD	.3	.1	.0	.6	.1	.1	.2	.1	.4
46	85	DAIRY PROD	21.6	4.2	.7	7.7	5.8	4.0	4.7	4.7	5.2
47	86	SUGAR	.0	.0	.0	.0	.0	.0	.0	.0	.0
48	87-89	FLOUR+BREAD	.1	.0	.0	.0	.0	.0	.0	.0	.0
49	90-94	OTHER FOOD	8.7	.7	.3	5.5	.7	1.0	1.1	.3	3.5
50	95	IND NEC	58.6	8.3	2.0	26.6	10.0	14.9	21.1	15.6	37.8
51	96-100	CONSTRUCTION	.0	.0	.0	.0	.0	.0	.0	.0	.0
52	101,102	AGRICULTURE	.2	.0	.0	.2	.2	.2	.1	.0	.0
53	103	FOREST	.0	.0	.0	.0	.0	.0	.0	.0	.0
54	104-106	TRANS + COM	343.8	45.4	24.7	98.1	84.1	72.4	100.0	53.1	162.7
55	107-109	TRADE + DIST	73.7	11.1	6.7	25.2	20.9	18.9	25.9	25.4	34.0
56	110	OTHER BRANCH	5.1	4.9	.2	6.3	8.2	2.6	4.1	1.9	16.5
57		TAXES +FEES	24.4	5.0	2.4	8.0	11.3	6.6	10.3	4.2	16.3
58		SUBSIDIES	-13.1	-1.2	-.4	-3.7	-1.5	-1.3	-2.2	-1.2	-3.2
59		TOTAL PURCH	5264.3	790.9	393.5	2068.0	1361.8	1332.8	1850.6	1023.8	3225.8
60		DEPRECIATION	258.0	135.7	53.0	205.0	138.5	106.3	146.3	49.4	235.5
61		WAGES	1554.2	390.9	238.4	1425.3	465.1	425.3	635.8	213.7	822.7
62		SOCSEC PAYMT	104.1	30.1	18.4	109.7	35.8	32.7	49.0	16.5	63.3
63		TURNOVER TAX	.0	.0	.0	.0	.0	.0	.0	.0	.0
64		OTHER FEES	.0	.0	.0	.0	.0	.0	.0	.0	.0
65		SUBSIDIES	.0	.0	.0	.0	.0	.0	.0	.0	.0
66		OTHER INCOME	1749.5	555.0	296.1	1587.1	399.5	444.0	780.3	295.2	691.0
67		NATIONAL INC	3407.8	976.0	552.9	3122.1	900.4	902.0	1465.1	525.4	1577.0
68		TOTAL OUTLAY	8930.1	1902.6	999.4	5395.1	2400.7	2341.1	3462.0	1598.6	5038.3
69		EMPLOYMENT	834.3	210.1	127.8	765.0	249.6	228.1	341.5	114.9	442.0
70		FIXD CAPITAL	3256.7	1509.5	559.2	2403.8	1679.3	1338.2	1820.3	621.0	3105.3

TABLE A-II THE RECONSTRUCTED 1972 SOVIET INPUT-OUTPUT TABLE IN PRODUCERS' PRICES
(IN MILLIONS OF RUBLES, EMPLOYMENT IN THOUSANDS OF WORK-YEARS)

SEQ NO.	110 ORDER NO.		AUTOS 19	AGRIC M+E 20	BEARIN GS 21	RADIO+ OTH MB 22	SANIT ENG E 23	OTHER METWRS 24	METAL STRUCT 25	REPAIR 26	ABRASV 27
1	1-4,6,7	METALLURGY	1037.8	1247.4	154.3	2602.4	382.8	1068.1	739.7	894.7	37.0
2	5	INDMET PROD	98.0	57.8	16.1	122.5	9.5	88.8	23.3	80.8	.5
3	8	COAL	4.1	7.6	.2	28.9	2.8	12.1	1.2	65.4	1.6
4	9	OIL EXTRAC	.1	.2	.0	.5	.0	.0	.0	.3	.0
5	10	OIL REF	40.4	31.9	6.1	82.0	3.4	9.9	5.4	115.0	2.3
6	11	GAS	17.9	11.2	1.1	31.9	2.8	2.6	1.5	11.3	.5
7	12,13	PEAT +SHALE	.3	1.0	.0	1.5	.5	.5	.0	.3	.0
8	14	ELEC POWER	160.8	177.5	27.7	363.7	25.2	60.5	44.1	283.1	20.5
9	15	EN+POW M+E	7.5	6.4	.0	39.8	1.3	.5	.2	80.7	.0
10	16,17	ELTECH+CABLE	113.6	150.4	4.0	1009.7	35.4	84.9	7.6	401.0	1.3
11	20-22	METLWK M+E	11.5	12.3	2.7	21.0	2.1	4.3	.9	9.3	.1
12	23	TOOLS + DIES	58.3	64.1	5.9	111.0	3.8	26.4	2.0	43.7	1.1
13	24	PRECIS INST	12.5	9.4	.5	1770.5	7.2	15.0	.5	97.2	.2
14	25-27	MI+MET M+E	.3	.2	.0	.2	.0	.2	.1	37.3	.2
15	28,29	PUMPS+CHEM E	5.8	20.7	.2	65.2	3.6	2.5	.4	75.7	.1
16	30-34,36	SPECL M+E	2.3	1.4	.0	20.6	.9	1.4	1.9	23.0	.1
17	35	CONST M+E	.2	.0	.0	.0	.1	.3	.6	76.6	.0
18	37,38	TRANSP M+E	.1	.3	.0	.0	.0	.1	.5	138.1	.0
19	39	AUTOS	2326.7	59.3	.3	286.2	1.3	35.7	2.7	670.4	.2
20	40	AGRIC M+E	37.7	1543.9	.2	212.6	.1	12.4	4.8	818.1	.1
21	41	BEARINGS	87.3	99.7	10.4	54.8	.7	2.8	.7	93.0	.1
22	18,19,42,43	RADIO+OTH MB	199.8	300.0	.0	8677.3	44.0	48.0	12.2	512.8	.0
23	44	SANIT ENG E	1.5	1.0	.1	27.8	79.3	3.9	3.2	5.2	.1
24	45	OTHER METWRS	61.3	81.4	6.6	480.3	9.9	94.7	4.2	126.0	.3
25	46	METAL STRUCT	.0	5.9	.0	5.9	.2	1.1	.8	4.5	.0
26	47	REPAIR	9.1	24.6	1.8	53.0	4.5	7.6	3.3	58.4	4.1
27	48	ABRASV	9.1	14.5	13.9	187.4	1.0	8.8	.9	9.7	90.2
28	49	MINERL CHEM	.2	.2	.0	4.1	.2	.3	.0	1.9	.5
29	50	BASIC CHEM	25.0	10.6	1.5	129.0	8.5	18.0	6.2	40.5	2.8
30	56	PAINT + LAC	66.1	56.8	.8	66.4	9.6	22.2	11.6	91.7	.6
31	54	SYN RUBBER	.0	.0	.0	.0	.0	1.7	.0	.0	.0
32	57	RUBBER PROD	722.8	306.4	2.8	416.1	7.6	34.9	2.2	198.8	.6
33	51-3,55,58-9	OTHER CHEM	51.2	17.5	2.8	418.9	10.3	53.7	1.8	55.0	7.3
34	60	LOGGING	6.4	2.7	.2	10.5	1.3	3.4	.7	13.8	.0
35	61,62	SAW + LUM PR	74.1	61.0	8.2	295.2	34.5	53.5	22.8	65.1	.8

36	63,64	FURN +OTH WD	7.5	8.4	1.5	57.3	1.5	23.1	2.0	23.4	.2
37	65	PAPER + PULP	19.4	13.8	2.7	18.9	2.1	31.2	.8	14.8	3.2
38	66	WOOD CHEM	.1	.2	.0	9.1	.3	.5	.0	.4	.0
39	67-73	CONST MAT	7.1	5.2	.9	81.4	3.0	5.6	3.1	39.1	.9
40	74	GLASS + PORC	34.3	6.3	.3	76.2	6.4	12.3	.5	11.3	1.6
41	75-80	TEXTLS	40.7	30.4	4.9	328.2	2.9	41.2	1.5	65.1	34.6
42	81	SEWN GOODS	24.8	20.1	3.2	99.7	5.4	17.3	6.1	50.5	1.6
43	82	OTH LT IND	48.1	7.0	.7	60.5	1.3	30.3	1.5	29.6	1.3
44	83	FISH PROD	.0	.0	.0	.1	.0	.0	.0	.1	.0
45	84	MEAT PROD	.2	.1	.0	1.9	.0	1.1	.0	.5	11.1
46	85	DAIRY PROD	8.7	10.3	4.5	63.1	6.1	4.9	.7	18.4	.5
47	86	SUGAR	.0	.1	.0	.0	.0	.0	.0	.0	.0
48	87-89	FLOUR+BREAD	.0	.0	.0	.2	.0	.0	.0	.0	.1
49	90-94	OTHER FOOD	2.2	6.8	.4	26.7	.8	3.6	1.1	5.5	1.5
50	95	IND NEC	88.3	62.0	1.9	.0	5.8	15.0	2.3	88.9	3.6
51	96-100	CONSTRUCTION	.0	.0	.0	.0	.0	.0	.0	.0	.0
52	101,102	AGRICULTURE	.1	.1	.0	.0	.1	.5	.0	.3	.0
53	103	FOREST	.0	.0	.0	.0	.0	.0	.0	.0	.0
54	104-106	TRANS + COM	319.5	273.9	20.6	782.2	50.6	133.1	68.4	346.4	9.9
55	107-109	TRADE + DIST	79.5	126.4	5.5	180.4	11.4	33.8	17.6	113.1	1.8
56	110	OTHER BRANCH	3.5	19.3	.3	23.1	1.6	12.5	.3	50.2	.1
57		TAXES +FEES	34.7	27.8	4.3	75.0	4.8	10.1	5.7	483.7	2.4
58		SUBSIDIES	-5.2	-4.5	-1.3	-38.6	-1.4	-4.7	-.3	-8.5	-7.1
59		TOTAL PURCH	5963.3	4999.0	318.8	19442.3	797.1	2152.2	1019.3	6531.2	240.5
60		DEPRECIATION	444.8	339.1	86.0	1820.0	46.0	122.7	62.9	772.2	18.4
61		WAGES	1344.7	1401.6	248.1	8043.6	253.4	1212.6	299.7	4110.4	53.7
62		SOCSEC PAYMT	103.5	107.9	19.1	530.9	19.5	93.4	23.1	316.5	4.1
63		TURNOVER TAX	.0	.0	.0	.0	.0	.0	.0	.0	.0
64		OTHER FEES	.0	.0	.0	.0	.0	.0	.0	.0	.0
65		SUBSIDIES	.0	.0	.0	.0	.0	.0	.0	.0	.0
66		OTHER INCOME	982.0	280.8	95.4	4066.9	259.7	532.8	349.0	3270.9	94.7
67		NATIONAL INC	2430.2	1790.3	362.6	12641.4	532.6	1838.8	671.8	7697.8	152.5
68		TOTAL OUTLAY	8838.3	7128.4	767.4	33903.7	1375.7	4113.7	1754.0	15001.2	411.4
69		EMPLOYMENT	722.1	752.8	133.2	4318.9	135.9	626.3	160.8	2206.8	28.6
70		FIXD CAPITAL	5130.6	3754.2	841.7	22958.0	631.4	1590.4	961.4	11247.4	241.4

TABLE A-II THE RECONSTRUCTED 1972 SOVIET INPUT-OUTPUT TABLE IN PRODUCERS' PRICES
(IN MILLIONS OF RUBLES, EMPLOYMENT IN THOUSANDS OF WORK-YEARS)

SEQ NO.	110 ORDER NO.		MINERL CHEM 28	BASIC CHEM 29	PAINT + LAC 30	SYN RUBBER 31	RUBBER PROD 32	OTHER CHEM 33	LOGGIN G 34	SAW + LUM PR 35	FURN + OTH WD 36
1	1-4,6,7	METALLURGY	6.0	313.9	196.1	68.6	16.5	316.8	14.0	59.0	39.9
2	5	INDMET PROD	6.3	11.4	.8	.0	42.1	4.3	20.5	34.8	53.9
3	8	COAL	.3	18.1	2.9	.0	2.2	11.1	2.6	13.5	14.0
4	9	OIL EXTRAC	.0	.3	.0	.0	.0	.0	1.4	.0	.0
5	10	OIL REF	15.5	45.5	10.0	62.0	28.5	166.7	137.4	39.9	13.8
6	11	GAS	2.8	68.6	1.9	.0	3.5	66.0	.0	3.8	3.8
7	12,13	PEAT +SHALE	.0	2.7	.0	.0	1.4	2.5	.0	16.4	10.8
8	14	ELEC POWER	43.4	613.6	12.8	182.8	105.6	515.9	36.5	163.9	57.1
9	15	EN+POW M+E	.4	11.1	.0	.0	.1	.2	2.9	1.1	.3
10	16,17	ELTECH+CABLE	4.5	42.3	.8	9.4	5.9	17.1	7.4	16.0	7.4
11	20-22	METLWK M+E	.1	1.1	.1	.7	.5	2.5	.8	11.8	2.5
12	23	TOOLS + DIES	.7	5.0	.6	.0	6.8	5.5	7.7	15.1	7.0
13	24	PRECIS INST	.3	13.5	.2	.0	1.0	8.9	.5	1.3	.6
14	25-27	MI+MET M+E	6.2	1.1	.1	.0	3.8	.4	.0	.0	.0
15	28,29	PUMPS+CHEM E	.8	20.0	.5	1.8	15.3	32.7	.5	1.4	.9
16	30-34,36	SPECL M+E	.3	1.2	.0	.0	1.0	16.8	35.1	11.2	1.6
17	35	CONST M+E	.6	.3	.0	.0	.0	.1	1.7	.1	.0
18	37,38	TRANSP M+E	.5	.8	.0	1.8	.1	.1	7.1	.3	.1
19	39	AUTOS	2.1	5.6	.6	.0	5.3	2.6	65.1	12.8	4.7
20	40	AGRIC M+E	.8	6.4	.0	.0	.2	.3	44.0	3.8	1.3
21	41	BEARINGS	.4	14.1	.1	.0	.7	1.5	2.3	2.2	.7
22	18,19,42,43	RADIO+OTH MB	44.8	576.7	6.5	.0	76.0	296.8	2.6	7.1	2.5
23	44	SANIT ENG E	.2	1.6	.1	.0	.3	1.4	.3	2.7	.8
24	45	OTHER METWRS	.4	18.4	14.1	.0	18.3	28.6	13.4	59.0	109.7
25	46	METAL STRUCT	.0	.4	.0	.0	.0	.0	.1	2.3	.8
26	47	REPAIR	4.2	50.7	6.8	4.1	7.4	79.2	47.5	22.9	6.8
27	48	ABRASV	.1	1.0	.1	.0	.3	1.4	.5	4.4	19.3
28	49	MINERL CHEM	7.7	294.1	9.7	4.6	4.3	53.2	.0	.1	.1
29	50	BASIC CHEM	25.4	623.1	33.6	74.2	28.0	461.6	1.1	13.7	4.3
30	56	PAINT + LAC	.7	25.1	344.3	7.4	24.5	50.4	2.5	41.7	137.3
31	54	SYN RUBBER	.0	.0	.0	1.4	1289.3	.0	.0	.0	14.9
32	57	RUBBER PROD	9.5	33.3	.6	1.0	99.6	31.1	41.3	13.9	13.6
33	51-3,55,58-9	OTHER CHEM	17.6	273.7	230.2	382.5	862.8	2448.1	2.4	110.2	109.6
34	60	LOGGING	.8	1.7	.3	.0	.4	1.5	156.2	2213.0	129.3
35	61,62	SAW + LUM PR	1.1	49.3	12.4	.0	12.0	29.6	49.4	1129.1	898.5

36	63,64	FURN +OTH WD	1.2	6.4	1.7	.0	1.5	27.5	6.3	28.4	56.2
37	65	PAPER + PULP	1.1	77.4	7.2	.0	7.8	363.3	1.0	23.1	23.3
38	66	WOOD CHEM	.6	36.8	45.0	44.0	12.2	30.9	.2	2.4	.7
39	67-73	CONST MAT	.6	45.4	2.5	.1	16.0	12.1	8.8	27.2	4.5
40	74	GLASS + PORC	1.2	7.2	5.8	.5	1.6	94.0	1.0	10.2	122.0
41	75-80	TEXTLS	1.4	103.6	1.3	.0	457.1	352.6	7.6	30.5	279.9
42	81	SEWN GOODS	1.6	29.0	1.4	2.8	16.0	20.7	41.6	22.1	13.4
43	82	OTH LT IND	.5	7.1	.3	.0	11.6	10.2	12.0	4.4	13.4
44	83	FISH PROD	.0	8.8	.0	.0	.0	10.6	.0	.1	.0
45	84	MEAT PROD	.0	8.7	.6	.0	.1	29.1	.1	9.5	5.6
46	85	DAIRY PROD	7.2	24.5	1.6	.0	10.5	38.1	.8	9.1	8.4
47	86	SUGAR	.0	.5	.0	.0	.0	13.6	.0	.0	.0
48	87-89	FLOUR+BREAD	.0	1.2	.0	.0	.1	5.0	.1	.2	.3
49	90-94	OTHER FOOD	.6	60.0	459.0	33.9	10.3	175.2	.7	4.7	2.0
50	95	IND NEC	.5	9.7	6.0	.0	7.6	21.4	4.9	36.6	17.5
51	96-100	CONSTRUCTION	.0	.0	.0	.0	.0	.0	.0	.0	.0
52	101,102	AGRICULTURE	.0	2.5	.2	.0	.1	25.6	5.0	8.6	.5
53	103	FOREST	.0	.0	.0	.0	.0	.0	425.8	.0	.0
54	104-106	TRANS + COM	13.8	305.6	77.5	49.1	177.9	357.1	123.4	924.8	218.7
55	107-109	TRADE + DIST	4.1	55.4	13.4	12.2	28.4	79.8	26.5	84.3	40.6
56	110	OTHER BRANCH	.2	5.6	2.2	.0	3.4	48.1	2.8	1.8	3.8
57		TAXES +FEES	5.6	58.8	84.0	18.2	12.1	101.6	101.9	43.0	130.8
58		SUBSIDIES	-1.5	-16.8	-11.1	-.5	-38.9	-52.5	-.9	-7.6	-26.3
59		TOTAL PURCH	243.2	3983.1	1584.8	962.6	3399.1	6418.9	1474.4	5291.9	2583.2
60		DEPRECIATION	91.7	670.4	27.8	102.0	121.4	583.7	403.7	395.6	135.9
61		WAGES	132.6	817.5	87.0	92.2	383.3	1120.1	2054.3	1495.0	1076.1
62		SOCSEC PAYMT	11.1	68.7	7.3	7.7	32.2	94.0	96.6	70.3	50.5
63		TURNOVER TAX	.0	.0	.0	.0	.0	.0	.0	.0	.0
64		OTHER FEES	.0	.0	.0	.0	.0	.0	.0	.0	.0
65		SUBSIDIES	.0	.0	.0	.0	.0	.0	.0	.0	.0
66		OTHER INCOME	170.9	1261.0	372.2	195.2	950.4	2489.0	669.2	1078.7	836.1
67		NATIONAL INC	314.6	2147.2	466.5	295.1	1365.9	3703.1	2820.1	2644.0	1962.7
68		TOTAL OUTLAY	649.5	6800.7	2079.1	1359.7	4886.4	10705.7	4698.2	8331.5	4681.8
69		EMPLOYMENT	58.2	444.4	47.7	49.6	218.1	623.5	956.6	892.2	677.1
70		FIXD CAPITAL	1352.1	9038.1	407.3	1363.2	1546.2	7636.3	3481.2	4251.1	1563.1

TABLE A-II THE RECONSTRUCTED 1972 SOVIET INPUT-OUTPUT TABLE IN PRODUCERS' PRICES
(IN MILLIONS OF RUBLES, EMPLOYMENT IN THOUSANDS OF WORK-YEARS)

SEQ NO.	110 ORDER NO.		PAPER + PULP 37	WOOD CHEM 38	CONST MAT 39	GLASS + PCRC 40	TEXTLS 41	SEWN GOODS 42	OTH LT IND 43	FISH PROD 44	MEAT PROD 45
1	1-4,6,7	METALLURGY	19.3	.6	1082.0	42.3	17.6	2.0	23.4	48.6	34.5
2	5	INDMET PROD	3.8	.1	151.0	3.3	17.9	1.4	9.4	11.5	2.4
3	8	COAL	74.4	1.9	286.5	3.6	26.7	8.8	9.5	14.9	15.9
4	9	OIL EXTRAC	.0	.0	.5	.0	.1	.0	.1	.1	.2
5	10	OIL REF	22.8	2.3	405.3	39.1	24.2	4.2	14.5	210.7	16.2
6	11	GAS	4.7	.2	138.2	18.0	11.4	1.0	3.2	.3	6.9
7	12,13	PEAT +SHALE	3.3	.2	16.2	.8	4.8	.5	1.5	.1	.3
8	14	ELEC POWER	140.5	2.5	626.2	46.1	335.9	45.5	62.3	25.2	93.8
9	15	EN+POW M+E	.4	.0	3.7	.1	1.6	.1	.1	10.5	.2
10	16,17	ELTECH+CABLE	5.9	.2	54.1	4.9	22.7	5.4	5.7	8.6	4.0
11	20-22	METLWK M+E	.6	.0	3.6	.2	.3	.0	.4	.2	.1
12	23	TOOLS + DIES	2.0	.1	15.1	2.3	6.9	2.6	3.5	11.3	1.5
13	24	PRECIS INST	1.1	.0	5.2	.9	2.5	.3	.7	3.3	.6
14	25-27	MI+MET M+E	.0	.0	14.4	.0	.0	.0	.0	.0	.0
15	28,29	PUMPS+CHEM E	1.1	.0	6.0	.2	.6	.1	.8	4.8	3.9
16	30-34,36	SPECL M+E	16.0	.0	107.7	2.1	106.2	15.4	11.7	8.4	3.8
17	35	CONST M+E	.0	.0	28.4	.1	.0	.0	.0	.0	.0
18	37,38	TRANSP M+E	.2	.0	2.7	.0	.1	.0	.0	41.2	.1
19	39	AUTOS	1.1	.1	34.3	1.4	3.6	3.4	1.4	3.4	5.5
20	40	AGRIC M+E	.2	.0	11.8	.2	.7	.1	.1	.8	.3
21	41	BEARINGS	1.3	.0	8.4	.4	2.4	.2	.4	.9	.4
22	18,19,42,43	RADIO+OTH MB	3.2	.1	173.8	20.4	.0	.0	.0	55.7	16.8
23	44	SANIT ENG E	.4	.0	16.1	9.4	1.4	.4	.8	.3	.5
24	45	OTHER METWRS	4.1	.1	48.2	2.9	21.2	20.4	27.7	62.9	10.7
25	46	METAL STRUCT	.0	.0	5.6	.0	.1	.0	.2	.1	.0
26	47	REPAIR	18.1	1.0	161.3	28.1	27.8	8.5	9.0	107.5	8.1
27	48	ABRASV	.6	.0	4.8	4.4	1.0	.3	2.1	.2	.2
28	49	MINERL CHEM	22.3	.0	1.5	11.5	.5	1.8	1.2	.0	.1
29	50	BASIC CHEM	69.3	5.6	86.4	85.2	42.1	.4	41.5	5.1	19.9
30	56	PAINT + LAC	3.3	.2	45.8	5.2	8.1	3.3	21.3	6.7	3.6
31	54	SYN RUBBER	.0	.0	6.5	.0	.0	.0	145.8	.0	.0
32	57	RUBBER PROD	4.3	.1	97.0	4.1	30.8	45.4	30.9	12.6	2.6
33	51-3,55,58-9	OTHER CHEM	28.0	17.2	124.9	37.7	2004.7	87.1	353.9	12.3	27.3
34	60	LOGGING	425.4	119.4	34.5	5.1	3.6	.8	36.9	4.8	3.5
35	61,62	SAW + LUM PR	15.7	1.5	134.3	44.6	14.6	10.3	25.2	120.6	65.0

36	63,64	FURN +OTH WD	5.8	.7	19.5	7.1	39.8	8.2	17.5	15.4	7.2
37	65	PAPER + PULP	586.0	1.1	93.5	17.5	55.9	26.8	65.7	56.9	24.2
38	66	WOOD CHEM	42.6	28.3	6.4	.3	1.9	.1	15.1	2.1	.3
39	67-73	CONST MAT	11.3	.2	2530.6	16.9	11.9	3.1	4.6	5.3	6.6
40	74	GLASS + PORC	3.3	.4	25.5	63.9	2.8	8.6	3.1	1.8	2.5
41	75-80	TEXTLS	75.1	.1	64.0	10.8	21884.5	8667.3	1308.5	168.2	18.4
42	81	SEWN GOODS	4.1	.3	66.2	6.6	25.5	25.4	11.1	29.9	30.1
43	82	OTH LT IND	17.4	.1	16.2	1.5	76.0	962.4	3312.8	9.1	6.9
44	83	FISH PROD	.0	.0	.3	.1	.4	.0	12.0	2994.0	5.0
45	84	MEAT PROD	11.1	.0	2.4	.5	2.6	.1	561.8	5.6	9590.9
46	85	DAIRY PROD	5.9	.2	30.2	5.1	9.5	.9	9.2	4.1	43.1
47	86	SUGAR	.0	.0	.0	.0	.5	.0	1.5	5.7	3.0
48	87-89	FLOUR+BREAD	.1	.0	.1	.0	2.9	.0	.1	4.6	26.3
49	90-94	OTHER FOOD	6.0	.2	22.4	.9	30.1	2.1	18.5	107.4	47.8
50	95	IND NEC	12.3	1.7	36.5	2.6	19.8	9.5	4.2	46.4	76.3
51	96-100	CONSTRUCTION	.0	.0	.0	.0	.0	.0	.0	.0	.0
52	101,102	AGRICULTURE	.0	.0	3.6	.3	7507.0	.8	926.4	13.5	22885.6
53	103	FOREST	.0	.0	.0	.0	.0	.0	.0	.0	.0
54	104-106	TRANS + COM	244.9	43.2	1560.4	70.7	510.6	142.8	137.2	299.2	139.1
55	107-109	TRADE + DIST	43.6	2.9	157.0	14.5	390.1	17.0	56.4	49.4	500.1
56	110	OTHER BRANCH	61.0	.2	42.8	3.4	16.0	2.8	84.1	1.9	10.4
57		TAXES +FEES	29.3	2.0	199.2	25.0	2893.7	3180.4	15.0	43.7	14.3
58		SUBSIDIES	-8.4	.0	-11.1	-2.0	-924.2	-374.7	-311.3	-18.9	-3324.3
59		TOTAL PURCH	2044.8	235.0	8807.7	670.3	35299.4	12953.3	7098.7	4638.9	30462.7
60		DEPRECIATION	384.4	10.4	1377.5	97.5	546.9	102.6	100.5	644.6	98.1
61		WAGES	378.4	18.7	3779.5	447.2	2861.5	2381.8	1168.1	1113.4	533.0
62		SOCSEC PAYMT	17.8	.9	230.5	27.3	194.6	162.0	79.4	75.7	36.2
63		TURNOVER TAX	.0	.0	.0	.0	.0	.0	.0	.0	.0
64		OTHER FEES	.0	.0	.0	.0	.0	.0	.0	.0	.0
65		SUBSIDIES	.0	.0	.0	.0	.0	.0	.0	.0	.0
66		OTHER INCOME	485.6	36.2	2254.3	541.2	4130.6	2424.2	535.7	420.3	1297.8
67		NATIONAL INC	881.8	55.8	6264.3	1015.7	7186.7	4968.0	1783.2	1609.4	1867.0
68		TOTAL OUTLAY	3311.0	301.2	16449.5	1783.5	43033.0	18023.9	8982.4	6892.9	32427.8
69		EMPLOYMENT	218.1	10.5	1949.5	250.9	1855.6	1789.6	710.6	357.3	343.5
70		FIXD CAPITAL	3367.1	101.1	16207.0	1165.0	7163.2	2061.7	1538.5	6328.9	2005.1

TABLE A-II THE RECONSTRUCTED 1972 SOVIET INPUT-OUTPUT TABLE IN PRODUCERS' PRICES
(IN MILLIONS OF RUBLES, EMPLOYMENT IN THOUSANDS OF WORK-YEARS)

SEQ NO.	110 ORDER NO.		DAIRY PROD 46	SUGAR 47	FLOUR+ BREAD 48	OTHER FOOD 49	IND NEC 50	CONSTR UCTION 51	AGRICU LTURE 52	FOREST 53	TRANS + COM 54
1	1-4,6,7	METALLURGY	42.0	28.9	13.4	74.1	763.4	3474.6	50.3	.8	71.8
2	5	INDMET PROD	2.3	1.8	2.9	6.2	59.7	345.2	39.1	.8	61.4
3	8	COAL	41.2	16.4	49.1	38.1	54.4	105.7	150.2	.7	116.4
4	9	OIL EXTRAC	.0	.9	.0	.7	.4	13.4	.0	.0	16.1
5	10	OIL REF	26.7	57.3	21.8	59.8	106.8	566.4	483.2	4.3	777.2
6	11	GAS	4.0	6.3	13.0	12.7	39.6	16.6	4.3	.0	25.0
7	12,13	PEAT +SHALE	1.7	.8	.8	1.4	3.7	14.5	90.9	.0	1.7
8	14	ELEC POWER	80.4	22.2	96.4	131.5	224.2	504.2	505.3	2.3	799.3
9	15	EN+POW M+E	.6	.4	.4	.4	4.9	35.8	.0	.0	3.5
10	16,17	ELTECH+CABLE	4.0	3.8	7.6	8.0	27.6	1416.1	62.4	.0	59.1
11	20-22	METLWK M+E	.1	.1	.2	.2	1.1	12.9	5.5	.0	.5
12	23	TOOLS + DIES	1.7	1.5	4.7	6.6	3.9	90.9	49.8	5.0	21.6
13	24	PRECIS INST	1.1	1.4	1.1	4.1	8.0	52.3	5.6	.0	11.4
14	25-27	MI+MET M+E	.0	.0	.0	.2	1.1	241.0	.0	.0	.0
15	28,29	PUMPS+CHEM E	2.5	1.1	.6	1.5	3.9	35.6	5.1	.0	6.3
16	30-34,36	SPECL M+E	19.2	6.8	19.4	17.1	4.9	90.2	.0	.0	20.8
17	35	CONST M+E	.0	.1	.0	.0	1.3	198.1	5.1	.0	4.1
18	37,38	TRANSP M+E	.1	.1	.0	.1	4.3	7.9	.0	.0	166.7
19	39	AUTOS	5.1	1.8	2.0	5.2	29.4	329.7	213.1	6.7	366.9
20	40	AGRIC M+E	.3	2.0	.2	.8	25.1	148.6	661.5	9.2	9.7
21	41	BEARINGS	.4	.6	.7	.9	4.2	14.2	12.6	.0	15.7
22	18,19,42,43	RADIO+OTH MB	20.2	21.7	39.5	52.5	9.8	412.8	24.3	20.7	72.3
23	44	SANIT ENG E	.7	.2	.5	.9	1.2	1131.4	.0	.0	2.9
24	45	OTHER METWRS	9.8	1.4	10.4	62.8	8.2	540.7	539.1	.9	25.6
25	46	METAL STRUCT	.0	.0	.0	.1	.2	1713.5	.0	.0	.0
26	47	REPAIR	13.5	7.7	20.3	26.6	6.7	914.3	1837.7	.0	192.2
27	48	ABRASV	.2	.2	.2	.2	1.9	16.1	12.2	.0	2.4
28	49	MINERL CHEM	.1	.9	.0	2.0	6.0	.0	48.4	.0	.0
29	50	BASIC CHEM	8.8	3.7	2.3	52.9	103.3	129.7	2084.1	3.3	24.6
30	56	PAINT + LAC	3.0	2.8	5.0	11.7	47.0	610.3	25.4	.0	52.5
31	54	SYN RUBBER	.0	.0	.0	.1	.0	.0	.0	.0	.0
32	57	RUBBER PROD	6.1	2.7	3.7	8.4	2.9	313.5	312.2	.0	545.8
33	51-3,55,58-9	OTHER CHEM	10.9	3.0	7.5	146.0	362.1	233.9	307.5	.0	14.4
34	60	LOGGING	2.4	1.1	2.1	3.6	28.2	438.0	134.8	2.1	36.1
35	61,62	SAW + LUM PR	22.2	4.7	83.4	178.9	30.9	3207.0	237.6	1.7	77.1

36	63,64	FURN +OTH WD	2.7	2.4	6.9	12.0	3.8	218.9	85.0	.0	56.5
37	65	PAPER + PULP	57.6	8.5	106.1	174.1	269.4	79.5	14.1	.3	13.0
38	66	WOOD CHEM	.2	.1	.1	4.7	.0	4.0	7.3	.0	1.4
39	67-73	CONST MAT	4.6	20.0	5.1	8.6	112.2	12621.2	154.3	2.2	25.4
40	74	GLASS + PORC	26.7	.7	2.2	129.9	26.0	379.2	23.6	.0	9.6
41	75-80	TEXTLS	11.3	20.8	18.9	442.3	509.8	187.4	172.0	.0	88.2
42	81	SEWN GOODS	9.8	9.3	31.6	19.8	20.0	375.0	181.2	5.6	95.6
43	82	OTH LT IND	3.2	1.2	5.1	4.9	5.1	69.2	70.5	.0	28.3
44	83	FISH PROD	.1	.0	11.6	17.8	17.1	.0	372.2	.0	.0
45	84	MEAT PROD	5.1	1.1	97.1	686.6	61.8	11.0	291.3	.0	.0
46	85	DAIRY PROD	1969.7	.3	436.9	87.2	15.8	7.0	743.0	.0	.0
47	86	SUGAR	133.3	1307.4	901.5	610.8	14.3	.0	111.3	.0	.0
48	87-89	FLOUR+BREAD	14.1	.0	4717.9	71.4	731.4	.9	2352.7	.0	.1
49	90-94	OTHER FOOD	36.6	8.4	979.5	7125.8	51.2	86.3	156.2	.0	11.4
50	95	IND NEC	23.8	15.2	96.8	118.1	420.3	142.2	4009.9	2.5	48.8
51	96-100	CONSTRUCTION	.0	.0	.0	.0	.0	.0	.0	.0	.0
52	101,102	AGRICULTURE	9221.0	2216.5	8380.6	5509.8	2139.3	46.5	22232.3	10.1	4.7
53	103	FOREST	.0	.0	.0	.0	.0	.0	.0	.0	.0
54	104-106	TRANS + COM	98.6	97.4	444.6	531.3	345.3	5841.4	1164.2	5.4	398.5
55	107-109	TRADE + DIST	212.6	152.3	652.4	446.0	209.6	465.5	1515.1	2.4	122.7
56	110	OTHER BRANCH	3.7	1.8	55.9	18.9	44.4	165.2	120.4	.0	.0
57		TAXES +FEES	60.6	12.4	1107.2	528.9	187.9	980.7	2201.0	13.9	1631.5
58		SUBSIDIES	-396.5	-108.0	-373.9	-477.1	-84.0	-22.3	-1633.4	.0	-6.6
59		TOTAL PURCH	11830.1	3972.2	18093.3	16988.1	7081.0	39033.9	42251.5	100.9	6130.2
60		DEPRECIATION	136.2	155.5	191.1	365.5	919.0	3568.0	6901.0	58.0	4698.0
61		WAGES	511.9	207.9	1065.8	1079.6	2089.8	25750.0	50645.0	594.0	9071.0
62		SOCSEC PAYMT	34.8	14.1	72.5	73.5	137.9	1589.0	2027.0	28.0	535.0
63		TURNOVER TAX	.0	.0	.0	.0	.0	.0	.0	.0	.0
64		OTHER FEES	.0	.0	.0	.0	.0	.0	.0	.0	.0
65		SUBSIDIES	.0	.0	.0	.0	.0	.0	.0	.0	.0
66		OTHER INCOME	1921.0	588.0	1537.4	3850.8	2294.4	7365.2	7371.9	-160.4	9095.8
67		NATIONAL INC	2467.7	810.0	2675.7	5003.9	4522.1	34704.2	60043.9	461.6	18701.8
68		TOTAL OUTLAY	14434.0	4937.7	20960.1	22357.5	12522.1	77306.1	109196.4	620.5	29530.0
69		EMPLOYMENT	330.1	149.3	803.9	754.1	1140.0	11920.0	29602.4	401.4	4968.5
70		FIXD CAPITAL	2310.9	2136.2	3351.4	5327.8	12440.7	23674.0	112665.0	726.0	64118.0

TABLE A-II THE RECONSTRUCTED 1972 SOVIET INPUT-OUTPUT TABLE IN PRODUCERS' PRICES
(IN MILLIONS OF RUBLES, EMPLOYMENT IN THOUSANDS OF WORK-YEARS)

SEQ NO.	110 ORDER NO.		TRADE + DIST 55	OTHER BRANCH 56	TAXES +FEES 57	SUBSIDIES 58	INTIND USE 59	CONSUMPTION 60	OTHER FD 61	TOTAL FD 62	GVO 63
1	1-4,6,7	METALLURGY	12.5	1.1	.0	.0	35742.5	1170.1	1653.0	2823.1	38565.6
2	5	INDMET PROD	6.9	2.0	.0	.0	1791.6	37.1	10.6	47.7	1839.3
3	8	COAL	74.6	3.0	.0	.0	8965.4	1231.7	112.7	1344.4	10309.8
4	9	OIL EXTRAC	.0	.0	.0	.0	3718.2	.0	745.8	745.8	4464.0
5	10	OIL REF	92.1	11.0	.0	.0	5420.6	735.7	1867.9	2603.6	8024.2
6	11	GAS	7.7	.5	.0	.0	1426.7	247.9	10.9	258.8	1685.5
7	12,13	PEAT +SHALE	4.5	1.0	.0	.0	519.7	45.2	-7.8	37.4	557.1
8	14	ELEC POWER	269.9	20.5	.0	.0	10224.6	3060.9	138.3	3199.2	13423.8
9	15	EN+POW M+E	.0	.1	.0	.0	753.8	.0	740.9	740.9	1494.7
10	16,17	ELTECH+CABLE	31.5	2.0	.0	.0	6330.9	716.6	1882.6	2599.2	8930.1
11	20-22	METLWK M+E	.0	.5	.0	.0	190.5	.0	1712.1	1712.1	1902.6
12	23	TOOLS + DIES	8.6	1.6	.0	.0	841.9	191.7	-34.2	157.5	999.4
13	24	PRECIS INST	4.7	1.6	.0	.0	2904.5	675.5	1815.1	2490.6	5395.1
14	25-27	MI+MET M+E	.0	.0	.0	.0	878.3	.0	1522.4	1522.4	2400.7
15	28,29	PUMPS+CHEM E	10.8	.2	.0	.0	647.1	678.5	1015.5	1694.0	2341.1
16	30-34,36	SPECL M+E	15.8	2.1	.0	.0	788.7	32.9	2640.4	2673.3	3462.0
17	35	CONST M+E	.5	.0	.0	.0	393.3	.0	1205.3	1205.3	1598.6
18	37,38	TRANSP M+E	.0	.0	.0	.0	752.7	36.9	4248.7	4285.6	5038.3
19	39	AUTOS	39.6	9.0	.0	.0	4991.9	1340.0	2506.4	3846.4	8838.3
20	40	AGRIC M+E	13.4	.0	.0	.0	4029.0	.0	3099.4	3099.4	7128.4
21	41	BEARINGS	1.3	.0	.0	.0	645.5	11.8	110.1	121.9	767.4
22	18,19,42,43	RADIO+OTH MB	106.4	.0	.0	.0	14055.5	2665.5	17182.7	19848.2	33903.7
23	44	SANIT ENG E	3.5	.1	.0	.0	1321.6	52.3	1.8	54.1	1375.7
24	45	OTHER METWRS	98.3	.2	.0	.0	2791.2	1245.6	76.9	1322.5	4113.7
25	46	METAL STRUCT	.0	.0	.0	.0	1760.5	.0	-6.5	-6.5	1754.0
26	47	REPAIR	123.4	.0	.0	.0	4718.9	615.7	9666.6	10282.3	15001.2
27	48	ABRASV	.1	.0	.0	.0	493.8	.0	-82.4	-82.4	411.4
28	49	MINERL CHEM	.0	.0	.0	.0	498.4	.0	151.1	151.1	649.5
29	50	BASIC CHEM	10.5	6.2	.0	.0	4961.5	115.8	1723.4	1839.2	6800.7
30	56	PAINT + LAC	39.3	1.9	.0	.0	2079.9	155.4	-156.2	-.8	2079.1
31	54	SYN RUBBER	.0	.0	.0	.0	1526.1	.0	-166.4	-166.4	1359.7
32	57	RUBBER PROD	19.2	1.2	.0	.0	3834.0	473.2	579.2	1052.4	4886.4
33	51-3,55,58-9	OTHER CHEM	27.6	48.5	.0	.0	9733.8	1582.1	-610.2	971.9	10705.7
34	60	LOGGING	16.3	3.4	.0	.0	4125.0	315.8	257.4	573.2	4698.2
35	61,62	SAW + LUM PR	76.8	1.6	.0	.0	7622.8	79.5	629.2	708.7	8331.5

36	63,64	FURN +OTH WD	39.8	3.3	.0	.0	923.5	3331.0	427.3	3758.3	4681.8
37	65	PAPER + PULP	123.9	291.4	.0	.0	2874.7	133.6	302.7	436.3	3311.0
38	66	WOOD CHEM	.9	.2	.0	.0	327.2	.0	-26.0	-26.0	301.2
39	67-73	CONST MAT	62.3	1.2	.0	.0	16079.7	261.4	108.4	369.8	16449.5
40	74	GLASS + PORC	77.3	.1	.0	.0	1286.8	535.1	-38.4	496.7	1783.5
41	75-80	TEXTLS	99.1	2.5	.0	.0	35906.9	10931.7	-3805.6	7126.1	43033.0
42	81	SEWN GOODS	139.8	2.5	.0	.0	1662.8	16487.3	-126.2	16361.1	18023.9
43	82	OTH LT IND	33.7	58.2	.0	.0	4991.3	6557.0	-2565.9	3991.1	8982.4
44	83	FISH PROD	28.7	.0	.0	.0	3479.7	2624.5	788.7	3413.2	6892.9
45	84	MEAT PROD	240.9	.2	.0	.0	11643.8	20086.9	697.1	20784.0	32427.8
46	85	DAIRY PROD	76.7	.1	.0	.0	3784.6	10381.2	268.2	10649.4	14434.0
47	86	SUGAR	24.6	.0	.0	.0	3128.4	3375.1	-1565.8	1809.3	4937.7
48	87-89	FLOUR+BREAD	119.9	.0	.0	.0	8050.7	14761.9	-1852.5	12909.4	20960.1
49	90-94	OTHER FOOD	241.5	.8	.0	.0	9792.6	14966.0	-2401.1	12564.9	22357.5
50	95	IND NEC	83.5	323.3	.0	.0	6236.3	5725.9	559.9	6285.8	12522.1
51	96-100	CONSTRUCTION	.0	.0	.0	.0	.0	.0	77306.1	77306.1	77306.1
52	101,102	AGRICULTURE	232.5	.0	.0	.0	81378.8	28084.0	-266.4	27817.6	109196.4
53	103	FOREST	.0	45.2	.0	.0	471.0	.0	149.5	149.5	620.5
54	104-106	TRANS + COM	356.9	37.1	.0	.0	22791.5	4238.7	2499.8	6738.5	29530.0
55	107-109	TRADE + DIST	51.1	15.9	.0	.0	7034.8	17594.9	655.3	18250.2	25285.0
56	110	OTHER BRANCH	119.3	6.0	.0	.0	1728.6	1875.2	225.7	2100.9	3829.5
57		TAXES +FEES	24.2	.5	.0	.0	15298.0	41445.0	-16.0	41429.0	56727.0
58		SUBSIDIES	-111.0	-.9	.0	.0	-8471.0	-10349.8	-627.2	-10977.0	-19448.0
59		TOTAL PURCH	3181.4	906.9	.0	.0	381881.1	210560.0	126940.3	337500.3	719381.4
60		DEPRECIATION	1813.0	52.0	.0	.0	37300.0	14840.0	.0	14840.0	52140.0
61		WAGES	11118.0	1006.0	.0	.0	155197.0	.0	.0	.0	.0
62		SOCSEC PAYMT	500.0	48.0	.0	.0	8730.0	.0	.0	.0	.0
63		TURNOVER TAX	.0	.0	55567.0	.0	55567.0	.0	.0	.0	.0
64		OTHER FEES	.0	.0	1160.0	.0	1160.0	.0	.0	.0	.0
65		SUBSIDIES	.0	.0	.0	-19448.0	-19448.0	.0	.0	.0	.0
66		OTHER INCOME	8672.6	1816.6	.0	.0	98994.3	.0	.0	.0	.0
67		NATIONAL INC	20290.6	2870.6	56727.0	-19448.0	300200.3	.0	.0	.0	.0
68		TOTAL OUTLAY	25285.0	3829.5	56727.0	-19448.0	719381.4	.0	.0	.0	.0
69		EMPLOYMENT	8243.0	667.1	.0	.0	86626.4	.0	.0	.0	.0
70		FIXD CAPITAL	31135.0	447.0	.0	.0	498478.0	.0	.0	.0	.0

TABLE A–III.—PRODUCT DESCRIPTION OF THE 56 PRODUCING SECTORS

Sector No.	Sector title	Description
1	Metallurgy	Ferrous ores and nonmetallic raw materials for ferrous metallurgy; pig iron, steel, and ferroalloys; rolled ferrous plate, sheet, bars, beams, rails, and pipe; nonferrous, rare, and precious metal ores; natural diamonds; nonferrous metals, alloys, and powders; semiconductor materials; carbon and graphite electrode products; chemical products of nonferrous metallurgy; coke, coke oven gas, coal oil, coal tar, and other products of coke chemistry; refractory brick, powder, and other products from refractory materials.
2	Industrial metal products	Steel wire, rod, tape, rope; wire nails, metal cloth, welding electrodes, chains, springs, screws, bolts, pins, rivets, keys, other industrial metal fasteners and hardware.
3	Coal	Coal and lignite; coal briquets; raw liquid fuels from coal; other products of coal processing.
4	Oil extraction	Crude oil and byproduct gas.
5	Oil refining	Refined petroleum fuels and lubricants; other products of oil refining (except carbon black).
6	Gas	Natural and manufactured gas; natural gasoline; other products of gas processing.
7	Peat and oil shales	Peat and peat briquets; shale oil and other products of shale processing.
8	Electric power and steam	Generation and transmission of electric power and steam.
9	Energy and power M. & E.[1]	Steam boilers and boiler equipment; steam, gas, and hydraulic turbines and equipment; nuclear power reactors; diesel engines (except auto, tractor, combine, and aircraft engines); steam engines; windmills.
10	Electrotechnical M. & E.[1] and cable products.	Electric motors and generators; transformers, rectifiers, and condensers; high- and low-voltage apparatus; electrical transportation equipment; electric furnaces, electric welding equipment; lighting equipment, fixtures, and bulbs; wet and dry batteries, electric insulating materials and products; electrical household appliances (except refrigerators); all types of cable, including conducting wire, cord, and cable.
11	Metalworking M. & E.[1]	All types of metalcutting and woodworking machine tools; sawmill frames; metal forging, pressing, stamping, and cutting machinery; molding and casting machinery and equipment.
12	Tools and dies	Cutting tools, dies, chucks, jigs, and other fixtures for metalworking and woodworking machinery; measuring tools; mechanic's hand tools; woodworking tools; chain saws.
13	Precision instruments	Electronic computers and data processing equipment; calculators; cash registers; copying machines, typewriters; office equipment; automatic control equipment; control, regulating, and measuring instruments (including scales); laboratory instruments; electrical and radio instruments; optical, astronomical, geodesical, meteorological, hydrological, geophysical, navigational, biological, and medical instruments; X-ray apparatus; materials testing equipment; drawing instruments, slide rules, mechanical pens and pencils; cameras, film projectors, and other photographic equipment; eyeglasses and other consumer optical devices; clocks and watches of all types.
14	Mining and metallurgical M. & E.[1]	Iron and steel smelting and rolling equipment; coking equipment; equipment for nonferrous metallurgy; oil and gas drilling, extraction, and refining equipment; ore and coal mining and concentration machinery and equipment; peat mining equipment.
15	Pumps and chemical equipment	All types of pumps and compressors, fans and ventilators; refrigeration equipment (inlcuding household refrigerators); oxygen and rare-gas apparatus; equipment for gas-flame metalworking; centrifuges, filter presses, autoclaves, mixing and drying drums, calenders, vulcanizers, heat exchangers, and other chemical equipment.
16	Specialized M. & E.[1]	Logging and lumbering equipment; pulp and papermaking equipment; equipment for the textile, chemical fiber, knitting, sewing, footwear, leather, fur, and cable industries; household sewing machines; cotton ginning equipment; equipment for flour mills, grain elevators, and grain storage facilities; food processing equipment; printing presses, typesetting machinery, and other equipment for the printing industry; equipment for the production of lime, cement, prefabricated concrete, brick, insulating materials, and other construction materials; cranes, conveyors, elevators, escalators, hoists, winches, and other hoisting, loading, and materials handling machinery.
17	Construction M. & E.[1]	Dredges, excavators, bulldozers, graders, pile drivers, power rollers, and other machinery for construction and road building; electric and pneumatic construction tools.
18	Transportation M. & E.[1]	Railroad, subway, and streetcar rolling stock and operating equipment; ships and boats of all types; horse-drawn vehicles.
19	Automobiles	Trucks, passenger cars, autobuses, auto tractors and trailers; motorcycles, scooters, and bicycles; automobile, motorcycle and scooter engines and components.

See footnote at end of table.

TABLE A—III.—PRODUCT DESCRIPTION OF THE 56 PRODUCING SECTORS—Continued

Sector No.	Sector title	Description
20	Tractors and agricultural M. & E.[1]	Tractors (including industrial and logging tractors); tractor and combine engines; all types of agricultural machinery and equipment.
21	Bearings	All types of ball and roller bearings (including those made of plastics) and appurtenances.
22	Radio-electronics and other machine-building.	Radio communications apparatus and equipment; telephone and telegraph equipment; consumer radio and television receivers; tape recorders; electro-vacuum and semiconductor devices; special materials and equipment for the electronic industry; medical, surgical, dental, and veterinary tools and equipment; equipment for retail trade, public dining, hospitals, and sanatoriums; glass industry equipment; firefighting, safety, sanitation, laundry, and dry cleaning equipment; castings, forgings, and stampings; parts and fittings in general machine-building use.
23	Sanitary engineering products	Heating and air-conditioning equipment; plumbing fixtures and fittings; cast iron sewer pipe; wood, coal, and gas stoves.
24	Other metal wares	Metal building components: metal containers; shoemakers', chauffeurs', and gardeners' tools; metal furniture parts; metal kitchen utensils, tableware, and cutlery; barbering tools; metal lamps and lanterns; metal sporting goods; knitting and sewing machine needles.
25	Metal structures	Metal frames for buildings and structures; metal sheds; metal bridgework; utility poles and masts; water towers.
26	Repair of M. & E.[1]	Repair of all types of machinery, equipment, vehicles, and instruments, including consumer appliances.
27	Abrasives	Abrasive powders, pastes, and tools; synthetic diamonds.
28	Mineral chemistry products	Extraction and concentration of apatite, phosphorite, natural potassium salts, native sulphur and boron, mineral pigments, and other mineral materials for chemistry.
29	Basic chemistry products	Inorganic acids, alkalis, salts, and compounds; mineral fertilizers; sorbents and catalyzers; pesticides, herbicides, and disinfectants; explosives.
30	Paints and lacquers	Paints, lacquers, varnishes; mineral pigments; wax compounds; polishing pastes; brake fluid.
31	Synthetic rubber	All kinds of synthetic rubber.
32	Rubber and asbestos products	Rubber tires, hoses, belts, machine parts; rubberized fabrics; rubber toys, sporting goods, and other rubber consumer goods (except rubber footwear); medical and hygienic rubber goods; asbestos fiber, cord, sheet, and other products (except asbestos-cement construction materials).
33	Other chemicals	Synthetic dyes and pigments; textile assistants; rubber and plastic additives; synthetic resins and plastics; synthetic fibers; synthetic alcohols; ketone and acetone; organic acids; synthetic detergents and cleaning agents; pharmaceutical preparations and medications; chemical reagents; photographic film and paper, photochemicals; carbon black; household chemicals; plastic household articles, machinery parts, and building accessories; phonograph records; polymer film, sheet, and pipe; glass fiber and products; activated charcoal.
34	Logging	Timber, firewood, natural resin.
35	Sawmills and lumber products	Lumber of all kinds; railroad ties; plywood; wooden containers; wood building components.
36	Furniture and other woodworking	Wooden and woven furniture, furniture parts, and furniture repair; wood machinery and wagon parts; hothouse frames; wooden household and sporting goods; matches; preservative treatment of lumber and wood products.
37	Paper and pulp	Wood pulp and cellulose; paper and cardboard of all types; paper boxes, bags, and other containers; wallpaper, notebooks, writing tablets, and other paper products.
38	Wood chemistry products	Products of wood distillation; wood alcohol; charcoal.
39	Construction materials	Cement; prefabricated concrete; block and brick; building stone; roofing and drainage tile; asbestos-cement and slate products; soft roofing materials; ceramic wall and floor tile and pipe; crushed stone, gravel, and sand; lime, gypsum, and other binding materials; plaster and products; insulation materials; linoleum and polymer wall and floor coverings; asbestos, graphite, mica, talc, and other nonore materials.
40	Glass and porcelain products	Glass and glass products; fiberglass and glass wool; porcelain housewares, art goods, laboratory supplies, plumbing fixtures and fittings.
41	Textiles	Cotton, silk, wool, and linen yarn, thread, cloth, and fabrics; cotton seed; hosiery products and knit goods; jute and hemp fiber, yarn, rope, and fabrics; fish nets; felt products; umbrellas; textile notions and haberdashery.
42	Sewn goods	Clothing and apparel; industrial sewn goods; clothing repair.
43	Other light industry products	Natural and artificial leather and products; rubber, leather, and textile footwear; natural and synthetic furs and products from natural and synthetic fur; tanning agents; bristle and brush products; buttons; shoe repair.
44	Fish products	Fishing and whaling; fresh and processed fish and seafood; fish flour and meal; other fish products.

See footnote at end of table.

TABLE A-III.—PRODUCT DESCRIPTION OF THE 56 PRODUCING SECTORS—Continued

Sector No.	Sector title	Description
45	Meat products	Meat and meat products; gelatin and glue; powdered eggs.
46	Dairy products	Milk, butter, cheese, casein, and other milk products.
47	Sugar	Refined and granulated sugar; refined molasses and syrup; beet pulp.
48	Flour, bread, and confections	Flour and cereals; flour milling byproducts; bread and bakery products; macaroni and related products; all types of confectionery products.
49	Other foods	Vegetable oils; margarine and mayonnaise; laundry soap and candles; canned, frozen, and processed fruits and vegetables; fruit juices and extracts; tobacco and products; cosmetics and perfumes; raw and refined alcohol; alcoholic and carbonated beverages; yeast; tea and coffee; table salt.
50	Industry not elsewhere classified	Natural precious and semiprecious stones (except diamonds); printing and bookbinding; musical instruments and appurtenances; games and toys (except rubber toys); pencils, pens, ink, and general office supplies; jewelry and art products; commercial laundering and dry cleaning; movie and still film printing and processing; water supply systems; feather and down products; processed animal feeds.
51	Construction	Industrial, commercial, transportation, agricultural, and residential construction—new and maintenance; design and survey work for construction; drilling for gas and oil.
52	Agriculture	All grain, vegetable, fruit, berry, technical (cotton, hemp, flax), and other field and horticultural crops; livestock and poultry raising, apiculture, sericulture; unprocessed animal products (meat, raw milk, eggs, honey, raw wool, raw silk, raw hides, etc.).
53	Forestry	Planting, care, and maintenance of forests.
54	Transportation and communications	Freight transportation, including pipelines; communications serving production, including postal services.
55	Trade and distribution	Wholesale and retail trade, including public dining; supply and distribution services; procurement of agricultural products.
56	Other branches of material production	Collection of ferrous and nonferrous metal scrap; motion picture production; publishing; noncommercial hunting, fishing, and trapping; gathering of wild fruits, nuts, herbs, etc.

[1] Machinery and equipment. Note that all machine-building sectors include spare parts.

Source: Tsentral'noye, Instruktsiya, 1971, pp. 9–24.

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SOVIET IMPLEMENTATION OF DOMESTIC INVENTIONS: FIRST RESULTS

(By John A. Martens and John P. Young*)

CONTENTS

I. Introduction

Because the Soviet Union must rely increasingly on "intensive" sources of economic growth—principally technological advance—to halt or reverse the secularly declining economic growth rates of the 1960's and 1970's, the performance of the Soviet economy in generating, assimilating, and diffusing new technology is attracting increasing attention by both Western and Eastern economists. With the increased importance of science and technology has come an awareness in the Soviet leadership that advances must be channeled to economically effective ends, and that implementation of developed technology, in the words of General Secretary Brezhnev, is the "weak link" in the chain of development from research to production.

Recent studies by Western researchers describe well many of the institutional and managerial impediments to technical innovation within the Soviet economy.[1] For the most part, however, data limitations have forced researchers to rely on case studies, anecdotal material, and enunciated Soviet policy to identify these impediments to

*This is a staff research note. It is an analytic document and should not be construed as a statement of Commerce Department policy. The authors wish to thank Ron Oechsler and Bob Teal for their computational assistance.

[1] Joseph S. Berliner, The Innovation Decision in Soviet Industry (Cambridge: The MIT Press, 1976); Ronald Amann, Julian Cooper and R. W. Davies (ed.), The Technological Level of Soviet Industry, (New Haven: Yale University Press, 1977).

innovation and evaluate their relative importance. While an accurate overall general picture has thus emerged, the absence of rigorous empirical tests has limited our ability to compare Soviet and Western performance, to evaluate trends in Soviet performance, and to identify performance variations within Soviet industry.

This study considers an important aspect of technical innovation, the implementation of inventions in Soviet industry. Our analysis is based on a random sample of data from a Soviet journal—*Vnedrennye izobreteniya* (*Introduced Inventions*). Later in the paper we describe the sample more fully. First, inventions are grouped by technical area. Second, the flows of inventions among originating and implementing industrial sectors and the flows of inventions among originating and implementing facility types are described. These groupings allow us to analyze more carefully bureaucratic and organizational influences on the innovation process. Third, the flows of inventions among originating and implementing regions are described and permit us to analyze the influence of location on technical innovation. We then calculate statistically the impact of certain technical and organizational factors on a critical indicator of implementation performance—lead time, a period beginning with the filing of an application for a Soviet inventor's certificate and ending with the certification by the implementing facility that the invention has been implemented. Finally, we contrast Soviet lead times with those in the United States and the Federal Republic of Germany, based on the results of similar studies undertaken for those countries. Here we attempt to establish quantitatively whether the Soviet Union is, in fact, a slower implementer of inventions than are selected Western countries.

Before presenting the results, we briefly describe the concept of invention in the Soviet Union, the administrative network established to foster and regulate inventing activity, and the role of implemented inventions in Soviet technical progress. This discussion, apart from defining technology, will serve to clarify the kind of technical advances represented by the object of our analysis—the implemented invention.

II. The Invention in the Soviet Union

A. Standards for Inventions

In the abstract, inventing activity, or the act of conceiving a new product or process and solving the technical problems associated with its application, is not inherent to a particular nation or culture National differences do arise, however, when the invention becomes a "patented" invention, since somewhat different criteria are applied by most countries in determining which inventions will be accorded patent rights. Because it is the formally certified Soviet invention (*izobreteniye*) that is the basis for our sample, we describe the legal criteria that a proposed invention must satisfy to be awarded a Soviet inventor's certificate.[2]

[2] In the Soviet Union inventions can be protected in two ways—a patent or an inventor's certificate. A patent confers on the patentee the exclusive rights to the invention. An inventor's certificate transfers the exclusive rights to the invention to the state.

Both foreigners and Soviet citizens have the right to choose either form of protection. However, Soviet legislators clearly expect foreigners to choose patents, while Soviets are to choose inventor's certificates. In the last forty years only about forty patent grants were made to Soviet citizens. For a more detailed description of this dual system of protection see John A. Martens, "Patents and Soviet Socialism: the Formative Years, 1919–1931," Osteuropa Recht, 1977, No. 4, 251–280.

Historically, the term invention has always had a distinct and consistent legal meaning in the Soviet Union, and almost always connotes patentability (*patentnosposobnost'*). The chief legal characteristics of inventions are defined by the Statute on Discoveries, Inventions and Rationalization Proposals of 1973 [3] and include: novelty, usefulness, being technological in nature, and being sufficiently disclosed.

Novelty.—According to Soviet law: "A solution shall be recognized as new if, * * * the essence of that solution or an identical solution has not been disclosed in the USSR or abroad to an indefinite circle of persons in such a way as to enable the solution to be realized." In other words, the newness of an invention is not relative only to technical developments existing in the Soviet Union, but to worldwide technical developments.

Establishing the degree of novelty is by no means a simple matter and is conducted by a large staff of highly trained technical experts at the State Committee for Inventions and Discoveries. These experts, or patent examiners, compare the specifications of each filed invention to similar patent grants published in the patent journals of major industrialized countries and to other relevant technical information. If an application is rejected for lacking sufficient novelty, the examiner must supply the applicant with specific references to the materials supporting the rejection.

The novelty examination provides the basis to the contention of many Soviet economic policy makers that an increased emphasis on the use of inventions will bring the technical level of Soviet industry closer to world levels.

Usefulness.—Usefulness, (*polozhitelnyi effekt*), while not clearly defined by law, requires that an invention represent a practical advance over existing technology. A useful invention must on balance have positive characteristics which outweigh any negative features—e.g., raise quality sufficiently to outweight any cost increases or, conversely lower costs with, at worst, only marginal reductions in quality.

Actual practice indicates that very few applications are rejected on the grounds of not being useful. This undoubtedly reflects the difficulties inherently involved in evaluating usefulness, in part because such evaluations would often require considerable assistance from out-of-house experts who work at actual production facilities.

Technical solution.—Soviet law does not explicitly define what is meant by the term "technical solution," but the law does list specific subjects that are not considered technical solutions. For example, economic management and educational methods and systems, construction projects and schemes, industrial design proposals, codes, information systems, and calculation methods are not patentable. (Article 21 of the 1973 Law on Inventions.) Excluding these subjects is not an uncommon practice in many of the world's patent systems.

Sufficient Disclosure.—In addition to satisfying the above standards, an invention "* * * must be disclosed in the description and illustrative drawings, schemes and other graphic materials with such completeness and clarity * * * to make it possible to utilize the invention." (Article 44 of the 1973 Law on Inventions.) This requirement in effect ensures, among other things, that the concept behind the in-

[3] For the official English translation see, Industrial Property, July 1974, pp. 298–319.

vention is workable, i.e., it could be replicated by others and further developed.

Inventions, then, are clearly held to be technical applications of the product of scientific research. This implies that implemented inventions will constitute a technical innovation, but will not encompass other productive innovations in such areas as the management and organization of economic activity. While demonstration of a sufficient degree of novelty is undoubtedly the most stringent test that an invention must meet, it is also the most difficult to apply. Consequently, many inventions declared new—both in the West and in the Soviet Union—are marginal achievements and fall quite short of what the standard suggests. On the whole, however, this standard of world "best practice" can be expected to have an economic impact. For example, the implementation of new investions in those Soviet economic sectors which generally lag behind the West might require proportionately larger technical advances, with associated problems and delays, than implementation in Western industry.

We also note that the Soviet Union certifies a second kind of technical development—the "rationalization" (*ratsionalizatorskiye predlozheniye*, or "*ratspred*"). Formally, the chief distinction between a rationalization proposal and an invention centers on novelty. Whereas an invention is new to the world, a ratspred need only be new to the enterprise. In practice, however, the distinction seems to be greater. Many Soviet references to ratspred indicate that enterprise management, in fact, applies standards very loosely.[4] Thus, while ratspred may envisage massive changes, the vast majority are minor proposals yielding marginal or even insignificant improvements.[5]

Although individually yielding small economies (between 1964–1973 average economies for ratspred were 1,400 rubles and for invention, 30,000 rubles),[6] collectively ratspred are a major force in economic growth.

By Soviet estimates, rationalization proposals accounted in 1973 for 89 percent of total economies yielded by inventions and rationalization proposals.[7] Rationalizations are not considered in this study because of the looser standards applied, the probable inclusion of non-technical subjects, and the constraints imposed by our data base, but they must be acknowledged in any general investigation of Soviet technological advance.

B. The Organization Network Supporting Invention

As an important contributor to technological advance, Soviet inventing is ultimately the responsibility of the State Committee for

[4] About 35 percent of the invention applications filed are granted and only 25 percent of these are implemented, while almost 89 percent of submitted rationalization proposals are accepted and 85 percent of these are used. Authors' calculations from Ye. I. Artemyev and L. G. Kravets, Izobreteniya-Uroven' tekhniki-Upravleniye, (Moscow: "Ekonomika," 1977), pp. 47–50 and Narodnoe Khozyaistvo SSSR v 1974 g.. p. 149.

[5] The significant difference in the technical level of inventions and rationalization proproposals is often mentioned by Soviets. One Soviet official wrote:

"(T)he heads of many ministries and important enterprises . . . introduce thousands of petty rationalization proposals whose development and implementation require almost no care from the manager, and no preparatory labor and material expenses from the enterprise."

F. T. Ananev, "Ulushchit' razrabotku: vnedreniye izobretenii," Izobretatel'stvo v SSSR, 1956, No. 2, August, 6.

[6] Artemyev and Kravets, op. cit., pp. 49–50.

[7] Ibid., p. 50.

Science and Technology (GKNT), the organization which oversees the development and implementation of Soviet science and technology policy. Inasmuch as inventions are nominally required to be economically useful, the State Planning Committee (*Gosplan*) is involved particularly in planning and administering the introduction of inventions in the national economy.

Operationally, however, Soviet inventing activity is directly overseen by the State Committee for Inventions and Discoveries (*Goskomizobreteniy*). Similar centralized invention agencies have managed inventing in the Soviet Union since the early 1920s. While all of these State Committees (of the Council of Ministers) are nominally equivalent in rank, the GKNT and Gosplan together exercise general supervision over all research, development, and innovation activity. However, the budget and scope of activities of the present State Committee for Inventions and Discoveries—dwarfing those of its predecessors—and its elevation in status from Committee to State Committee in 1973, underscores the importance now accorded to technical innovation by Soviet policy makers.

The State Committee for Inventions and Discoveries maintains the Soviet patent office, and it develops and applies standards for certifying inventions and rationalization proposals. The Committee provides a myriad of support services to ministries, institutes, and enterprises, and exercises some actual authority (by way of plan formulation and monitoring) over industrial invention and innovation. In particular, the Committee, with the Committee on Wages, manages the system established to award bonuses to innovators on the basis of the economic effectiveness of their developments.

Finally, what for our purposes is one of its most important functions, the Committee manages the collection, publication, and dissemination of information on inventions, both when first certified and when implemented. In 1962, the Central Scientific Research Institute of Patent-Technical Information (TsNIIPI) was established subordinate to the Committee. One of TsNIIPI's most important duties was the processing and distribution of Soviet and foreign patent information. This information has become a vital tool for the management of innovation policies by other state agencies. For example, the State Committee for Science and Technology makes extensive use of TsNIIPI data in technological forecasting and in the process of central R&D planning. Gosplan and the individual industrial ministries also draw heavily on TsNIIPI data for their R&D planning and estimations of technical levels. The Soviet Bureau of Standards (Gosstandardt) makes use of patent information in establishing many nationwide technical standards. Thus, TsNIIPI's patent information provides a convenient technical yardstick against which domestic developments can be measured and an important platform from which new foreign technical trends can be spotted.

Two of its publications are of particular interest—the Soviet patent journal (*Ofitsial'nyi Byulleten': Otkrytiya, Izobreteniya, Promyshlennye obratsy i Tovarnye znaki*) and the Soviet journal Introduced Inventions (*Vnedrennye izobreteniye*). Abstracts of all inventions when certified are to be published in the patent journal. Typically,

publication takes place approximately 2 years following the filing of an application. If the invention is subsequently implemented, notification of such implementation is published in the second journal (see Section III.B).

Finally, at the policy level, the State Committee interacts with the central patent departments of industrial ministries, the Ministry of Higher and Specialized Secondary Education, and the academies of sciences; and, at the operational level, with patent organizations in their subordinate research and production establishments. In most industrial ministries, invention and accompanying patent services are managed in the technical main administrations (*glavnye tekhnicheskiye upravleniye*). Most research institutes, design bureaus, production associations, and enterprises maintain a Bureau of Rationalizations and Inventions, known by the acronym BRIZ.

C. Process for Granting an Inventor's Certificate

When an employee creates a new invention,[8] the invention bureau (BRIZ) of the empoyee's place of work is notified. The BRIZ patent specialists make a preliminary search of the available patent and technical literature to ascertain whether the proposed invention is in fact new. If the BRIZ search uncovers no materials vitiating the proposed invention's novelty and if the proposed invention does not contradict other rules of patentability, the BRIZ specialists draft the specifications for the inventor's certificate. The drafted application is then filed at the State Committee's examination institute (VNIIGPE).

As soon as an application is received in the State Committee, it is dated and checked for compliance with the Committee's formal requirements—proper number of forms, necessary signatures, an object not obviously unpatentable, etc. If the application is in the correct form, one copy is sent to the appropriate patent examiner and another copy is sent to a relevant industrial organization. During the examination of the application, there may be considerable correspondence between the examiner and the inventor(s) on the exact nature of the claims being made. If the examiner finally considers the invention to be patentable and if the industrial organization has not successfully challenged the usefulness or novelty of the invention, the inventors are granted an inventor's certificate. Once granted, the invention is assigned a number from the state register for inventions and published in the official bulletin of the State Committee.

D. Comparability With Western Concepts and Procedures

The present Soviet Statute on Inventions has deep roots in German [9] and early Russian law.[10] Consequently, most Soviet legal concepts and procedures are quite similar to those found in Western patent laws.

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[8] Approximately 93 percent of Soviet inventors' certificates are granted to individuals connected with state organizations, rather than to independent inventors. Ye. I. Artemyev and L. G. Kravets, p. 47. Thus, the process described refers exclusively to inventions created within state organizations.

[9] John A. Martens, "The Development of the Soviet Law on Inventions, 1919–1959," unpublished Ph. D. dissertation, University of Notre Dame, August 1977, p. 71.

[10] Hiance, Martine and Plasseraud, Yves, "La Protection des Invention en Union soviétique et dans les républiques Populaires d'Europe," (Paris: Libraires Techniques, 1969), p. 50.

On the basic issue—standards for patentability—Soviet criteria are common to Western laws. While the actual application of the legal criteria—for example, how strictly do Soviet examiners interpret novelty—is difficult to assess, many Western patent attorneys consider Soviet standards to be rigorous.[11]

Especially important for our purposes is the fact that Soviet law requires that applications for inventors' certificates disclose an invention to such a degree as to demonstrate its workability. Of further importance is the Soviet practice of giving the rights of inventorship to the person(s) who first file for protection and not necessarily to those who first invent. Patent lawyers refer to this regulation as a first to file system, and it is identical to the system of West Germany and most other countries. Both of these practices imply that our data and lead times (see Section V) are likely to approximate well the period of development and engineering associated with implementation, and they facilitate comparisons between Soviet and certain Western performance (see Section V.B(2)).

E. Invention and Technological Progress in the Soviet Economy

The implementation of individual certified inventions—or innovation—is clearly but one of many contributors to technological progress in the Soviet Union. Significant innovation also occurs in large projects which involve combinations of patented inventions and other technical and managerial developments not officially recognized. The implementation of rationalization proposals makes, as noted, an important contribution, and there clearly are a host of engineering developments, often associated with major construction or reconstruction of industrial plant, that are either not patentable or not patented. Finally, as has often been noted, subsequent diffusion of technical advances throughout Soviet industry will have a substantially greater quantitative impact than implementation at the first facility.

Having acknowledged these alternative sources of technological advances, we believe, first that implementation of inventions is likely to account for an important and growing share of overall Soviet technical advance; and second, that the object of our analysis—Soviet performance in implementing inventions at the first facility (innovation)—can serve as a good proxy for performance in diffusing inventions throughout industry.

In early years of Soviet industrialization, much technology with great impact on industrial productivity was imported. Further, with the preeminence of ambitious production targets, filing for inventor's certificates on relatively minor developments might have been considered by certain planners and managers as a bureaucratic "afterthought", and in failing to file, they incurred no economic penalties.[12]

Continued dependence on imported technology institutionalizes a technological lag. Soviet progress in reducing technological lags in

[11] For some comments of Western attorneys on Soviet practice see, John A. Martens, "Patenting in Communist Countries: The Experience of Some U.S. Companies," Journal of the Patent Office Society, 1978, April, pp. 248–260.
[12] See Martens, op. cit. (dissertation), pp. 273–301.

certain areas [12a] and Soviet desire to equal or exceed Western capabilities argue that the Soviet leadership would have a greater stake in a viable inventions program. Soviet actions bear this out. The Committee for Inventions and Discoveries was elevated in status to a State Committee in 1973, and its budget, staffing, and number of publications have increased at such a dramatic rate that it now can effectively monitor and enforce compliance of standards and procedures that it and its predecessor organizations have been formally accorded since the 1920s. Soviet planning authorities have elevated the importance of new technology plans (including inventions targets) in overall institute and enterprise plans, and measures have been instituted to tie meaningful financial bonuses to economically effective inventions, with precautions taken to ensure that the inventors themselves receive the bulk of the rewards. Finally, strong Soviet interest in foreign licensing of its technology, which surfaced in the 1960s, virtually requires procurement of inventor's certificates—i.e., filing for an inventor's certificate is the first step in patenting abroad. To this end, in 1965 the Soviet Union joined the Paris Convention for the Protection of Industrial Property. Recently, there has even been discussion of developing a viable domestic licensing market. For all these reasons, the Soviet research director and industrial manager have a rising stake in securing the protection afforded by the inventor's certificate, while the supporting state bureaucracy has grown to accommodate the program.

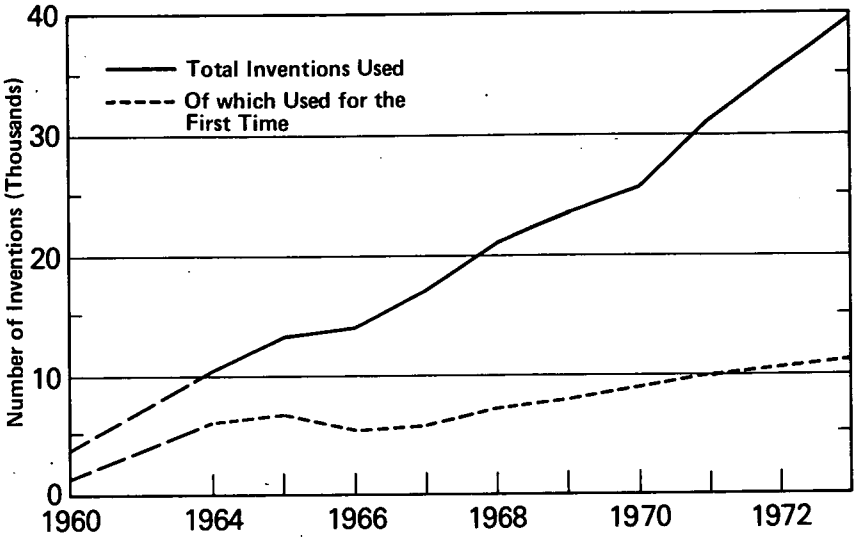
This is not to argue that the Soviet inventions program is an unqualified success. Yet, Soviet data reveal that the number of inventor's certificates granted has been increasing at a high rate—higher than the rates of increase in spending on R. & D. (In 1965 slightly over 10,000 inventor's certificates were granted; in 1974, well over 40,000.) Moreover, while inventions make up less than 1 percent of total introduced innovations, they account for a significantly greater share (11 percent) of the economic savings attributable to inventions and rationalizations.[13] The increased "inventions consciousness" of managers also seems to be reflected in the strong growth in the subsequent diffusion of inventions. (See figure 1.) Finally, the Soviet invention system has received increasing recognition from foreign firms. Foreign patent applications, mostly from the West, have risen from 1,250 in 1965 to 5,858 in 1974.

[12a] For an excellent discussion of this topic, see R. Amann, J. M. Cooper and R. W. Davies, The Technological Level of Soviet Industry, New Haven: Yale University Press, 1977.

[13] Artemyev and Kravets, op. cit., p. 49.

Figure 1

Inventions Used in the U.S.S.R.
(Total and used for the first time)



Sources: 1960 in Maksaryev, Yu. E., "Po leninskomu puty," *Voprosy izobretatel'stva*, 1969, No. 6, 20 and 1964-1973 in Artemyev, Ye. I. and Kravets, L. G., *Izobreteniya—Uroven' tekhniki—Upravleniye*, Second revised edition, (Moscow: "Ekonomika," 1977), p. 49.

In sum, we believe that a strong case can be made that the inventor's certificate today is less likely to be viewed as an afterthought. Further, because the past decade's increase in the proportion of inventor's certificates coming from State organizations [14] indicates the development of a "patent consciousness" within the Soviet R. & D. establishment and because the opportunities for wholesale Soviet borrowing are becoming increasingly limited, we believe that first implementation and subsequent diffusion of Soviet inventions are likely to account for a growing share of technological progress.[15]

While our sample of implemented inventions covers only implementation at the first facility, there is reason to believe that the revealed patterns of implementation, including lead time, can provide useful insights into implementation of all new technology. The supporting organizational infrastructure and most policies that move new technology are not unique to first implemented inventions. If anything, we may be focusing on a subject of Soviet innovation where performance is relatively good. Innovative activities not recognized and rewarded by formal programs, such as certain process engineering developments, may be given particularly inadequate attention by Soviet managers. Management of complex programs not accorded high priority also is alleged to be another Soviet weakness.

[14] In 1965, 29 percent of inventor's certificates granted came from state organizations; in 1974, 93 percent. Ibid., p. 47.

[15] For a very important Soviet decree on the importance now accorded the management inventory see "O dal'neishem razvitii izobretatel'skogo dela v strane, uluchshenii ispol'zolaniya v narodnom khozaistve otkrytii, izobretenii ratsionalizatorskikh predizohenii i povyshenii ikh roli v uskorenii auchno-teknichesrogo progressa." Postanovieniye Tsentral'nogo Komiteta KPSS i Sovyeta Ministrov SSSR No. 575 of Aug. 20, 1973.

Overall, however, we believe our findings on the impact of technical, organizational, and administrative factors on lead time will be relevant to general analyses of Soviet implementation of technology.

III. Soviet Data on Inventions

A. The Use of Invention Data

Researchers have long sought to use patent statistics as measures of technical change and inventive activity, or to correlate patent statistics with such general economic phenomena as productivity and growth.[16] These past studies are careful to point out, however, that there are many pitfalls and limitations associated with patent data.

One of the most obvious weaknesses of patent statistics is their inability to reflect the wide variation in the level of sophistication among patented inventions. Other difficulties come from sources as disparate as technological breakthroughs (causing grants to mushroom disproportionately to R. & D. investments), interindustry differences in the propensity to patent, and changes in judicial philosophies (a reluctance of the courts to uphold patent rights would tend to discourage filing).

While some of the above problems certainly apply to the Soviet data used in the present study—especially the effects of technological revolutions and changes in the propensity to file—an important difference should be noted. The patent statistics customarily used by social scientists are gathered from a population of all granted patents. No distinction is usually made between grants which were actually implemented and those never used. The Soviet data in our study, however, represent a subset of all granted "patents", viz. inventions which were actually put to use in the Soviet economy. This subset is probably less influenced by some of the above mentioned quirks of patent law and clearly permits us to focus on the economic factors in the innovation process itself. For example, it is reasonable to assume that many of the basically insignificant or parallel inventions commonly found in the population of all grants in any country are excluded from this study's data base, for usage implies a favorable on-site economic or technical evaluation that goes beyond formal legal criteria. Further, the problem of the disproportionate number of grants surrounding single technological breakthroughs creates less of a distortion when looking at inventions used, for only those grants which reflected truly economical potential—not those filed primarily to stake out technical areas—would appear in the subset.

Consequently, the data used in our study provide an unusually favorable framework for addressing a multitude of technical and economic questions on innovation in the Soviet economy.

B. Sources of Soviet Data on Inventions

There are two main sources of data on Soviet inventions. The first is the official journal (*Ofitsial'ny Byulleten'*), which announces all

[16] See, for example, Richard R. Nelson, "The Economics of Invention: A Survey of the Literature," The Journal of Business Volume XXXII (1959), No. 2, pp. 101–127 and The Rate and Direction of Inventive Activity: Economic and Social Factors, A Report of the National Bureau of Economic Research, New York, (Princeton: Princeton University Press), 1962.

newly granted inventor's certificates, and patents. The official journal has been published—under various titles—since 1924 and corresponds to the official publications of Western patent offices. The second source *Vnedrennye izobreteniya* (*Introduced Inventions*) has no counterpart in the West and fulfills a need peculiar to a socialist economic system.

Although this second journal was first published in 1968, the fundamental ideas behind its publication were formulated early in Soviet history. During the NEP period of the 1920s, the Soviet state established formal procedures for the dissemination of important technical developments among industrial branches. Later, under the first five year plan, these procedures became centralized through a central card file for socialist exchange (*Kartoteka "SO"*). Upon implementing a suggestion of significant economic or technical importance, factories were to make the suggestions readily available to other factories by describing it on a centrally stored file card.[17] The journal *Vnedrennye izobreteniya*, a modern equivalent of the Kartoteka "SO", lists information on Soviet inventions which are implemented or introduced into the economy for the first time.

IV. Patterns of Soviet Inventing and Implementation

As the basis for our analysis, we have taken a random sample of 1619 implemented inventions from four issues (published between 1974 and 1977) of the journal *Vnedrennye izobreteniya* (*Introduced Inventions*). We estimate that our sample includes approximately 3–5 percent of the total number of inventions implemented for the first time during the period covered by our data (1967–1975). In addition to listing the title and authors of each implemented invention, data is provided relating to its chronology, technology, and supporting organizational network. Specifically, the information permits us to construct a measure of lead time, to classify inventions by technical area, and in most cases to classify inventions by the industrial sector, facility type, and geographic location of the originating and implementing facility. In this section, we define our measure of lead time and describe our sample along the above dimensions.

A. The Measure of Lead Time

While the information listed in the journal varies in its completeness, the two data elements of central importance to our study—the filing date for an inventor's certificate and the use date for an invention—were almost always provided. We define lead time as the elapsed time from the filing date to the use date.

The filing date is considered the day on which the State Committee for Invention receives the proper forms disclosing the invention. Since this date protects the inventor from any subsequent filings of identical inventions in the U.S.S.R. by others and establishes a one-year period of similar protection in foreign countries that belong to the Paris Convention, inventors and their institutes are under considerable pressure to file for an inventor's certificate at the earliest date

[17] A. Smirnov and A. Zapol'skii, Izobretatel'stvo v SSSR i za granitsei, (Moscow: ONTI Izdatel'stvo NKTP, 1934), p. 31. See also Martens, op. cit. (dissertation), pp. 260–268.

possible. For these reasons, the filing data probably closely approximates the moment when researchers are reasonably sure of the technical orginality and potential usefulness of their research. In addition, the disclosure requirement mentioned above ensures that the filing date corresponds to a time when the invention is actually developed enough to be workable.

Soviet legislators have carefully established legal criteria to define the concept of introduction or implementation, since fixing the date of introduction or use directly affects inventors' rewards and partially affects the evaluation of enterprise innovation performance.

An invention is considered used: (1) "if a method, when it began to be used in the production process"; (2) "if a device or substance, when it began to be applied in the manufacture of products or in the use of existing products including experimental models brought into operation"; (3) when it is recognized as fit for industrial manufacture prior to the conclusion of experimentation and is transferred into manufacture; (4) when previously prepared and tested and then included in an experimental model (batch, series) or method (technology); (5) when previously prepared and tested and then used in testing another proposal; or (6) when applied to improving the production and testing of experimental models. An invention is not considered used: (1) during its trials; (2) during the manufacture or testing of an experimental model; (3) during the preparation of production; or (4) if only included in the standards, standard designs and other documentation.[18]

This legal definition of use corresponds most closely to Soviet use of the term *vnedreniye* (introduction) in common parlance.[19] Use or introduction, however, is not synonymous with assimilation (osvoyeniye), and the commonly cited assimilation period does not correspond with our measure of lead time. A new product or process is not considered fully assimilated until rated design and engineering parameters (unit cost, quality criteria, etc.) have been attained in the manufacturing facility, a stage that is typically not reached until several years *after* introduction.

In addition to providing well-defined legal criteria on introduction, the Soviets have also established an elaborate computerized system for monitoring the use of inventions in the economy. This system was developed in the early 1960's and includes a series of standardized forms issued by the Central Statistical Administration for data collection.[20] Consequently, the Soviet data on introduced inventions undoubtedly possess a remarkable degree of homogeneity.

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[18] See article 91 of the 1973 Statute on Inventions and points 4 and 5 of "Instruktsiya o poryadke vyplaty voznagrazhdeniya za otkrytiya, izobreteniya i ratsionalizatorskiye predlozheniye of Jan. 15, 1974" in Voprosy izobretatel'stva, 1974, No. 6, 52–58.

[19] An equivalent term is "use" (ispol'zovaniye). See I. E. Mamiofa, Osnovy izobretatel'skogo prava (Leningrad :Lenizdat, 1976) p. 58. On some of the conceptual difficulties surrounding the term vnedreniye, see John A. Martens, "Disputes Over Inventors' Rewards in Soviet Law—An Analogy to Infringement," International Review of Industrial Property and Copyright Law, vol. 8 (1977), No. 4, pp. 314–320.

[20] For the questionnaires used by the Soviets see "Instruktsiya o poryadke sostavleniya otcheta o postuplenii i vnedrvenii izobretenii i ratsionalizatorskikh predlozhenii po forme No. 4–NT: Utverzhdena TsSU SSSR on 11 July 1975," in Normativnye akty: Prinyate v period s 1 Yanvarya po 31 Dekabrya 1975g., (Moscow: TsNIIPI, 1978), pp. 67–86. See also "Razyasneniye o poryadke sostavleniya perechnya ispol'zovannykh v proizvodstve izobretenii po forme No. 4–NT (perechen') ot Oct. 30, 1975 g. No. 3," in ibid., pp. 273–286.

B. Technologies

Every invention is classified by the Soviets according to the second edition of the International Patent Classification. On this basis, we were able to assign technical areas to each invention in our sample. Furthermore, many of the sampled inventions contained information of sufficient detail on the using facility to allow their assignment to a specific Soviet industrial sector. These two sets of information were combined in table 1.

TABLE 1.—INDUSTRIAL IMPLEMENTATION OF SAMPLED SOVIET INVENTIONS

[By technical area]

Sector where used	Technical area									
	Instrumentation (materials testing; measurement and control)	Computers and related equipment	Radio-electronics	Electrical engineering and machinery	Scientific instruments (physical and chemical property evaluation)	Metalworking	Nonferrous metallurgy	Ferrous metallurgy	Chemistry	Transportation equipment
Educational and scientific[1]	16	11	7	4	11	3	3	2	8	0
Civilian machine building	49	31	14	53	2	98	11	18	8	30
Defense industrial	37	28	59	28	13	57	7	3	8	6
Other civilian heavy	13	5	8	21	6	17	7	20	47	17
Light industry	1	1	2	7	2	7	1	0	11	4
Transportation	10	11	1	22	2	27	5	1	6	50
Power generation and transmission	6	6	6	18	1	4	0	0	0	1
Construction	3	0	2	3	0	6	0	0	0	10
Other	19	8	6	11	18	17	2	2	12	7
Unknown	7	4	4	7	0	9	2	2	2	2
Total	161	105	109	174	55	245	38	48	102	127
Percent	9.9	6.5	6.7	10.7	3.4	15.1	2.3	3.0	6.3	7.8

See footnote at end of table.

TABLE 1.—INDUSTRIAL IMPLEMENTATION OF SAMPLED SOVIET INVENTIONS—Continued

[By technical area]

	Technical area									
	Power generation	Construction	Mining and drilling	Glass and ceramics; paper and pulp; timber and woodworking	Domestic goods; textiles and publishing	Food processing and handling	Medical equipment and preparations	Agriculture	Total	Percent
Educational and scientific [1]	1	1	1	4	1	3	0	1	77	4.8
Civilian machine building	31	14	3	15	16	13	0	8	414	25.6
Defense industrial	8	1	0	7	4	1	5	0	272	16.8
Other civilian heavy	4	12	17	26	1	3	0	0	224	13.8
Light industry	4	2	1	6	27	42	4	3	125	7.7
Transportation	2	14	1	11	5	2	1	3	174	10.7
Power generation and transmission	8	2	0	3	1	0	0	0	56	3.5
Construction	0	26	0	7	1	0	0	1	59	3.6
Other	0	11	3	4	9	3	20	20	172	10.6
Unknown	1	0	0	4	0	2	0	0	46	2.8
Total	59	83	26	87	65	69	30	36	1,619	
Percent	3.6	5.1	1.6	5.4	4.0	4.3	1.9	2.2		100.0

[1] Academy of Sciences and MinVUZy.

Source: Authors' sample from the journal Vnedrennye izobreteniya.

On the whole, technologies line up with expected users. For example, the use of chemical inventions is concentrated in the Other Heavy sector, which includes the Soviet chemical industry; use of metalworking inventions is concentrated in the "civilian machine building" and "defense industrial" sectors; and domestic goods and food processing inventions are used in "light industry".

Several other important relationships also emerge from table 1. First, the technical areas of the inventions used by the Educational and Scientific Sector closely parallel the technical areas of the inventions used in the three heavy industry sectors. This pattern lends credence to the view that the Educational and Scientific sector is much more oriented toward the producer goods industries (sector A) than toward the light industries (sector B). Second, both the defense industrial and construction sectors show a greater degree of technical specialization than do the other sectors. Six technical areas account for slightly more than 58 percent of all inventions used by the defense industrial sector and the three construction related technical areas account for almost 75 percent of inventions used in the construction sectors. In comparison to the defense industrial sector, the other two heavy industrial sectors (Machine Building and Other Heavy) are much more broadly based.

C. Sectors

Since in many cases both an originator and a user of an invention are identified, we were able to assign facilities to economic sectors. Table 2 summarizes the intersectoral movement of Soviet inventions. (Information on originating sectors was, unfortunately, often missing. Of the 1619 sampled inventions, 790 had no information on the originating sector. Information on using sectors was far more complete, with only 46 sampled inventions without using sector information.)

The number of inventions remaining within a sector—almost 75 percent of the sampled inventions for which originators and users were identified—emerges as the most striking feature of this table. In addition, several sectors stand out as being predominately net suppliers of inventions to other sectors (Educational and Scientific) or net users of inventions from other sectors (Transportation).

D. Facilities

Information on the type of facility which created an invention was available for slightly over half of the inventions sampled. Information on the type of facility implementing an invention was more complete, available for somewhat over two-thirds of the inventions sampled. The data on interfacility movement is presented in table 3.

TABLE 2.—INTERSECTORAL MOVEMENT OF SOVIET INVENTIONS

Originator	User											
	Educational and scientific	Civilian machine building	Defense industrial	Other civilian heavy	Light industry	Transportation	Power generation and transmission	Construction	Other	Unknown	Total	Percent
Educational and scientific	57	14	5	11	5	10	4	2	7	15	130	8.0
Civilian machine building	0	189	4	19	7	15	3	2	13	11	263	16.2
Defense industrial	0	0	1	0	0	0	0	0	0	1	2	.1
Other civilian heavy	1	8	1	81	2	10	2	0	5	4	114	7.0
Light industry	0	2	0	0	41	3	1	1	6	0	54	3.3
Transportation	0	1	0	1	0	47	0	4	3	0	56	3.5
Power generation and transmission	0	3	0	0	2	2	27	1	0	0	35	2.2
Construction	0	3	0	4	0	9	2	27	8	1	54	3.3
Other	0	9	0	10	16	16	5	7	46	12	121	7.5
Unknown	19	85	261	98	52	62	12	15	84	2	790	48.8
Total	77	414	272	224	125	174	56	59	172	46	1,619	
Percent	4.8	25.6	16.8	13.8	7.7	10.7	3.5	3.6	10.6	2.8		99.9

Source: Authors' sample from the journal Vnedrennye izobreteniya.

TABLE 3.—INTERFACILITY MOVEMENT OF SOVIET INVENTIONS

Originator	User											
	Scientific research facilities					Educational facilities						
		Of which—					Of which—					
	Total	Scientific research institute	Project design and technological institute	Project and design bureaus	Production facilities	Total	University	Polytechnical institute and higher technical school	Other (main administration)	Unknown	Total	Percent
Scientific research facilities	110	104	6	5	209	1	1	0	59	99	483	29.8
Of which—												
Scientific research institute	103	103	0	4	177	1	1	0	46	93	424	26.2
Project design and technological institute	7	1	6	1	32	0	0	0	13	6	59	3.6
Project and design bureaus	1	1	0	12	79	0	0	0	11	28	131	8.1
Production facilities	1	1	0	1	139	1	1	0	8	23	173	10.7
Educational facilities	0	0	0	0	10	9	3	6	0	7	26	1.6
Of which—												
University	0	0	0	0	1	3	3	0	0	2	6	0.4
Polytechnical institute and higher technical school	0	0	0	0	9	6	0	6	0	5	20	1.2
Other (main administration)	0	0	0	0	2	0	0	0	9	11	22	1.4
Unknown	46	42	4	8	301	9	1	8	55	365	784	48.4
Total	158	148	10	26	740	20	6	14	142	533	1,619	
Percent	9.8	9.1	0.6	1.6	45.7	1.2	0.4	0.9	8.8	32.9		99.9

Source: Authors' sample from the journal Vnedrennye izobreteniya.

While the table indicates that the solid majority (approximately 75 percent) of implemented inventions for which data on both facilities exists comes from R&D establishments, the almost 25 percent share provided by production facilities is, perhaps, surprising.[21] The relatively minor participation of education facilities (providing about 3 percent of the implemented inventions) and their relative isolation from production facilities (providing only about 2 percent of inventions implemented by production facilities) is striking. This isolation has often been criticized in the Soviet press and is further underscored by the fact that educational facilities are reported to provide more than 10 percent of all Soviet inventions.[22] Also striking is the minor participation of independent design bureaus of various types, which, since they are charged with elaborating and incorporating applied research findings, were expected to figure most significantly in our sample.

E. Locations

While information on facility locations is the most incomplete (only 40 percent of sampled inventions for originators and 65 percent for users), a number of patterns do appear.

Foremost, table 4 on interregional movement depicits a strong tendency for inventions to be created and used in the same republic—over 78 percent of sampled inventions for which location data exist. Although the unusually large concentration of industry in the RSFSR alone might seem to preordain such an outcome, this tendency remains even at the oblast' levels. Secondly, table 4 illustrates the relatively larger contributions made by the major industrial R&D centers—Moscow, Leningrad, and Kiev—in the creation of useful inventions. Interestingly, the Ukraine's proportion of inventions used (19.1) is much larger than its proportion of inventions created (10.7). This might, however, be to some degree a result of having more complete data on the users of inventions.

F. Representatives of the Sample

When organized according to the broadest technical categories of the International Patent Classification, our samples of introduced inventions are representative of the total population of recently granted Soviet inventor's certificates.[23] (See figure 2.)

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[21] E. Zaleski; J. A. Kozlowski; A. Wienert; R. W. Davies; M. J. Berry; and R. Amman, Science Policy in the USSR (Paris: OECD, 1969), pp. 410–413. The inventions originated by production facilities do not appear to be economically insignificant. The average annual economies for these inventions (51,370 rubles) exceed the average economies for the whole sample (34,652 rubles).

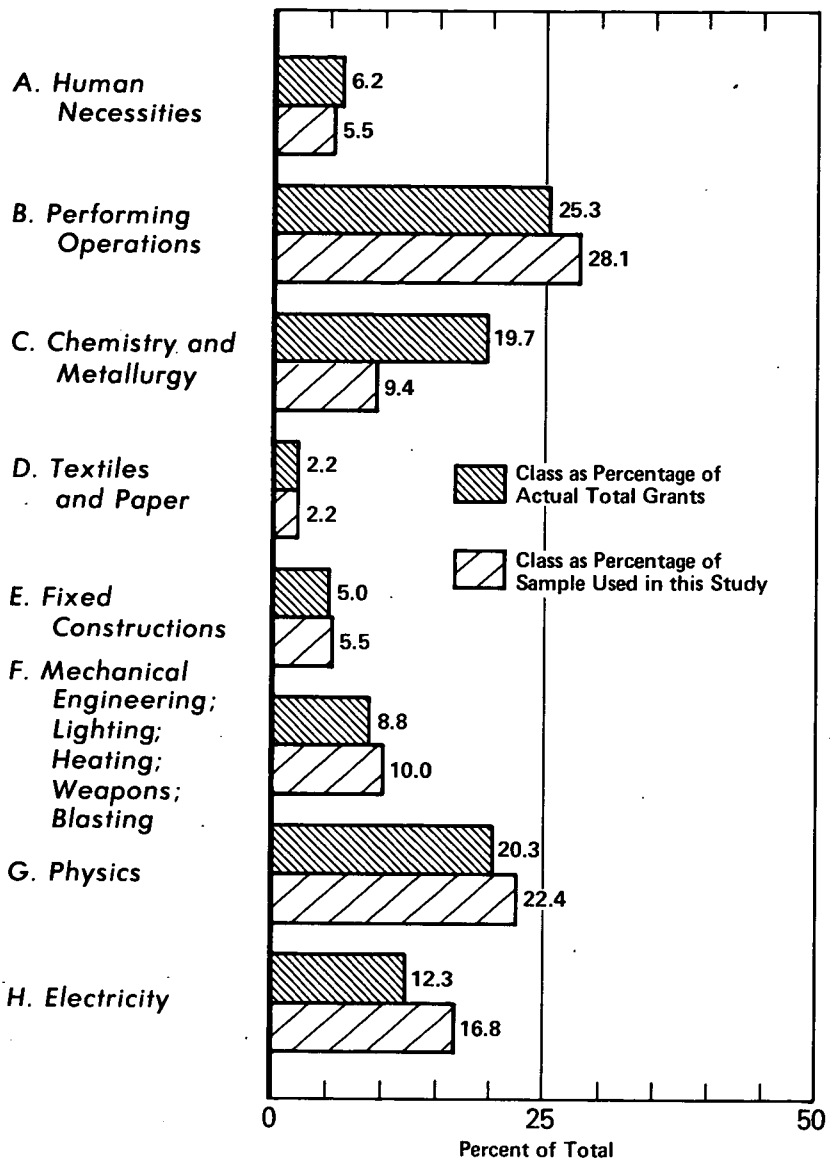
[22] See "Tvorcheskoi deyatel'nosti izobretatelei i ratsionalizatory—vse mernuyu poderzhku," Voprosy izobretatel'stova, 1979. No. 1, p. 6.

[23] Data on total population is from 1967 to 1974. See Artemyev and Kravets, op. cit., p. 48.

Figure 2

Distribution of Soviet Inventors' Certificates by Technical Area

(As specified by the international patent classification)



Source: Percentage of actual total grants from Ye. I. Artemyev and L. G. Kravets, *Izobreteniya—Uroven' tekhniki—Upravleniye*, Second revised edition, (Moscow: "Ekonomika," p. 47; Percentage of sample from authors' sample of inventions in Soviet journal *Vnedrennye izobreteniya*.

TABLE 4.—INTERREGIONAL MOVEMENT OF SOVIET INVENTIONS (Republics and oblasts)

Originator	User																			
	RSFSR				Ukraine and Moldavia							Baltics				Central Asia and Kazakhstan				
	Total	Leningrad	Moscow	Rostov	Total	Dneprpetrovsk	Donetsk	Kiev	Khar'Kov	Moldavia	Belorussia	Total	Lithuania	Latvia	Estonia		Caucasus	Unknown	Total	Percent
RSFSR	224	34	70	12	33	1	7	1	5	0	13	14	7	4	3	11	4	83	382	23.6
of which—																				
Leningrad	34	26	1	1	6	0	0	0	2	0	0	2	1	1	0	2	1	13	58	3.6
Moscow	98	4	67	2	16	0	4	1	3	0	11	7	4	2	1	5	2	43	182	11.2
Rostov	9	0	0	7	1	0	0	0	0	0	0	1	1	0	0	0	0	0	11	.7
Ukraine and Moldavia	15	1	2	3	118	7	14	20	13	9	6	7	5	2	0	2	1	24	173	10.7
of which—																				
Dneprpetrovsk	1	0	1	0	7	6	0	0	0	0	1	1	0	1	0	0	0	1	11	.7
Donetsk	1	0	0	0	9	0	9	0	0	0	0	1	1	0	0	0	0	3	14	.9
Kiev	4	0	0	2	30	0	2	20	0	0	1	0	0	0	0	0	0	13	48	3.0
Khar'Kov	1	0	0	1	18	0	2	0	13	0	0	1	1	0	0	1	0	3	24	1.5
Moldavia	0	0	0	0	9	0	0	0	0	9	1	0	0	0	0	0	0	2	12	.7
Belorussia	0	0	0	0	0	0	0	0	0	0	17	1	1	0	0	0	0	3	21	1.3
Baltics	1	1	0	0	2	0	0	0	0	1	0	24	12	10	2	0	0	3	30	1.9
of which—																				
Lithuania	1	1	0	0	1	0	0	0	0	1	0	13	12	1	0	0	0	0	15	.9
Latvia	0	0	0	0	1	0	0	0	0	0	0	9	0	9	0	0	0	2	12	.7
Estonia	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2	0	0	1	3	.2
Central Asia and Kazakhstan	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	1	13	.8
Caucacus	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	10	2	13	.8
Unknown	253	41	46	15	156	24	29	15	15	5	32	63	30	11	22	23	18	440	985	60.8
Total	496	76	119	30	309	32	50	36	33	15	68	110	56	27	27	47	33	556	1,619	99.9
Percent	30.6	4.7	7.4	1.9	19.1	2.0	3.1	2.2	2.0	0.9	4.2	6.8	3.5	1.7	1.7	2.9	2.0	34.3	99.9	

Source: Authors' sample from journal Vnedrennye izobreteniya.

However, when compared to the total population of introduced inventions for 1966–1967 (see figure 3), our sample reflects one major bias, viz. an underrepresentation of inventions from the defense industrial sector.[23a] The noticeable difference is the sizes of "Unknown" and "Other" categories merely reflects the more detailed information on users provided in the journal *Introduced Inventions* than was provided in the 1967 Soviet study.[24]

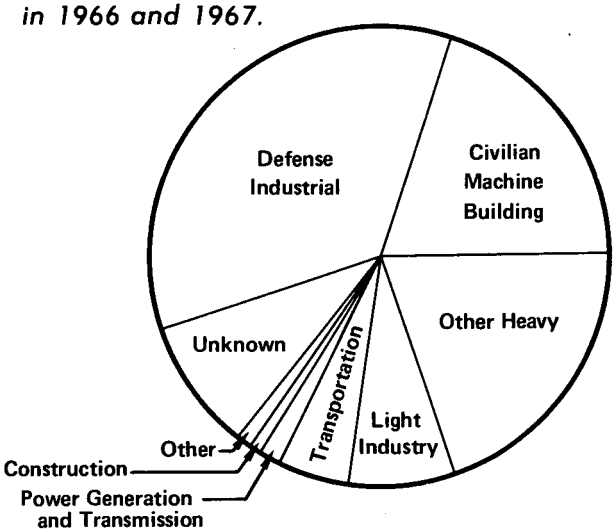
[23a] We believe that our sample of inventions implemented in the defense industrial sector are dual use in nature. We base this belief on the technical description of the invention and on the fact that the journal *Introduced Inventions* is published to disseminate information on potentially useful inventions throughout the Soviet economy.

[24] Tsentral'nyl Sovlyet VOIRa, Sravitel'nye pokazateli po izobretatel'styu i rationalizatsii ministerstv i vedomstry SSSR za 1966–1967 gg. (po dannym statichetnosti forme 4–NT), (Moscow: 1968).

Figure 3

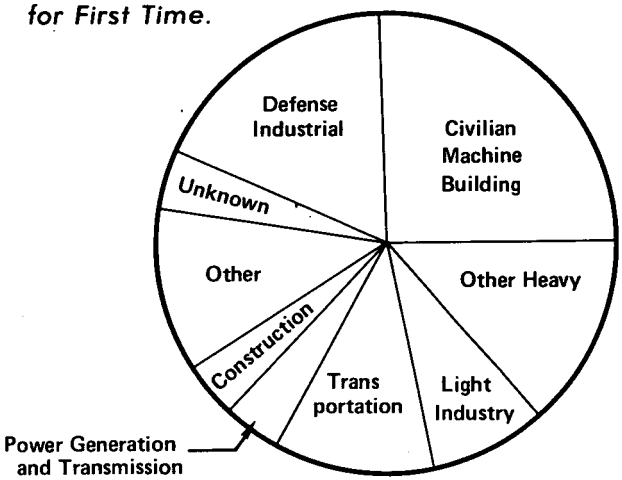
Soviet Inventions Used for the First Time According to Industrial Sector

A. All Inventions Implemented for First Time in 1966 and 1967.



Source: Tsentral'nyi: Sovyet VOIRa, *Sravnitel'nye pokazateli po izobretatel'stuv i ratsionalizatsii ministerstv i vedomstv SSSR za 1966-1967gg. (po dannym statotchetnosti po forme 4-NT).* Moscow: 1968, pp. 7-8.

B. Sample Used in this Study of Inventions Implemented for First Time.



Source: Authors' sample from the journal *Vnedrennye izobreteniya.*

V. Lead Time for the Implementation of Soviet Inventions

The time required to bring new technology on stream is acknowledged to be an important determinant of the rate of technological progress. In a static context, time saved in the implementation of technology permits benefits to be realized that much sooner. More important is the dynamic impact, since technological progress is usually an incremental, reinforcing process. The effect of more rapid implementation of technology is compounded through succeeding generations of technical advance.

We measure lead time as the period from the filing for an inventor's certificate to formal certification by a Soviet facility that the invention has been introduced. Ideally, this measure of lead time would correspond closely for every observation to the underlying period required for implementation of an invention. The period would begin at the point when economic feasibility is accorded a high probability, following the completion of applied research and sufficient developmental work to justify the application for an inventor's certificate,[24a] and the period would encompass the advanced developmental and engineering stages leading to successful introduction or realization.

We recognize that our definition of the lead time period—dictated by the data—is somewhat arbitrary. It is clearly implausible to certify that advanced developmental work begins or introduction takes place on a particular day. Furthermore, because certain individuals (at least the inventor himself) will appreciate the economic and technical significance of the invention at some point prior to filing and may then begin steps to implementation, our use of the filing data as the beginning point may tend to slightly understate actual lead time periods in Soviet industry. However, we believe this bias is minimized by the "first-to-file" pressures of the Soviet patent system, providing that the inventor risks losing his rights by delaying the filing. Furthermore, to the degree that any bias created by our measure is felt equally throughout industry, or to the degree that we are able to make adjustments for the bias when it is not, our estimates will provide reliable indicators of relative lead time performances among technological areas and Soviet industrial sectors.

In the next section we briefly outline theoretical considerations affecting lead time, followed by a series of estimates based on our sample of implemented inventions.

A. Theoretical Considerations

We hypothesize that lead time (LT) required to implement an invention will be a function of the capital, labor, and material inputs (I) applied to the developmental and engineering process. A higher rate of application of inputs may be expected to decrease requisite lead time.

[24a] Our interpretation of the filing date is not totally without precedent in the Soviet technical literature. One recently published work clearly places the application for an inventor's certificate at the end of the stage of applied scientific research work (prikladyne nauchno-issledovatel'skiye raboty), which directly precedes developmental work (opytno-konstrukforskiye raboty). See V. S. Sominskiy, V. I. Kublis and K.G. Fedorov Unravlenive naukoi v khimicheskoi promyshlennosti, Moscow: Izadatel'stov "Khimiya", 1978, p. 40.

More specifically, the productiveness of inputs applied to implementation will be influenced by: (1) the technical features of the innovation; and (2) the effectiveness of the relevant organizations and administrative policies in managing the implementation process. In the former case differences in levels of inputs required to implement two inventions might be attributable to such factors as the technical areas, the proportionate advance in state-of-the-art, and the scale of industrial application. In the latter case, innovation takes place not in a vacuum but in a supporting infrastructure which moves the technology from research to production. In the Soviet Union there is variation in the organizational makeup, administrative policies, access to inputs of economic sectors and, more specifically to industrial ministries. This variation in what amounts to managerial effectiveness could produce different results for the same invention applied in different ministries. In functional notation, lead time for the ith invention (LT_i) will be a function of the rate at which inputs (I_{it}) are applied, the resources required by technical characteristics of the invention (f_i) and the set of (assumed to be applied on a sectoral (s)) conditions that determine the effectiveness of application (g_i^s):

$$LT_i = g_i^s(f_i(I_{it}))$$

where

$$\frac{dLT_i}{dI_{it}} < 0, \frac{d^2LT_i}{dI_{it}^2} > 0$$

Planners may be expected to allocate resources to invention implementation with the objective of maximizing the discounted sum of net economic benefits associated with each invention in the first and subsequent applications. Net economic benefits may be defined as the sum of annual economies and related benefits beginning in the first period following implementation less the costs incurred in effecting implementation. Clearly, the lead times themselves are a function of the pattern of input application. Thus, lead time is, within limits, a variable subject to planner manipulation with optimal lead time a function of the tradeoff between the benefits perceived by planners with successful implementation and of the opportunity cost of the required resource inputs.

For our purposes this simple formulation has two important implications. First, the real test of performance in the introducing facilities and sectors—the productiveness of resources applied to the implementation process—must take into account the "objective" technical features of the invention. Second, the appropriateness of the rate and size of input application can only be judged in relation to the pattern of costs and benefits associated with each invention. Thus, we can estimate relative lead times in technical areas or industrial sectors and we can find that lead time is relatively slow (or fast) by some objective measure or international standard. This could be accounted for by particularly bad (or good) Soviet management and utilization of resources in the implementation process, but we must allow for a alternative explanation—namely, that Soviets chose to devote a different quantity and time distribution of resources to the process. This deci-

sion in turn might reflect bad judgment or real differences in perceptions of costs and benefits. We could find, for example, that lead time in Soviet defense industrial sectors averaged 20 percent less than lead time for similar inventions implemented in civilian industry. We cannot conclude that defense industrial/management is superior, as the 20 percent time savings might have required a doubling in cost. And even if so, it might still have been a proper decision in light of Soviet objectives.

B. Estimates of Lead Time

In this section we first present measures of lead time corresponding to the technical, sectoral, facility type and geographic classifications of our sample. The hypotheses we test do not exhaust the possibilities afforded by the data, but rather are designed to illustrate important lead time differentials in the main dimensions of the sample and to illustrate useful areas of future research.

Our analysis of factors influencing lead time are constrained by two features of the data—one endemic and one which can be partly compensated for by enlarging the sample.

First, the data provide no information on the inputs applied to the implementation process—i.e. we cannot distinguish between "large" and "small" inventions. The implications of this omission for any evaluation of performance were discussed in the previous section. Second, as apparent from the tables in Section IV, not all observations have a complete set of data elements. In some cases this can be compensated for by enlarging the sample. However, in other cases the pattern of missing information is not random, but is correlated with features of our sample (e.g., the defense/civilian dichotomy).

Finally, we compare overall Soviet lead times with lead times measured in other studies for West Germany, the United States and a special U.S. national Aeronautics and Space Administration program.

1. LEAD TIME IN THE SOVIET UNION

a. Lead time by technical area

Table 5 presents average lead time by technical area in ascending order. An F-test on the sample means is significant at the 1 percent level.

Many different factors—for example, differences in the relative complexity of inventions, in the mastery of related skills, in the managerial efficiency of involved organizations or in state priorities can influence average lead times among technologies. The relative impact of these factors on each technical area is difficult to identify, thus making a rigorous interpretation of the rankings presented in table 5 difficult. For example, the relatively fast performance of radioelectronics (ranked third) and "computers" (ranked seventh) corresponds roughly with perceptions of rapidly advancing technologies by world standards. Yet, the relative slow performance of "electrical engineering and machinery," where related ministries have undergone considerable reform, seem only explainable by somewhat tenuous ad hoc

forms of reasoning—such as having relatively more complex inventions or requiring greater inputs for implementations. Similarly, while the slower performances of "domestic goods" and "food processing" squares with commonly held views on Soviet industrial priorities, the top performance of "glass and ceramics; paper and pulp; timber and wood working" requires additional explanation—e.g., a high concentration of petty inventions or inventions which require few resources to implement.

TABLE 5.—ESTIMATES OF LEAD TIME BY TECHNICAL AREA

[In ascending order]

Rank and technical area	Mean lead time (years)	Within class standard deviation
1—Glass and ceramics; paper and pulp timber and woodworking	3.30	2.53
2—Scientific instruments (physical and chemical property evaluation)	3.55	3.07
3—Radioelectronics	3.66	3.12
4—Medical equipment and preparations	3.67	2.86
5—Transportation equipment	3.73	2.45
6—Construction	3.78	2.56
7—Computers and related equipment	3.79	2.40
8—Metalworking	3.90	2.70
9—Ferrous metallurgy	3.92	3.15
10—Power generation	4.01	2.45
11—Domestic goods; textiles and publishing	4.01	2.86
12—Food processing and handling	4.04	3.48
13—Instrumentation (material testing; measurement and control)	4.26	3.49
14—Agriculture	4.26	3.28
15—Mining and drilling	4.47	2.47
16—Electrical engineering and machinery	4.82	3.82
17—Nonferrous metallurgy	4.91	3.94
18—Chemistry	5.35	3.69
Sample average	4.01	

$$F^{17}_{1,601} = 2.745$$

The appearance of chemistry at the very bottom of our list, however, corresponds to frequently heard criticisms of the Soviet chemical industry—including harsh criticism by the Soviet leaders themselves.

b. Lead time by implementing sector

Table 6 presents average lead time by identified implementing sector. An F-test on the sampled means is significant at the 1 percent level.

There is rough correspondence between technical and sectoral rankings (tables 5 and 6 respectively) where sectors are predominant users of a given technology (e.g., transportation, construction, and power generation and transmission technical areas and sectors). There is a striking difference between mean lead times for the defense industrial and civilian machine building sectors. However, the approximately 11.5 percent lower mean lead time in the defense industries is the result of a technical profile more heavily weighted in favor of rapidly technical advancing areas than is the case for civilian machine building as a whole (see tables 1 and 5). After accountng for the technical area of the invention, the lead time difference between the defense industrial and civilian machine building sectors is *not* statistically significant.

TABLE 6.—LEAD TIME BY IMPLEMENTING SECTOR

Rank and sector	Number	Mean lead time (years)	Within class standard deviation
1—Transportation	173	3.27	1.94
2—Defense industrial	260	3.77	3.54
3—Construction	58	3.78	2.83
4—Education and scientific	75	4.02	3.26
5—Light industry	121	4.15	2.88
6—Civilian machine building	387	4.26	3.10
7—Other heavy civilian	216	4.70	3.44
8—Power generation and transmission	52	5.01	4.27
Total sample	1,342	4.09	

$$F^{7}_{1,334} = 4.584$$

c. The impact of facility type—the movement from research to production

A number of Western and Soviet scholars have pointed out difficulties associated with movement of new technology from research or educational to production facilities.[25] On the one hand, research facilities may be expected to have the physical plant, human resources and the time to prepare new technology for eventual introduction. On the other hand, research facilities have been criticized for failing to adapt new technology to the requirements of production facilities and for general lack of interest in the eventual use of their results.

Of all inventions implemented in production facilities, we know that 337 originated in research, design, and educational facilities, and 150 other production facilities (not in-house: associations (*obyedineniye*), enterprises (*predpriatiya*) and plants (*zavody*)).

Average lead times for the inventions implemented in identified production facilities are presented in table 7, with the production facility to production facility flow broken down to account for in-house or same facility implementation.

The means of the relevant sub-samples—research originators (3.92) and organizationally district production facilities—(3.86) are not significantly different. While the sub-samples are small, these results suggest that the type of originating facility does not have a significant impact on lead time.

TABLE 7.—LEAD TIME IN THE MOVEMENT OF INVENTIONS TO PRODUCTION FACILITIES

Originator	Number	Mean lead time	Within class standard deviation
Inventions orginating in research facilities and used in production facilities [1]	337	3.92	2.19
Inventions originating in production facilities and used in production facilities	150	2.97	2.16
Of which originated in-house	101	2.53	1.81
Of which from other production facilities	49	3.86	2.53
Total	487		

[1] Excludes in-house production.

[25] See Berliner, op. cit., pp. 104–108.

d. In-house implementation and adjustment of sectoral results

As implied by the last set of results, whether or not an invention is implemented and introduced in the same facility has a marked impact on lead time. This is plausible for several reasons: (1) Problems of imparting know-how and transferring documentation and materials are minimized; (2) actual recognition of the presence of a patentable invention might occur after implementation had begun; and (3) the incentives to file may be reduced when only in-house use can be envisioned. We have sufficient information to determine whether or not the invention was originated and used in the same facility for 754 of our observations.

Average lead times within this subset are as follows:

	Number	Mean lead time	Within class standard deviation
In-house implementation	240	2.85	1.89
Implementation of inventions orginating out-of-house	514	3.82	2.28
Total	754	3.51	2.21

The difference in means is statisically significant at the 1 percent level.[25a] In-house implementation reduces average lead times by approximately one-third, but this subsample ($\overline{X}$ 3.51) is not representative of the full sample ($\overline{X}$=4.01)

A factor with such a large impact must be accounted for in measurements of lead time along other dimensions. Tests reveal that results for two sectors may be significantly affected after accounting for this factor.

First, virtually all inventions implemented in the scientific and educational sectors are in-house inventions. Therefore, the relevant comparison for lead time in this sector is with in-house implementation in other sectors, as presented in table 8. On this basis, Educational/Scientific lead times are particularly long.

Second, the defense industrial sector is the only sector of our sample for which virtually no information is provided on the originating facility. Thus, we have no indications of which defense industrial inventions were implemented in-house. However, while a particularly high proportion of in-house defense industrial implementation could help explain superior overall defense industrial lead times, we have no basis for assuming that the proportion is significantly different from that for other sectors.

[25a] The evidence of shorter lead-times in the case of in-house implementation suggests why the Soviets are creating scientific production associations (NPO's)—organizations usually incorporating a research institute, design bureau and production facilities—inteneded to reduce the time required for new technology assimilation.

TABLE 8.—TOTAL, SCIENTIFIC-EDUCATIONAL, AND CIVILIAN MACHINE BUILDING LEAD TIMES, TAKING INTO ACCOUNT IN-HOUSE IMPLEMENTATION

Sector	Number	Mean lead time	Within class standard deviation
Total implementations	754	3.51	2.21
1. Of which—			
Originated in-house	240	2.85	1.89
Originated out-of-house	514	3.82	2.28
2. Of which—Implemented in educational/scientific sector[1]	56	3.18	2.01
3. Of which—			
Implemented in civilian machine building sector	217	3.78	2.28
Originated in-house	81	3.18	2.02
Originated out-of-house	136	4.13	2.36

[1] Only 2 inventions originated out-of-house.

e. The impact of location

Several urban areas in the Soviet Union are known to have especially large concentrations of long-established research and developments facilities. Close proximity to R. & D. establishments may be expected to facilitate implementation for a number of reasons, including proximity to the inventions themselves, proximity to supporting technical assistance, and reliance on a large and well-developed infrastructure for supply of skilled labor and special-purpose materials.

To test this hypothesis, we measured average lead time by implementing location, with a subset of inventions defined for those implemented in Moscow, Leningrad, Kiyev and Kharkov oblasts, all oblasts with large R. & D. bases. Results are presented in table 9. The difference in mean lead times between this group of urban centers and other locations is statistically significant at the 1 percent level. While part of the difference is explained by a slightly higher concentration of in-house implementation in urban centers, the difference remains significant after taking this factor into account.

TABLE 9.—LEAD TIME BY IMPLEMENTING LOCATION

Location	Number	Mean lead time	Within class standard deviation
All locations	1,015	4.26	3.17
Of which—			
Moscow, Leningrad, Kiyev, and Kharkov Oblasts	244	3.40	2.52
All other locations	771	4.52	3.31

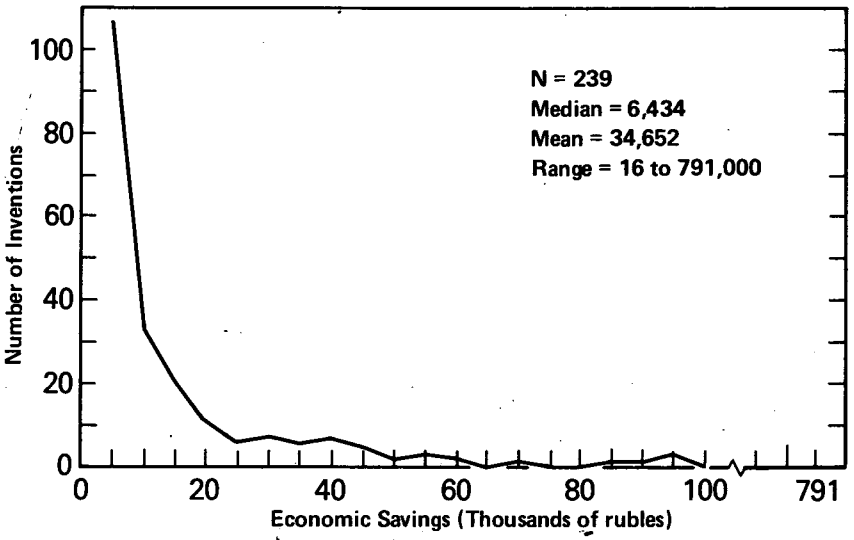
f. Economic effectiveness of the invention

Calculations of economic effectiveness are provided for 239 of our observations.[25b] The distribution of these observations is presented in figure 4.

[25b] Economic effectiveness is an expression representing the annual cost savings expected or realized from a new advance in relation to the process it is replacing. The net unit current and pro-rated capital cost savings are multiplied by annual output to arrive at the sum of annual economies.

Figure 4

The Distribution of Economic Savings for Inventions Sampled in this Study*



*23 inventions had economic savings greater than 100,000 rubles and are not represented on this graph.

Source: Authors' sample from *Vnedrennye izobreteniya.*

The number of observations is too few to be representative of the entire sample, especially since missing calculations are not randomly distributed. With this caveat, we have performed a simple linear regression of lead time (in days) on economic effectiveness (in rubles). The coefficient on effectiveness has a value of −.001, not significantly different from 0.

However, as indicated in the first part of this section, we cannot assess whether economic effectiveness should be correlated positively or negatively with lead time without information on the technical requirements and cost of implementation. To the extent that increase in economies is likely to be associated with increase in the "size" or cost of the invention, we might expect a positive correlation between lead time and effectiveness. This hypothesized relationship is not borne out, possibly because (apart from the expected weak correlation) the higher effectiveness of "larger" inventions can more than compensate for higher costs associated with rapid implementation, yielding roughly equivalent lead time as smaller inventions.

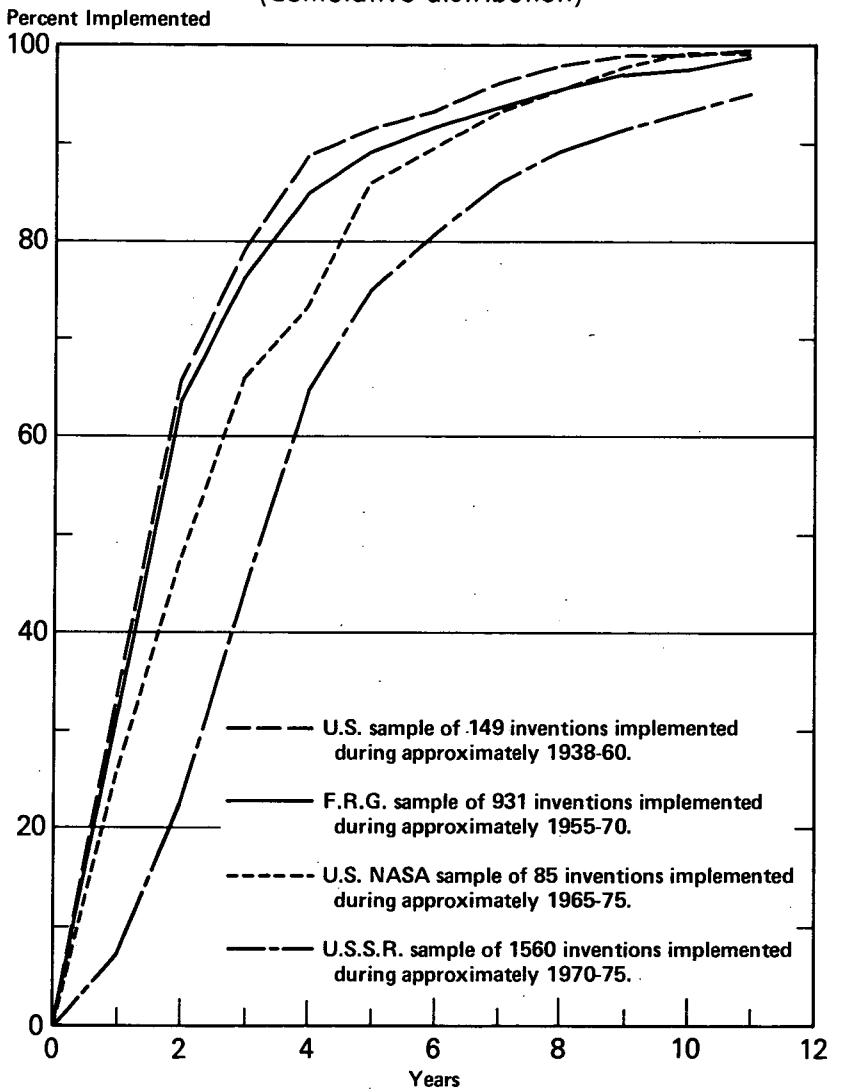
2. COMPARISON OF SOVIET AND WESTERN LEAD TIME

Our definition of lead time—which uses features of patent law common to many countries—provides an unusual opportunity to compare the technical innovation performance of several countries. In fact, some Western studies on the use of patented inventions permit, with varying degrees of qualification, just such comparisons.

Figure 5

Lead Time for the Implementation of Inventions—U.S., F.R.G., U.S. NASA, and U.S.S.R.

(Cumulative distribution)



Source: U.S. data from Barkev S. Sanders, "Speedy Entry of Patented Inventions into Commercial Use," *The Patent, Trademark and Copyright Journal of Research and Education*, Volume 6 (1962), No. 1, p. 95; FRG data from Klaus Grefermann, et. al. *Patentwesen und technischer Fortschritt, Teil I Die Wirkung des Patentwesens im Innovationsprozess,* (Goettingen: Verlag Otto Schwarz, 1974), Tabelle 62-65; NASA data collected by authors from NASA patent waiver records; and USSR data from authors' sample of inventions in journal *Vnedrennye izobreteniya.*

Figure 5 presents cumulative implementation of inventions for the Soviet Union (based on our sample), the Federal Republic of Germany, the U.S., and the U.S. National Aeronautics and Space Administration, (based on results of other studies). The curves indicate the percent of inventions implemented (y-axis) in any given number of years (x-axis). We now describe the basis and findings of each of the other studies.

a. West German lead time

There are many similarities between West German and Soviet patent law. For example, the requirements for drafting claims and for patentability are quite similar. While such considerations are important for comparisons of patent usage, most important for a comparison of lead time is the fact that both laws give the rights to an invention to the first person filing a valid application. This similarity ensures that many of the same pressures for early filing exist in both the Soviet Union and West Germany. Consequently, there are reasonable grounds for assuming that Soviet and West German filing dates are comparable, implying that corresponding measures of lead time are likely to capture similar underlying innovation activities.

Since Western countries have no central monitoring system for the implementation of inventions, Western implementation data must come from questionnaires connected to special studies. Of prime importance, for our purposes, is that the implementation data in such questionnaires be defined clearly enough to ensure comparability to Soviet data. Fortunately, we were able to find a detailed study of the West German patent system which provided implementation data that are quite comparable to the Soviet data.[26]

There are, nevertheless, two important differences in the West German data which directly affect the lead time period. First, West German lead times are calculated from the time of invention—not patent filing—to realization (wirtschaftliche Benutzung). Since the study notes, however, that filing quickly follows invention (one year or less 62 percent; 1 to 2 years 29 percent; 2 to 3 years, 3 percent),[27] this difference would probably cause only a small shift in the German distribution—thus making Soviet performance even less favorable by comparison. Second, some respondents interpreted realization to mean licensing (72 of the 931 West German inventions were licensed).[28] Since the license date could easily precede actual use, this difference would tend to put West German performance in a favorable light. In general, however, the West German and Soviet concepts of implementation are very similar, for both infer the start of serial production and not just the creation of a prototype or working model.

b. U.S. lead time

The U.S. patent system is not a first to file system, but a first to invent system—according an inventor some rights even before filing. Thus, it is questionable whether the U.S. filing date can be used as a

[26] A. Grefermann, Karl Heinrich Oppenlaender, Elfried Peffgen, Karl Ch. Roethlingsholfer, and Lothar Scholz, Patentwesen and Technischer Fortschritt Teil I: Die Wirkung des Patentwesens in Innovations prozess, (Goettingen: Verlag Otto Schwarz and Co., 1974).
[27] See ibid., table 32.
[28] Ibid., tables 60–65.

starting point for lead times or is conceptually similar enough to be compared to the filing dates of first to file countries. In other words, lead times calculated on the basis of U.S. filing dates would be inherently shorter than the lead times of first to file countries. Nevertheless, for the sake of completeness, we have included on figure 5 the results of a study on U.S. patent usage.[29]

c. U.S. NASA lead time

Although comparisons of U.S. and Soviet lead times are severely hampered by the differences in legal systems mentioned above, a NASA program on patent waivers offers an unusual opportunity to calculate some more comparable U.S. lead times. Specifically, private contractors working on NASA funded research projects may apply for the patent rights to inventions considered to have potential commercial value.[30]

The granted petition for the patent rights is termed a patent waiver. This waiver is offered by NASA as a means of encouraging commercial spin-offs and is to be applied for when contractors first become aware of the technical originality and commercial potential of their research. In our sample, the date of a petition for a patent waiver preceeded the actual filing for a patent in one-third of the cases. Consequently, the date of a petition for a patent waiver can reasonably be assumed to correspond more closely to the Soviet and West German filing dates than do U.S. filing dates.

To administer the patent waiver program, NASA established an Inventions and Contributions Board. One of this Board's functions has been the monitoring of the commercial development of waived patents. In carrying out this function, the Board has followed up the granted patent waivers by means of a questionnaire. The date of first commercial use is one of the items of this questionnaire. Consequently, we are able to establish a lead time for NASA patent waivers by calculating the time between the waiver petition and first commercial use.

d. Comparing lead times

In addition to the problem created by differences in U.S. and FRG/U.S.S.R. filing criteria, the comparison of lead times needs additional qualification. As indicated in figure 5, the time periods covered by the inventions sampled differed among studies. With differing time periods, the technologies and technical generations covered by the sample clearly differ. If newer or older technologies differ inherently in their required lead times or if R&D management practices have changed significantly over time, the comparisons are, to that extent, misleading.

However, the differences between U.S.-West German performance and Soviet performance are striking. (The U.S. and West Germany implemented over 50% of their inventions in little more than one year,

[29] Barkev S. Sanders, "Speedy Entry of Patented Inventions into Commercial Use," The Patent, Trademark, and Copyright Journal of Research and Education, 1962, Volume 6, No. 1, pp. 87–116. Since many inventions were actually used before patent applications were filed, the U.S. distribution would include a large number of negative lead times. These cases were discarded, thus making U.S. performance somewhat less favorable.

[30] "Patent Waiver Regulations," Federal Register, Volume 42, No. 212 (Nov. 3, 1977), pp. 57449–57454.

whereas the Soviets needed slightly more than three years to achieve this percentage of implementation). In fact, while the U.S., West German and NASA distributions are not significantly different statistically from each other, all are significantly different from the Soviet distribution at the 1 percent level.

VI. Summary and Implications

A. Summary

In this paper we have exploited a newly available data source—*Introduced Inventions*—to investigate Soviet performance in the implementation of inventions. We first outlined the Soviet concept of an invention and described the process by which inventions become formally certified. In particular, we argued that inventions implemented for the first time make an important contribution to overall technological progress, and due to a number of factors inventions as a whole may indeed be growing proportionately as a source of technological progress. In any case, because Soviet inventions are implemented in the same organizational networks and subjected to the same types of policies as other technical innovations, our findings may be expected to apply—with appropriate qualification—to Soviet innovation in general.

Secondly, we defined the critical performance measure—lead time—and described our sample of implemented inventions on the basis of technical concentration, sector of origin and use, types of originating and using facilities, and location of origin and use. The technical and sectoral breakdown of our sample closely paralleled the corresponding breakdowns in the population of total Soviet inventions, testifying to the representativeness of our sample. Patterns of intersectoral, interfacility and interregional flows are consistent, for the most part, with prior expectations, particularly concerning: (1) the high proportions supplied internally within broader sectors (regions, etc.); (2) the tendencies for certain sectors to be net originators (e.g., scientific and educational) and certain sectors to be net users (e.g., transportation); (3) the tendencies for certain facility types to be net originators (e.g., research institutes) and certain types to be net users; and (4) the expected geographic concentrations of sources of inventions in acknowledged "science centers"—namely Moscow, Leningrad, and to a lesser extent Kiyev and Khar' kov. The only unexpected result in this outline of the sample is the surprisingly small role played by independent design bureaus of various types in the invention process.

Following a theoretical discussion of the factors influencing leadtime and the limited way our data encompasses these factors, we presented measures of lead time for several dimensions of our sample. Among the major findings:

There is significant difference between average lead times by technical areas, with 2.05 years separating the fastest and slowest of the 18 areas;

There is significant difference between average lead times by implementing sector, with 1.74 years separating the fastest and slowest of the 8 sectors;

Lead time is found to differ significantly when the invention was originated and implemented in the same facility, reducing lead time by an average of 25 percent over the implementation of inventions from different facilities;

Lead time for implementing inventions in production facilities is found to be unrelated to whether the invention originates in a research/educational facility or a second production facility;

Lead times for inventions implemented in R&D intensive urban centers (Moscow, Leningrad, Kiyev and Khar'kov oblasts) are found to be approximately 24 percent less than lead times for inventions implemented in other locations;

Lead time is found to be uncorrelated with the economic effectiveness of the invention, although we are unable to account for the cost of the invention; and

Average lead time for inventions implemented in the defense industrial sector is found to be 11.5 percent less than average lead time for inventions implemented in the civilian machine building sector. However, the lead time difference between the two sectors can be accounted for by the defense industrial sector's proportionately greater number of inventions from rapidly advancing technical areas, i.e., after accounting for the technical area of the invention, the difference is not statistically significant.

We note that severe missing data problems make it inadvisable to test other important hypotheses until the sample is expanded, which is now underway.

Finally, we presented comparisons of overall lead time performance between the U.S.S.R. (based on our sample), the U.S., the Federal Republic of Germany (based on earlier studies) and the U.S. National Aeronautics and Space Administration (based on a special NASA program). Differences in national patent policies and study data collection standards make it impossible to draw exact comparisons, but even allowing for a significant margin of error, it is evident that U.S.S.R. lead time is by far the longest of the four. At the end of two years, 66 percent of U.S. inventions were implemented, 64 percent of FRG inventions, 47 percent of NASA inventions, and 23 percent of Soviet inventions. A F-test on the means of the three Western samples failed to show a significant difference at the 5 percent level, while a F-test on all four means was significant at the 1 percent level.

B. Implications

To the best of our knowledge, we have provided the first comprehensive measure of Soviet lead time and measure of certain technical, organizational, and administrative factors affecting Soviet lead time. These findings demonstrate the value of studying Soviet inventions in general and of using the journal *Introduced Inventions* in particular. Further, it is interesting to note that data on implemented inventions comparable to Soviet data are not collected in Western countries. Thus, for once, more accurate international comparisons await expansion and improved standardization in Western data sources, not Soviet.

The results of this paper bear out most of the hypotheses developed earlier by Western scholars on the basis of case studies, Soviet policy pronouncements and anecdotal material. As previously noted, the

breakdown of our sample by technology, sector, facility type and location reveals almost without exception the expected concentrations and flows of inventions. "In-house" implementation drastically reduces lead time, and Soviet lead time is considerably slower than Western lead times. These and other expected results are testimony to the value of traditional research approaches and particularly to Western abilities to deduct performance on the mass of complex economic policy pronouncements that issue from all levels of the Soviet state and party apparatus. However, our finding of similar lead times in the defense industrial and civilian machine building sectors—after accounting for technology—questions the generally accepted view of markedly superior defense industrial performance.

The implications of our finding of relatively slow Soviet lead time—and hence poor innovative performance—for future Soviet technological advance have been well developed in numerous other sources and are not repeated here.[31]

The damaging effect from the compounding of each successive technical generation's long lead times is, however, worthy of reiteration. In general, our findings help explain the secular decline in Soviet factor productivity demonstrated in macroeconometric studies of the Soviet economy.[32]

The findings of differentials in sectoral performance also have important implications for Soviet economic prospects. Our results suggest that lead times in civilian machine building are slightly longer than lead times in other civilan industries. (This result may stem from our inability to take into account all relevant factors—e.g., possibly larger and more complex inventions within civilian machine building sector.) The civilian machine building sector includes ministries that specialize in computers, instruments and sophisticated electrical machinery, and it has been a principal recipient of Western technology (automobiles, chemical machinery). Generally, machine building has been acknowledged by Soviet specialists to be the principal foundation for technical progress. Comparatively poor performance in this key sector can only hinder performance in other sectors that rely on machine building for plant and equipment. As sectors become increasingly interdependent, both technically and economically, poor civilian machine building performance may even affect the defense industries.

Finally, we reiterate the crucial point made earlier that our study of lead time lacks essential data—e.g. resources applied to innovation and Soviet priorities—necessary for a fuller evaluation of sectoral managerial performance and economic organization. Thus superior sectoral or ministerial lead times may be "bought" at such a cost in resources so as to more than overcome what may in fact be comparatively poor management and organization. Nevertheless, our study strongly implies that overall Soviet management and economic orga-

[31] See, for example, Berliner, op. cit.; Philip Hansen, "International Technology Transfer from the West to the U.S.S.R.," in Soviet Economy in a New Perspective (Washington: Joint Economic Committee, 1976), pp. 786–812; David Granick, Soviet Introduction of New Technology: A Depiction of the Process, SSC–TN–2625–7, SRI/Strategic Studies Center, 1975; and John P. Young, Alvin M. White, Hugh L. Shaffer and L. N. Freudenreich (Batellie Memorial Institute), A Description and Comparison of the Planning and Management of Research and Development in the U.S.A. and the U.S.S.R., Report prepared for the National Science Foundation, June 17, 1977.

[32] See, for example, Rush V. Greenslade, "The Real Gross National Product of the U.S.S.R., 1950–1975," in Soviet Economy in a New Perspective (Washington: Joint Economic Committee, 1976), pp. 269–300 and Donald W. Green, Gene D. Guill, Herbert S. Levine and Peter Miovic, "An Evaluation of the 10th Five-Year Plan Using the SRI–WEFA, Econometric Model of the Soviet Union," in ibid., pp. 301–376.

nization for technical innovation are comparatively poor by Western standards.

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SOVIET TECHNOLOGY GAP AND DEPENDENCE ON THE WEST: THE CASE OF COMPUTERS

(By Kenneth Tasky*)

CONTENTS

TABLES

FIGURE

I. SUMMARY

The Soviet computer industry lags behind the West in the number, variety, and technology of computers as well as in auxiliary equipment and supporting services. This has led to a substantial level of imports to meet priority needs. Although Western computers comprise only about 4 percent of the total Soviet inventory because of their superior performance and reliability, their relative contribution is much larger.

During 1972–77, the U.S.S.R. imported more than $245 million of computer equipment from the West. Nearly 82 percent consisted of computer systems almost evenly divided between large and minicomputers. The United States was the largest single supplier accounting for $120 million or nearly half of the exports of total equipment. Including indirect sales, the U.S. share was much larger, since exports of U.S. components in the products of U.S. overseas subsidiaries and other Western firms are not included. The U.S. was also the dominant supplier in numbers of systems exported, accounting for 61 percent of all systems (excluding systems from overseas subsidiaries) : 42 percent of the 45 large computers that were exported, and 62 percent of the 721 minicomputers.

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Most of the imported large computers are used for economic data processing. By contrast, nearly half of all imported minicomputers are used for basic and applied research and development; another 30 percent are employed in industry mainly for process control, and to a lesser extent, for management. Of all the Western computers in industry, half are in the automotive sector.

The Soviets have imported large Western computer systems because these offer performance they cannot match, include complex software they have not developed, or include training they cannot duplicate. Minicomputers have been imported for similar reasons and also because the great diversity of types of Western systems makes it possible to meet a wide variety of specialized needs. As a result of these attributes, Western computers enable the U.S.S.R. to accomplish tasks that would be very difficult if not impossible with domestic systems. For example, U.S. computers in use at the KAMA Truck Plant aided in reducing the time required to achieve a given level of output by at least five years. Finally, the training programs for civil applications provided with imported systems can be reproduced including possible use in military applications.

Over the next few years, the scope and pace of Soviet imports of Western computer equipment is likely to be mainly determined by progress in domestic computer technology. Since the technology gap is not expected to narrow substantially, the Soviets probably will continue to purchase the very large and the very small Western systems. The required outlays of hard currency per computer, however, may gradually decline as advances in Western technology continue the trend toward increased unit capability for less cost.

II. Introduction

Until fairly recently, the Soviet computer industry had focused mainly on the development and production of scientific-type computers for use in science and engineering, and special-purpose computers for military applications. The Soviets paid little attention to the creation of general-purpose computer models designed especially for data processing.[1] In general, data processing needs were met by using scientific computers suitably modified. In the event, this option proved counterproductive because it imposed on users costs and engineering and software burdens that were unacceptable. Users were reluctant to buy computers, and when allocated from above, used them inefficiently or sometimes not at all. Moreover, when the Soviets desired reliable, versatile, high-speed computers for general data processing, for the automation of production or industrial processes, or other specialized needs, they had to be imported.

However, most computers were embargoed by COCOM[2] and, for many years, this limited Soviet options for importing computer equipment. Since the late 1960's, however, embargo restrictions have gradually been relaxed leading to increased Soviet imports of computers.

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[1] In scientific computers, design is optimized to process numbers. By contrast, the design of general-purpose computers is optimized to process letters, symbols, and numbers. Scientific computers are relatively inefficient in data processing applications; general-purpose computers are useful, and can be efficient, in both scientific and data processing applications.

[2] COCOM is a voluntary organization of NATO countries (minus Iceland) and Japan that was established in 1950 to develop and administer export control policies. COCOM meets regularly in Paris to consider changes in the list of embargoed commodities and to decide on requests for exceptions to the embargo.

This paper provides U.S. government estimates of Soviet imports of computers and related equipment from the West (including Japan) for the period 1972–77 and analyses the potential impact. In addition, a brief discussion of Soviet computer production and technology is provided by way of background for understanding the motivation for the U.S.S.R. turning to the West. Finally, prospects for Soviet-Western trade in computers is briefly discussed.

III. Background [3]

A. Production and Technology

The U.S.S.R. has been producing digital computers commercially since the mid-1950's, although output did not reach a significant level until a decade later. During 1965–75, the value of output grew at an extraordinarily rapid rate—roughly an average of 36 percent a year,[4] compared with a rate of 10 percent for the U.S. computer industry over the same period.[5] Despite this large differential rate of expansion, the gap in the total inventory of computers continued to increase.

In 1974 the U.S.S.R. had an estimated 12,500 computers installed and in use [6] compared with 207,000 units for the U.S.[7] By 1977, this gap had widened substantially—an estimated 20,000 in the U.S.S.R. compared with 325,000 in the U.S.

The Soviet gap in production is complemented by a gap in technology. In technical capabilities and performance, general-purpose computers now in production in the U.S.S.R. are approximately equivalent to those marketed in the U.S. in the late 1960's. In addition, software is still primitive by U.S. standards, and is available mainly for small- and medium-sized machines; software for large multi-machine configurations or for time-sharing systems apparently exists only on an experimental basis. The U.S.S.R. has finally recognized the importance of providing user services (centralized maintenance facilities, specialized training programs, libraries for software programs), but still is moving slowly in these areas to remedy the massive deficiencies that are the consequence of historic neglect.

The long term preoccupation with the development of scientific computers satisfied the preferences of scientific institutes and the military, but not those of economic planners. Indeed, throughout the 1950's and

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[3] For a full discussion of material covered in this background section, see K. Miller, "Computers in the Soviet Economy," New Directions in the Soviet Economy, Joint Economic Committee, Congress of the United States, Washington, D.C., 1966, Part II–A, Section 2, pp. 327–337; N. C. Davis and S. E. Goodman, "The Soviet Bloc's Unified System of Computers," Computing Surveys, vol. 10, No. 2, June 1978, pp. 93–112; H. Campbell, Organization of Research and Development, Production in the Soviet Computer Industry, R–1617–PR, Rand Corporation, Santa Monica, Calif., December 1976; M. Cave, "Computer Technology," in *The Technological Level of Soviet Industry*, edited by R. Amann, J. Cooper, and R. W. Davies, Yale University Press, New Haven, and London, 1977, pp. 377–406; also see S. E. Goodman, "Computing and the Development of the Soviet Economy," this volume.

[4] Derived from data in *Narodnoye khozyaystvo SSSR za 60 let*, Statistika, Moscow, 1977, p. 221. Output is in constant rubles.

[5] Derived from data in Electronic Market Data Book, Electronic Industries Association, Washington, D.C., various years. U.S. output is in current dollars. However, despite considerable inflation in producer durable prices during this period, the evidence suggests that there were offsetting cost reducing changes in design and production.

[6] Data on computers installed in the U.S.S.R. is given in *The American Computer Industry in Its International Competitive Environment*, Domestic and International Business Administration, U.S. Department of Commerce, Washington, D.C., 1976, pp. 67–68.

[7] Data on computers installed in the United States as given in EDP Industry Report, International Data Corporation, Waltham, Mass., vol. 13, No. 20 and 21, May 19, 1978, p. 9.

early 1960's, planners were enmeshed in a protracted ideological and bureaucratic debate over the need for making computers designed especially for economic data processing. A tentative move in the direction of increased production of computers for data processing took place in 1965 with the introduction of new MINSK and URAL models of computers. These purported to be general-purpose types, but were actually modifications of earlier scientific computers. Nevertheless, the introduction of these computers was a beginning that, for all practical purposes, resolved the historic debate. Since that time, the development and production of general-purpose computers has been pushed vigorously.

The MINSK and URAL series proved to be seriously deficient for processing large amounts of economic data. They possessed a small main memory, relatively slow processing speeds, lacked disk memory [8] and functioned with poor quality input-output and other peripheral devices. In addition, because Soviet producers provided little service after delivery, users had to modify these models to meet their specialized needs.

In the process, they created non-standard computers, even for the same model, which differed enough in circuitry so that they could not employ the same programs. These deficiencies reinforced a Soviet decision to build a new family of general-purpose data processing computers—called the RYAD [9]—ushering in the era of "modern" Soviet computing.

The RYAD program first surfaced in 1967 as a Soviet project.[10] Subsequently, most of the countries of Eastern Europe became reluctant participants. RYAD computers are based on the design of the IBM System 360 series. As a result of using a proved design the Soviets hoped to avoid costly development programs and to reach large-scale production more quickly than otherwise would be possible. By making RYAD compatible with IBM, a large library of IBM software would be available to the Soviets. The U.S.S.R. could also supplement domestic production by importing IBM machines and compatible peripherals manufactured by IBM and other Western firms.

RYADs produced from 1972 (the first year of production) [11] to 1975 were not well-received by users. In 1975, some of the original models—the low- and medium-capacity members of the family—were modified and users seemed somewhat more enthusiastic. Currently, a new family of compatible computers, the so-called RYAD–2 series, is under development. These computers, intended to become the main data processing computers for the 1980's, are designed to incorporate many of the advanced features of the IBM System 370 series, and are intended to be compatible with the IBM models as well as RYAD–1 computers.

Currently, the U.S.S.R. is producing large numbers of medium-size RYAD computers, perhaps in larger volume than can be used effectively, but few very large, complex systems or very small minicomputers. Western experts believe that Soviet failure to master the

[8] Magnetic disk memories are high speed auxiliary devices used for the permanent storage of computer data.
[9] "Ryad" is the Russian word for "series."
[10] Nedelya, Moscow, No. 43, Dec. 4, 1967, p. 7.
[11] Izvestiya, Jan. 22, 1972, p. 5.

production of advanced types of integrated circuits is retarding production of these latter systems.[12] Unlike the vast majority of Soviet computers in production which utilize relatively simple, low density integrated circuits, the large machines require very complex high speed circuits, and small minicomputers require circuits of very high density.

The ASVT program is a second major Soviet computer program currently underway.[13] Unlike RYAD, which is the responsibility of the Ministry of the Radio Industry, ASVT is under the control of the Ministry of the Instrument Building Industry. ASVT computers are intended mainly for industrial plant management and process control applications. Until recently, ASVT computers used for process control were physically large and had very limited capabilities. Although current models are more modern minicomputers, they are only in limited production or are still under development.[14] Thus, minicomputers are not widely available in the U.S.S.R.

In the area of scientific computers, the BESM–6, which began to be produced in 1965, continues to be the primary work horse. Two new models, the El'brus-1 and -2 [15] are the first publicly acknowledged developments since the BESM–6. The El'brus-2, which is the largest of the new models, is claimed to be equal in size and speed to the largest scientific computers currently available in the West. However, El'brus computers are still under development and it may be some time before deliveries can start in earnest.

B. Soviet Need for Computers

The Soviets need large numbers of data processing computers to: (*a*) facilitate planning, and to reduce the cost of processing the enormous volume of economic data generated by the economy; (*b*) increase efficiency in the management of enterprises; (*c*) increase plant productivity and product quality through the application of computers in process control; and (*d*) accelerate research and development in many areas. Finally, the wide application of computers offers the prospect of releasing large amounts of labor at a time when the supply of labor is becoming tight.

The number of computers needed to flesh out all of the Soviet schemes is staggering. Moscow plans eventually to computerize management information systems and production processes in most enterprises and economic organizations through the use of "Automated Management Systems" (ASUs).[16]

Since there are some 43,000 industrial enterprises, and tens of thousands of communications, transport, scientific, agricultural, and other service enterprises in the U.S.S.R., the task of computerization will require a very large number of computers. A. A. Dorodnitsyin,

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[12] "Computer Games," Time, Aug. 1, 1977, p. 45.
[13] "Aggregatnaya Sistema Sredstv Vychislitel'noy Tekhniki" which freely translates as Unified System of Computers.
[14] N. C. Davis and S. E. Goodman, op. cit., p. 108.
[15] Pravda, Apr. 4, 1978, p. 3.
[16] Avtomatizirovannye Sistemy Upravleniya (ASU). ASU is an imprecise term the Soviets apply to management science in the operation of a process, enterprise, branch of industry, or ministry. ASU is based on computers and econometric methods and can be anything from a simple automated bookkeeping system to a complex system for the collection, processing and distribution of economic data throughout the economy. For a full discussion of this program, see G. S. Greenslade, "The Soviet Economy on a Treadmill of 'Reform,'" this volume.

head of the Computer Center of the Academy of Sciences, estimated in 1966 that 3,500 medium-sized computers would be required in the central planning network alone.[17] At current production rates of perhaps 2,000 to 3,000 computers a year, Soviet plans seem grandiose.

The Soviets also need to solve the problem of what might be termed the technology of mass utilization of computers; that is, the development and integration of those related and supporting activities needed to maximize the use of the computer: software, training, computer installation and maintenance. Complaints of deficiencies in this area still abound in the Soviet press. For example: some enterprises and organizations continue to order computers before they are ready to install them.[18] As a result, computers are sometimes left in the open, uncrated "for 4 to 6 months and even longer", [19] and one RYAD was reportedly stored in boxes "for a year".[20]

Sometimes users place computers in an improper operating environment, such as a room lacking air conditioning, which raises downtime from overheating; or a room with improper air filtration which jeopardizes functioning of magnetic disc memory devices.[21] A common complaint centers on the inadequacy of software which, according to one source "cannot satisfy the serious client".[22] Other complaints focus on problems of installation—". . . of all the M–6000 computers placed with customers, 39 percent were put into operation after a great deal of delay" [23]; shortages of peripheral equipment—" equipment is now arriving at the computer centers [of the USSR Ministry of Trade] in an uncoordinated fashion and without the necessary peripherals and auxiliary devices" [24]; and shortages of trained personnel—"year after year, the higher educational institutions of the country send us an extremely limited number of specialists—in particular computer hardware and mathematical programming specialists." [25]

IV. Imports

The U.S.S.R. has been importing computer equipment fom the West in small quantities since at least the late 1950's.[26] However, until about 1970, strict adherence of Western countries to the international COCOM embargo restricted deliveries to the smaller and less advanced types of computers and related equipment. The total value of Soviet computer imports from the West through 1970 probably was yalued at less than $20 million.

In 1969, the embargo on computers was substantially liberalized and Soviet imports picked up steam; in 1971, amounting to roughly $10 million, or half the value of imports during the preceding 20 years. A major impetus to Western computer sales came after President Nixon's 1972 visit to the U.S.S.R. opened the era of detente. In 1972, imports jumped to an unprecedented high of $27 million, including

[17] "Russia Bets Its Future on Computer Know-How," Business Week, Aug. 13, 1966, p. 92.
[18] Pravda, Mar. 2, 1977, p. 2.
[19] Ibid.
[20] Ekonomika i Zhizn, No. 6, 1977, pp. 83–86.
[21] Ibid.
[22] Sotsialistecheskaya Industriya, Aug. 21, 1977, p. 2.
[23] Ibid.
[24] Sovetskaya Torgovlya, Mar. 28, 1978, p. 2.
[25] Ibid.
[26] Berenyi, "Computers in Eastern Europe," Scientific American, October 1970, pp. 102–108.

11 large computer systems at an average price of $1.5 million, and 27 minicomputers averaging more than $200 million each.[27]

Since 1972, the value of imports for individual years has fluctuated around a generally rising trend line (table 1). In 1977, the most recent year for which detailed data have been compiled, total imports of computers from the West amounted to about $63 million. For the period 1972–77 as a whole, Soviet imports were more than $245 million, representing about 30 percent of computer imports from the West by all European Communist countries (figure 1).

TABLE 1.—U.S.S.R.: VALUE OF IMPORTS OF COMPUTER EQUIPMENT FROM THE WEST, 1972–77[1]

[In thousands of U.S. dollars]

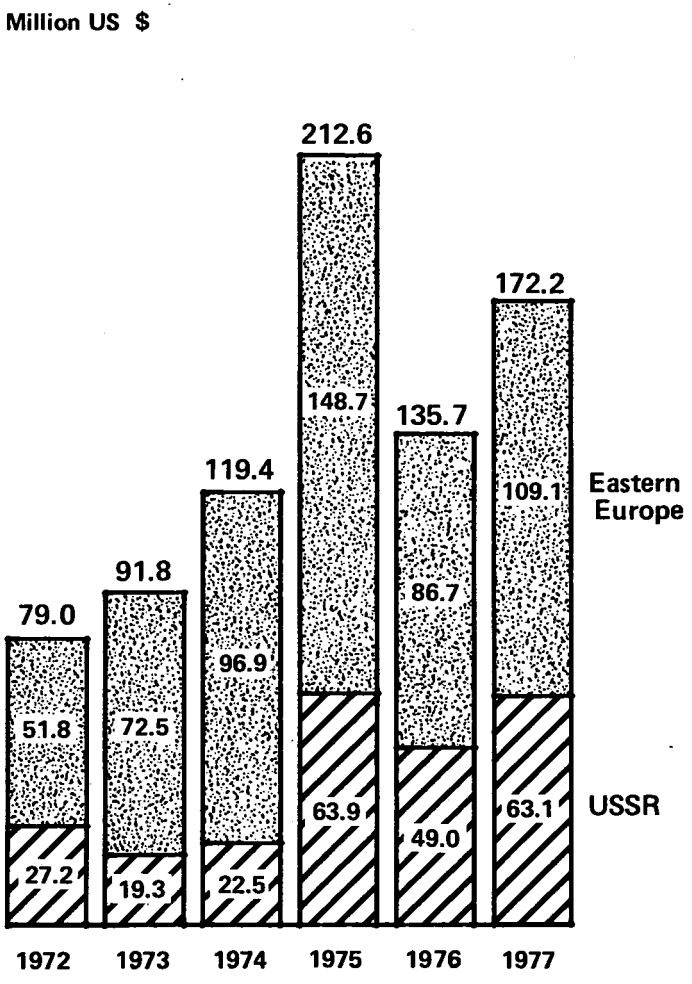
Exporting country[2]	1972	1973	1974	1975	1976	1977	1972–77
Large computer systems:							
United States	3,620	0	2,301	15,291	13,627	12,723	47,562
France	4,116	1,690	3,403	4,393	4,360	4,560	22,522
Germany	6,101	0	0	2,318	0	10,798	19,217
Japan	860	0	0	0	0	5,521	6,381
United Kingdom	1,289	1,191	0	0	0	0	2,480
Italy	494	0	0	0	0	0	494
Subtotal	16,480	2,881	5,705	22,002	17,987	33,602	98,657
Minicomputer systems:							
United States	4,862	4,756	6,311	17,891	12,048	6,912	52,780
United Kingdom	486	1,422	535	5,817	6,436	8,703	23,399
Germany	205	3,054	3,085	7,289	2,509	1,804	17,947
Japan	0	940	1,002	57	2,972	1,029	6,000
France	0	0	88	536	347	0	971
Netherlands	64	64	310	291	0	0	729
Denmark	0	0	11	139	0	0	150
Canada	0	0	30	0	115	0	145
Subtotal	5,617	10,237	11,372	32,019	24,426	18,449	102,120
Peripheral equipment:							
United Kingdom	1,251	2,099	1,277	3,992	1,186	1,118	10,923
United States	1,520	1,307	919	1,934	2,259	1,880	9,818
Germany	28	911	540	544	225	1,170	3,418
France	738	549	37	45	0	1,724	3,092
Japan	63	823	0	0	0	0	886
Canada	0	0	0	0	0	560	560
Belgium	0	70	0	0	130	0	200
Netherlands	32	10	18	5	0	8	72
Italy	0	0	19	0	0	0	19
Subtotal	3,630	5,770	2,809	6,519	3,800	6,459	28,988
Spare parts:							
United States	886	322	1,030	1,628	2,408	3,401	9,675
United Kingdom	600	0	1,592	1,348	0	746	4,286
France	0	0	0	280	0	450	730
Germany	25	88	0	118	335	4	572
Subtotal	1,511	410	2,622	3,375	2,744	4,601	15,263
Total equipment:							
United States	10,887	6,385	10,561	36,744	30,342	24,916	119,835
Germany	6,359	4,054	3,625	10,269	3,039	13,776	41,153
United Kingdom	3,625	4,712	3,405	11,156	7,622	10,567	41,088
France	4,854	2,239	3,528	5,254	4,707	6,734	27,316
Japan	923	1,763	1,002	57	2,972	6,551	13,268
Netherlands	96	74	327	296	0	8	800
Canada	0	0	30	0	115	560	705
Italy	494	0	19	0	0	0	513
Belgium	0	70	0	0	130	0	200
Denmark	0	0	11	139	0	0	150
Total	27,238	19,299	22,508	63,916	48,957	63,111	245,028

[1] Totals may not add due to rounding.
[2] Countries are arranged in descending order according to the total value of exports for the period 1972–77 as a whole.

[27] A computer system normally is a complex of equipment that includes, in addition to the computer proper (central processing unit) a variety of other devices (peripherals) for storing, entering, extracting, and presenting information. Most minicomputers are computer systems in this sense.

Figure 1

USSR and Eastern Europe: Value of Imports of Computer Equipment From the West



During the same period, computers as such, accounted for an overwhelming share of the value of all computer equipment imports—nearly 82 percent—followed by peripherals (12 percent), and spare parts (6 percent). In value, computers were almost evenly divided between large systems and minicomputers. The average value of large computer systems imported has been gradually trending upward from

$1.5 million per system in 1972 to $2.8 million in 1977.[28] This reflects Soviet purchase of larger, more complex, and more advanced computer hardware. In contrast, minicomputers in both units and value have been trending downward. In 1975, Soviet imports of minicomputers peaked at 250 units valued at about $32 million. The average value of minicomputers has declined from $208 thousand in 1972, to $144 thousand in 1977. This decline, however, reflects the rapidly declining costs of Western minicomputers, and does not suggest the Soviets are purchasing relatively less advanced models.

The volume of Soviet imports of peripheral equipment has been relatively small because: (*a*) imported computer systems already include all the peripherals needed to make the systems work and peripherals do not have to be purchased separately;[29] and (*b*) Soviet requests for peripherals for use with Soviet systems (e.g., RYAD) have generally not been approved. Were this restriction to be lifted, it is likely that peripherals would represent a much larger share of imported computer equipment.

The United States is the largest single Western supplier of computer equipment to the U.S.S.R. accounting for nearly half of all Soviet imports during 1972–77. The U.S. accounted for half of all computers (including large systems and minicomputers), a preponderant share of the spare parts (63 percent), and about one-third of all peripherals. Indeed, the U.S. share of total computers (excluding peripherals) is larger if deliveries to the U.S.S.R. from U.S. overseas subsidiaries are taken into account.[30]

Following the U.S. in total sales were West Germany and the United Kingdom, statistically tied for second place, each with sales of $41 million (17 percent) during 1972–77. Lesser suppliers were France with 11 percent, and Japan with 5 percent.

U.S. dominance in Soviet imports is even more pronounced in the comparison of unit shipments (table 2). U.S. sales accounted for 61 percent of the total computer imports during 1972–77, including 42 percent of the larger computer systems and 62 percent of the minicomputers. Again, the U.S. share would be substantially higher if U.S. units produced overseas were added to domestically produced totals. For example, of the 766 total computers approved, about 85 percent are believed to be U.S. models. Although the total number of Western computers represents only about 4 percent of the Soviet inventory their contribution is much higher. Western systems offer performance, reliability and capability superior to Soviet computers.

Although detailed breakdowns have not yet been compiled for 1978, preliminary calculations indicate that sales of computers to the U.S.S.R. expanded substantially last year to nearly $85 million. This represents a 57 percent increase in value over the previous record year of 1975. Although the number of units sold may be less, the unit value of Soviet imports of systems is perhaps one-fourth greater than that of 1977—evidence that the trend toward imports of computers of ever increasing complexity is continuing.

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[28] Inflation may account for some portion of the increase, but is believed to be small since computer prices in the West have declined rapidly in recent years.

[29] Peripherals that have been purchased separately are add-ons to expand the capacity of purchased Western systems.

[30] For example, U.S. subsidiaries in West Germany accounted for roughly $15 million worth of computer exports to the U.S.S.R., or 41 percent of total West German shipments. In addition, many of the purely West German computers contain a substantial portion of U.S. parts or peripherals.

TABLE 2.—U.S.S.R.: IMPORTS OF COMPUTERS FROM THE WEST, 1972–77

[In units]

	1972	1973	1974	1975	1976	1977	1972–77
Large computer systems:							
United States	3	0	1	6	4	5	19
Other countries [1]	8	3	3	3	2	7	26
Subtotal	11	3	4	9	6	12	45
Minicomputer systems:							
United States	17	41	56	156	118	62	450
Other countries [1]	10	33	34	94	34	66	271
Subtotal	27	74	90	250	152	128	721
Total computers:							
United States	20	41	57	162	122	67	469
Other countries [1]	18	36	37	97	36	73	297
Total	38	77	94	259	158	140	766

[1] NATO countries (minus Iceland) and Japan.

Generally, the end-use of computers sold to the U.S.S.R. is identifiable only in very broad terms and provides little understanding of how Soviet end-users intend to use a particular computer. For example, large data processing computers have been sold to Soviet institutes for the purpose of "scientific research". This end-use could include, in addition to basic research, engineering development, training, and other uses. Again, the end-use specified for some minicomputers is "industry"—a broad category including activities as disparate as plant management control, control of industrial processes, and industrial R&D.[31]

Table 3 separates Soviet imports into three major categories: R&D; industrial; and economic. R&D includes both basic and applied research and development. The industrial category includes both management and process control end-uses; generally, large computer systems are used for management, and minicomputers for process control. "Economic" is a very broad category that includes, banking, education, medical, trade, and other services.

TABLE 3.—U.S.S.R.: DISTRIBUTION OF IMPORTED COMPUTERS BY END USE, 1972–77

End use	Units			Share percent		
	Large computers	Mini-computers	Total	Large computers	Mini-computers	Total
	(1)	(2)	(3)	(4)	(5)	(6)
Total	45	721	766	100	100	100
R. & D.[1]	6	323	329	13	45	43
Industrial[2]	3	218	221	7	30	29
Economic[3]	36	180	216	80	25	28

[1] Includes both basic and applied research and development.
[2] Includes both management and process control.
[3] Includes banking, education, medical, trade, and other uses.

[31] All computer sales to the U.S.S.R. are approved by COCOM for specific civilian end-uses in specific civilian sectors. In the case of large powerful computers, certain safeguards are attached to the sale to deter any attempt to divert the computer to military purposes. These safeguards range from periodic visits to the installation up to extended residency by Western personnel, depending on the size and power of the system. Generally, there are no special safeguards applied to the sale of minicomputers other than assurances given by the Soviet purchaser that the computer will be used only for peaceful purposes.

As indicated in table 3 four-fifths of all large computers imported are used for economic—that is, general data processing—applications. In contrast, only one-fourth of the minicomputers (column 5) are for general economic use. Nearly one-half of the minicomputers are being used in R&D applications, and a little less than one-third to improve the efficiency of production (process control). These and other data in table 3 yield the generalizations that the Soviets:

Have been more interested in buying Western minicomputers than large systems.

Desire Western minicomputers mainly for R&D.

Desire large systems mostly for economic data processing.

TABLE 4.—U.S.S.R.: DISTRIBUTION OF IMPORTED COMPUTERS BY MAJOR SECTOR OF END USE

[In percent]

Sector of the economy	R. & D.	Industrial	Economic	Total
(1)	(2)	(3)	(4)	(5)
Automotive	5	50	10	20
Science [1]	40	2	4	19
Chemical	13	6	8	10
Biological/medical	11	1	16	10
Metals/minerals	9	10	8	9
Government [2]	4	1	23	8
Light industry	2	15	8	8
Machinery [3]	8	8	2	6
Electronics	3	5	8	5
Trade	2	1	7	3
Other	2	1	5	1
Construction	1		1	1
Total	100	100	100	100

[1] Applied physics, space research, and atomic energy among others.
[2] State planning committee (Gosplan), state supply committee (Gosnab), state bank (Gosbank) and other organizations.
[3] Aircraft, ship, machine tool and other machinery producing sectors.

Table 4 provides further clarification of how the Soviets are using imported computers. The three major categories of end-use (from table 3) are broken down further according to the sector being served by each of these end-uses. In this context the term "sector of the economy" is applied broadly to include activities that are not normaly defined as industries, such as: basic science, trade, and government. The table indicates, for example, that of all the computers dedicated to R.&D. (column 2), 40 percent of these are used in "science"—that is, by scientists or in scientific organizations; 13 percent of the total are being used for R.&D. in the chemical industry; 5 percent for the automotive industry, etc. Column 5 shows each sector's share of all the computers imported. Thus, the automotive industry and the science sector are obtaining relatively more computers than any other industry, each having about one-fifth of the total. In sum, Western computers used in R.&D. are concentrated in science; those used for industrial purposes, in the automotive industry; and those used for purely "economic" purposes, in government.

The sectors listed in column 1 are themselves relatively general items that include a variety of activities and organizations. For example, "science" includes computers used in applied physics, space research, and atomic energy among others; "machinery" includes computers in

aircraft, ship, and machine tool organizations; "electronics" includes instrument and computer facilities. One caveat is in order: the listed sectors may not be mutually exclusive. For example, computers in "science" may be in use researching or developing an electronics technology; computers in "electronics" may be in use developing equipment for scientific application.

Soviet imports of large Western systems are characterized by one or more of the following three important features: they contain performance capabilities that the Soviets cannot match; they utilize complex software that the Soviets have not developed; and they offer expert training in the operation of large computer systems that the Soviets cannot duplicate. In some cases, the Soviets have imported large systems to gain the advantage of all three features as shown in table 5.

TABLE 5.—U.S.S.R.: BENEFITS GAINED BY SELECTED IMPORTED COMPUTER SYSTEMS

End user	Type computer	Quantity (units)	Advantage to U.S.S.R.
Kama River truck plant [1]	IBM 370/158 IBM System 7	1 10	Combination of high processing rate and large capacity internal and peripheral memory; specialized software packages for planning, scheduling, monitoring production and inventory reporting, and controlling operations both on the production floor and in the warehouse.
Ministry for Civilian Aviation for passenger reservations.[2]	Univac 1106	2	Dual processor for full time on-line availability; large internal and external memory; fully developed software packages optimized for airline reservations, accounting, and statistical analysis.
For air traffic control [3]	Swedish	Several	Complex integration of computers, radars, and communications equipment; highly involved software packages to monitor and control many aircraft simultaneously.
Intourist [4]	IBM 370/145	1	Large internal and external memory; specialized software for tourist reservations and inventory.
Institute of Geophysical Exploration.[5]	CDC Cyber-73	1	Special hardware and software for preprocessing and final processing of seismic information.

[1] Computerworld, June 25, 1975, p. 38.
[2] Electronic News, Aug. 25, 1975, p. 16.
[3] East-West Markets, Oct. 6, 1975, pp. 8–9.
[4] Electronics Weekly, Sept. 15, 1976, p. 15.
[5] East-West Markets, Jan. 24, 1977, pp. 6–7.

Minicomputers also possess, on a smaller scale, the advantageous features of the large systems. A major reason for importing minicomputers, however, is their scarcity in the U.S.S.R. Until at least 1975, minicomputers were produced in very limited quantities, and even today, domestic models do not measure up to Western performance standards. Furthermore, Soviet models lack the versatile software packages that come with Western models. Many Western minicomputers are sold with complete software packages which include both general-purpose and special-purpose applications programs. Moreover, the diversity of types of Western "minis" with differing capabilities and specialized applications surely has been an attractive feature to the Soviets; they have purchased both general-purpose machines of varying speeds and memory capacities, as well as special-purpose models that are dedicated to a single end-use.

Indeed, the Soviets have imported minicomputers across the whole spectrum of the Western types including those: (*a*) capable of sup-

porting large time-sharing networks; (*b*) approaching the capabilities of full scale, general-purpose computers in speed and capacity; (*c*) capable of being programmed to control multiple activities at one time; and (*d*) entirely dedicated to the operation of a particular laboratory instrument, or industrial process.

V. Impact of Acquisitions

The main effect of imports of large computer systems has been to enable the U.S.S.R. to accomplish tasks that otherwise would have been extremely difficult, or impossible to accomplish, to the same extent, or within the same time frame set by Moscow. For example, the highly integrated system of computers for delivery to the KAMA foundry will enable the Soviets to produce castings for 250,000 diesel engines a year by 1985, in support of 150,000 trucks to be produced at KAMA and other plants. KAMA truck output, at maximum capacity, will increase total Soviet truck production by about 10 percent. Hence, Western computers at KAMA may have provided a necessary (though not sufficient) condition for increasing Soviet truck output by 10 percent by 1985, which may be 5 to 10 years sooner than otherwise would have been possible. Since many of the trucks almost certainly will be used by both military and civilian organizations, the Soviets gain military as well as economic benefits from the purchase of those computers.

The purchase of computers for Aeroflot and Intourist reservations, taken together, will enable the U.S.S.R. to process an expected 200,000 Western visitors for the 1980 Olympics. Without these computer systems the Soviets would have been hard put to handle even a fraction of this number of people. Considering that most of the visitors will fly into Moscow from Western Europe on Soviet aircraft for a packaged deal cost of roughly U.S. $1,000, each visitor could add at least $1,500 to Soviet hard currency revenues or on the order of $200 to $300 million.

One of the greatest benefits to the Soviets from Western computer systems is the training and experience gained. The large systems in particular, typically, involve full installation, maintenance, and software support. These are extractable benefits with a multiplier effect. The training and experience gained with a single system can be applied to the development of a cadre of Soviet specialists capable of training others. In time, the accumulating expertise can be applied to the development of native software.

Western computers also can benefit military users in limited ways. For example, computers installed in civilian research organizations for work on basic technologies can produce results that have spillovers in military areas, or lessons learned at civilian facilities can be passed on to military users. Training and experience on large management information systems like KAMA, or scheduling systems like Aeroflot, can raise the level of expertise of military specialists involved in command and control and logistics. These military benefits, however, are indirect requiring much additional development work by the Soviets to be of practical military value.

VI. Prospects for the 1980's

The Soviet Union will continue to import Western computer equipment during the 1980s. The scope and pace of imports is likely to be determined by progress in computer technology on the home front, and by the availability of hard currency. It seems likely that if the Soviets do not acquire computer manufacturing technology,[32] Soviet state-of-the-art will continue to lag significantly behind that of the West in the 1980s. It may be expected, therefore, that the Soviets will continue to purchase Western computers at the limits of the technology, namely very large systems and minicomputers.

The computers that the Soviets import in the 1980s will be more advanced than previous imports. That is because, as Western technology advances, embargo constraints may be relaxed. It may even prove to be the case that the U.S.S.R. will acquire more advanced technology at less cost than at present. Western computer technology is changing so rapidly that succeeding computer models typically offer greater capability for the same or less cost.

An unpredictable factor affecting Soviet imports in the 1980s will be the treatment of technology sales. Should controls of sales of technology be relaxed, the Soviets probably would undertake large-scale purchases of computer manufacturing, test, and quality control equipment. The Soviets recognize that purchase of Western manufacturing technology offers the best, and probably the only path for bridging the technology gap quickly. Technology has been sold to the Soviets in the past to a very limited extent. Prospects for a major relaxation of technology controls and hence, of large-scale Soviet purchases, however, seem remote for the next few years at least.

[32] The Soviets have been persistently negotiating with Western firms for many years for production technology and turn-key facilities to produce computer equipment. See for example: Electronic News, Oct. 29, 1973, p. 1; Electronic News, July 22, 1974, p. 13; Electronic News, Sept. 14, 1975, p. 57; East-West Trade News, Dec. 22, 1976, p. 7; Electronic News, June 2, 1975, p. 20.

COMPUTING AND THE DEVELOPMENT OF THE SOVIET ECONOMY

(By S. E. Goodman*)

CONTENTS

I. Introduction

Although the development of computing [1] in the U.S.S.R. has closely followed the Western technical pattern, it has differed considerably in time-scale, philosophy, institutional arrangements, capital decisions and applications. In particular, it is only within the last ten years that the Soviet Union has allocated the priorities and resources necessary for the production and use of complex general purpose computer systems on a scale large enough to begin to pervade the national economy.

It is not difficult to understand why the Soviet Union was slow to make such a commitment to the use of this technology. The pervasive and effective use of computers on a national scale encompasses much more than what is involved with other high technologies whose use tends to be passive. For example, the technology for nuclear energy can be developed by small, relatively isolated, R&D groups and production is limited to a few locations. The product, electricity, is ideologically harmless and no different from what is produced from other energy sources. In contrast, computer use is not passive. Once the hardware is delivered to the customer, he has to figure out what to do with it. The possibilities are virtually limitless, but they are not easy to implement. User education and the establishment of a sophisticated service structure are large, slow and difficult undertakings. Furthermore, the existence of such a versatile, information-oriented technology at many thousands of locations requires political attention that is not warranted

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[1] We will only be concerned with digital computers.

by other technologies. Computer manufacturing also demands a high level of quality control in a large number of mass produced products that range from punched cards to extraordinarily complex circuits. In short, this is not the kind of technology that is easily nurtured by the Soviet system and, for a long time, the leadership did not perceive much need to go to a lot of trouble to develop a full range of capabilities and promote widespread use.

The current intensive effort to build and use computers was forced by internal economic pressures and, to a lesser extent, by the greater needs of the military. The leadership now sees computing as a means to help reverse slowing growth rates, increase factor productivity, make more effective use of material resources, build and control offensive and defensive systems, and design sophisticated weapons. It is apparently hoped that this technology can make the existing economic system more efficient and effective, and thus avoid any fundamental and politically unacceptable reforms. In this context, it is worth noting that computing has been so successful in helping to achieve these goals in the United States because of an economic and cultural environment that the Soviets want to avoid.

The history of Soviet computing reflects a slow and costly learning experience that illustrates many of the weaknesses, and some of the strengths, of their system. The computer industry in the Soviet Union is still backward as compared to those of the West and Japan; but relative to its own past, substantial progress has been made during the 1970s. To some extent, this progress is a measure of what, by Soviet standards, has been an unusually large involvement with foreign industries.

It is too early to try to draw confident conclusions about the long term future of computing as part of the Soviet economy, but it is important to describe some of the developments that have been taking place. Our focus will be on the computer industry itself and on general purpose use. The application of computers to high level economic planning is considered in another article in this volume.[2]

The important areas of direct process control, military applications, component construction, and scientific computing are more technical, and information is more subject to U.S. and U.S.S.R. security controls, but there will be some discussion of these topics to provide a broader perspective. Little will be said about technology transfer. This subject, and particularly the transfer of software technology and products, has been discussed in other articles.[3]

Section II is a short analysis of the Soviet commitment to computing as revealed by the general purpose computer development activity in the U.S.S.R. over the last three decades. Sections III and IV contain more detailed discussions of certain aspects of this commitment, and of recent Soviet progress and problems in building a computer industry and utilizing the computers they have. The final section speculates on short term prospects.

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[2] Schroeder, G., "Soviet Economy on a Treadmill of Reforms," in this compendium.

[3] Goodman, S. E., "Soviet Computing and Technology Transfer: An Overview," World Politics, vol. XXX, No. 4, July 1979; "Software in the Soviet Union: Progress and Problems," Advances in Computers, vol. 18, 1979; and Chapter 3 of Computer Networks: An Assessment of the Critical Technologies and Recommendations for Controls on the Exports of Such Technologies, Computer Network Critical Technology Expert Group, a report prepared for the U.S. Dept. of Defense, 1979.

An elementary glossary of technical terms is contained in the Appendix. References to the technical literature have been kept to a minimum; a large number of such references may be found in the sources listed at the end of this article.

II. The Commitment

The U.S.S.R. was the first country on continental Europe to build a stored program digital computer. This machine, the MESM, was operational in 1951—only two years after the first such computer, the English EDSAC. By 1953, the Soviet Union had put a computer into serial production, and had completed a working prototype of one of the world's first "supercomputers."

During the early 50's, both the U.S. and U.S.S.R. used computers primarily for doing scientific and engineering computations. Neither was using computers to any great extent for data processing or economic planning. The technology was not available for such applications. Furthermore, in the Soviet Union, there was serious ideological suppression of the use of economic theory and quantitative methods in economic planning.[4] Thus there was indirect opposition to the use of computers for this purpose. However, computing itself, measured against the achievements of the rest of the world, was doing reasonably well in the Soviet Union at the time Stalin died.

After the death of Stalin, the most visible form of Soviet computer-related activity was the pro-cybernetic euphoria that had developed by the late 1950's. Soviet academics and the public media took this opportunity to become enamoured with cybernetics to an extent that is without precedent in the history of science in the U.S.S.R.[5]

For the most part, governmental officials and technical people who were in positions to determine policy and capital investment ignored the popular discussion and academic plans. Little effort was made to produce large quantities of suitable computer hardware intended for widespread general purpose use. No great need for this was perceived anywhere in the industrial or military sectors, and the cost would have been a great strain on their limited capabilities that would have been out of proportion to the short term benefits.

But Soviet computer developments during the remainder of the 1950's and into the early 60's were not insubstantial. It can be argued that, with the exceptions of the U.S. and U.K., the Soviets were doing at least as well as any other country in developing an indigenous computer industry. The U.S.S.R. developed about two dozen different digital computer models by 1961, and its production capacity was growing at a respectable rate.

Nevertheless, Soviet computing capabilities rapidly fell behind those of the U.S. during this period. While the Soviets continued to use computers primarily for doing engineering and scientific computations, Americans and West Europeans were discovering that digital computers could be used for other purposes. The most important of these applications was business and government data processing.

[4] Judy, Richard W., "The Economists," in H. Gordon Skilling and Franklyn Griffiths (eds.), Interest Groups in Soviet Politics, Princeton University Press, Princeton, N.J., 1971, 209–252.

[5] Graham, Loren R., Science and Philosophy in the Soviet Union, Knopf, N.Y., 1972.

The U.S.S.R. did not have a well developed business equipment industry. There were no Soviet counterparts to the NCR, Burroughs, IBM, etc. salesmen running around the U.S. selling cash registers, adding machines, punch card calculators or typewriters. Nor did they have the established business equipment industry organizational structure, customer and sales support base, and base of production talent that these U.S. companies would use to drastically change the character of American and world computing.

Of course, the lack of a sophisticated business equipment industry was not the only Soviet deficiency. They also lacked a suitable customer base. In the U.S., there existed a large number of independent, competitive, opportunistic, cost conscious, information oriented enterprises of various sorts who perceived a need for what computer technology might be able to offer. Consumer demand for computer equipment and services greatly exceeded market forecasts. An extraordinarily effective user-vendor feedback system had already developed in the United States during the 1950's. Users could make their needs known to vendors, and the vendors were responsive. Technological innovations in the U.S. computer industry were often customer inspired.

The lack of customer-oriented, widespread, data processing computer use in the U.S.S.R. adversely affected the development of effective service and support organizations, as well as three very important technical areas: memory, input/output (I/O) peripherals, and software. It was in these areas that the East-West computer technology "gap" was largest and growing most rapidly.

Given the conservative economic environment in which they existed, it is not surprising that most potential Soviet computer users did not share their American counterparts' enthusiasm. From their perspective, they were getting along well enough without computers. No salesmen came around to tell them what they were missing. Even the Soviet military, which existed in a very competitive world environment, was much less enamoured with computers than its U.S. counterpart—although many early Soviet computer-related developments were at least partially in response to military needs. Any real initiative to greatly accelerate and expand the practical development of Soviet computing capabilities would have to come from high-level government and Party sources.

A high-level reassessment of computing had begun by the early 60's. The nonproductive administrative and clerical component was becoming an increasingly large fraction of the total labor force. One obvious solution was to substitute machines for people, a method that had already been demonstrated effective in the West. This solution might also be extended to the production processes themselves. Furthermore, computers could qualitatively extend production capabilities, e.g. by permitting productive activity in physical environments unsuitable for humans. It is not surprising then that the leadership began to look towards computing for help in treating a variety of economic ills. Public rhetoric began to be supplemented by serious CPSU endorsements and practical measures.[6]

[6] The focus here will be on practical measures. For assorted statements from the Soviet press, Party congresses, etc. see Campbell, Heather, "Organization of Research, Development and Production in the Soviet Computer Industry," RAND Corp., R-1617-PR, December 1976, Section III.

Because record keeping and data processing tasks were required at all levels of administration, there was a recognized need to have suitable equipment at all levels. Furthermore, any rational approach required that the equipment and methods used at lower levels be useful without major modification at higher levels. This meant that an upward compatible family of computers was needed. Simply stated, an upward compatible series consists of a sequence of increasingly more powerful computers that have been designed so that programs and data which can be run on any one machine can also be run, without modification, on all the larger models in the family. Thus the same management programs and data formats for keeping track of rolling stock at a small railroad yard on a small computer model could be used at a larger yard using a larger machine. Such compatibility is also important to future growth. An enterprise that outgrows its current computer is able to switch to a larger one without the time-consuming, error prone, and disruptive experience of rewriting all of its programs and reformatting all of its data.

The first Soviet attempt to produce an upward compatible family was the Ural-10 series (the Ural-11, -14 and -16), designed and manufactured in Penza under the Ministry of the Radio Industry.[7] The series was of Soviet design, but the machines were difficult to program and had design features that were poorly suited for data processing applications. Only about 1000 units of all three models were produced, although the production period extended from 1965 to at least 1973.

At essentially the same time that the U.S.S.R. announced and began to produce the Ural-10 series, 1964–65, IBM announced and began to produce its System 360 (S/360) family. In spite of some technical and organizational difficulties, by 1970 IBM had built more than 35,000 units of over a dozen S/360 models. This family was a monumental technological achievement that consolidated IBM dominance over both the domestic U.S. and non-communist international data processing markets.

By any technical standard of comparison, e.g. component circuitry, design, storage capacity and quality, peripherals, software and service, the Urals were very limited compared to the S/360 or the offerings of a half dozen other Western vendors during the mid-to-late 60s. Furthermore, with the exception of the BESM–6 (a large scientific computer), the Soviets were not producing anything else in quantity that was much better than the Urals (but a good deal that was worse) before the 1970s.

Although the Ural-10 series appeared concurrently with the S/360, it can be argued that its real counterpart was the IBM 1400 series. Prominent Soviet computer scientists had been advocating the development of a compatible family since at least 1959. The 1401 model appeared in quantity in 1960–61, and was an immediate success. By the end of 1963, about 14,000 1400 series machines had been built. The decision to go ahead with the Ural family was probably made during 1961–62, and was likely influenced by this U.S. success. Technically, the Urals were much closer to the 1400s than the 360s, but it should

[7] This discussion hardly begins to describe Soviet digital computer development activity before 1970. More detailed sources are listed in the Selected Supplementary References, in particular: Campbell, Davis and Goodman, Ershov and Shura-Bura, Goodman (software), Rudins, and Ware.

be emphasized that the Urals were not close copies of the 1400s. This apparent policy of minimizing technological risk by using an already proven U.S. system as a model for their own efforts, has continued to characterize Soviet computing developments.

The Soviets began working on another upward compatible family in 1966–67, the ASVT family intended for industrial automation, under the Ministry of Instrument Construction, Means of Automation and Control Systems (Minpribor). Production was announced in 1968. This effort represents the first serious attempt by the Soviets to copy serially the architecture of a Western computer (the S/360) at a level intended to provide actual program compatibility. However, the effort failed because of underestimations and the use of an inadequate circuit technology.

Handicaps that continued to afflict all Soviet computer models were problems with and shortages of main and secondary storage and input/output (I/O) peripherals. Secondary storage was on poor quality tape and drum units. Disk storage was essentially nonexistent. Alphanumeric line printers and CRT displays were not widely available until the mid-60s. I/O paper products were very poor. Additional reliability in I/O and secondary storage had to be bought through duplication of hardware or redundant storage of information.

The Soviet hardware situation crippled software development. This was made worse by the lack of hardware vendor customer service. Users had to write all but the most basic utility programs. Furthermore, the users had to maintain the hardware themselves. This eventually led to local engineering modifications that made it difficult or impossible for users with the same CPU model to share software. Soviet computer systems were not large or complex enough to necessitate the development of modern operating systems. Most machines were so small, and so poorly equipped with peripheral devices, that only one application program could be in memory at any time.

Communicating with the computer was another software problem. Every computer has its own basic set of "built-in" instructions, known as the machine language. Writing programs directly in machine language involves writing lines of numeric or symbolic code that requires a detailed knowledge of the internal structure of the computer. Such programs tend to be hard to read and debug, but writing small machine language programs is within the capabilities of most scientists and engineers. Since the mid-fifties U.S. and West European computer scientists had been developing so-called higher order languages (HOL), which used stunted English syntax and standard mathematical notation. Programs written in a HOL are easier to read and correct than those in machine language, and the detailed management of memory locations and register contents is done by the HOL translator (the most common form is called a compiler, a software program that translates a user HOL program into machine language) and other software that is supplied to the user. It is thus possible for relatively unsophisticated users to write large applications programs in a HOL, input the program via some convenient means, and let the systems software (compilers, operating systems, etc.) handle it from there. The use of a HOL requires an appreciable amount of main memory to store the translator, and alphanumeric I/O capabilities.

Because of these and other factors, the Soviet software situation by the early 1970s could be summarized as follows. Software existed primarily in the form of many isolated pockets of machine language programs. There was very little portability between installations. Computer centers were essentially on their own once the hardware was delivered. Many large applications, especially those of a non-numeric nature, were out of the range of the hardware. Little experience had been built up in the development of large, modern software systems. And most important, computers were not accessible to users who had not had much technical training.

By the last few years of the 60s, it had become clear to the Soviets that they had underestimated the effort and commitment that was required to succeed in their goal of pervasively infusing computing into their economy. It is also clear that the leadership had, if anything, become more committed to that goal.

During 1967, it was decided to invest resources comparable to what IBM had put into the S/360, into another effort to build an upward compatible family of general purpose computers. By 1969, the Soviets had succeeded in persuading most of their Council of Economic Mutual Assistance (CEMA) allies to cooperate in the development and production of a computer family to be known officially as the Unified System (ES), and more popularly as Ryad.[8]

It is only with the development of Ryad that the Soviets have begun to follow the West in the production and installation of complex general purpose computer systems that are intended for widespread use. Ryad is the most important concrete manifestation of their commitment to the use of computers in their economy. Cooperation with the other CEMA countries was desired as a means of solidifying economic and military ties through technological interdependence. The Ryad project reflects very high level national and international decisions to build up the general purpose computing capabilities of the Soviet Bloc. This time, there was a commitment to succeed like there had never been before.

Not surprisingly then, the Ryad plan was very conservative. No effort was made to try to attain or surpass the world state-of-the-art in any technical sense. The primary objective was to get a large number of respectably modern computers into productive use in the U.S.S.R. national economy as expeditiously as possible. The plan was to copy a well-proven system from abroad (the obvious choice was the IBM S/360) to limit technological risk, and also to make it possible to "borrow" billions of dollars worth of software that could quickly be put into productive use.

The CEMA countries have been reasonably successful in carrying out this plan, although they underestimated some difficulties. Between 1972–74, five small and medium scale Ryad–1 computers went into production, including two Soviet models. During 1975–76, five others went into production. Three of these are made in the U.S.S.R. The largest machine of the Ryad–1 group, the Soviet ES–1060, did not go into production until late 1977. Many of these models had serious problems, but they still represent significant progress over what had been available earlier. These are reasonably powerful and modern systems

[8] Davis, N. C. and S. E. Goodman, "The Soviet Bloc's Unified System of Computers," ACM Computing Surveys, vol. 10, No. 2, June 1978, 93–122.

and, for the first time, disk storage and respectable systems software (appropriated from IBM) are available to a large body of general purpose users.

The most substantial evidence that the Soviets are satisfied with their current approach to building up their indigenous computer industry is a joint CEMA Ryad-2 series based on the IBM S/370,[9] and a joint CEMA minicomputer project known as the Small System (SM), that seems to be at least partially based on U.S. Hewlett-Packard and Digital Equipment Corp. systems.

Over the last 12–15 years, when the Soviets have been trying to develop a large, capable computing industry to serve the general economy, they have also been trying to build up a much larger and more sophisticated user base. Progress here has been very slow by U.S. standards, but it has not been insubstantial. This is a far larger and more difficult problem than building respectable central processing units. We will have more to say about this problem in subsequent sections.

III. The Computer Industry

A. Structure

Responsibility for most of the computer production in the U.S.S.R is distributed between two ministries. The ministry of the Radio Industry (MRP), under P. S. Sleshakov (a member of the Soviet SALT delegation), has primary responsibility for manufacturing general purpose and large scale scientific computers. Soviet contributions to the Ryad project are under its purview. The Ministry of Instrument Construction, Means of Automation and Control Systems (Minpribor), under K. N. Rudnev, has broad responsibilities for developing and producing equipment for industrial control, where control is defined to include production planning and management. The development and production of computers for these purposes would seem to leave a lot of room for overlap of interest with MRP. Indeed, some of the mainframes Minpribor was building in the late 1960s put it in direct competition with MRP, a conflict that appears to have been settled in favor of MRP. Although its mainframe production now appears limited to the well-regarded ASVT M–4030, Minpribor has effectively staked a claim to most of the openly publicized Soviet minicomputer industry, including the Soviet contributions to the SM project, and its role is now complementary to that of MRP.

Two other ministries are basic to the Soviet computer industry. The Ministry of the Electronics Industry (MEP), under A. I. Shokin, develops components for all the others, and uses some of these components to develop and produce computing equipment for itself and special users. The Ministry of the Communications Equipment Industry (MPSS), under E. K. Pervyshin, is responsible for telecommunications equipment. It will have a major role in the development of computer networks.

Several ministries with a strong defense orientation (aviation, shipbuilding, assorted "machine building" ministries), develop computers for internal use. Several additional ministries are major suppliers of

[9] A Ryad-3 program has recently been announced, but as yet few details are available. Pleshakov, P. S., *Ekonomicheskaya gazeta*, No. 31, July 1978, 15.

material and equipment to computer manufacturers and computer installations. These products include paper cards, paper tape, printout paper, magnetic tape and other magnetically coated storage surfaces and air conditioning equipment. The Ministry of Communications will have responsibility for maintaining telecommunications lines for computer networks.

Among high-level government organizations that are not production ministries, several seem to be deeply involved, on a continuing basis, with the development of the Soviet computer industry. These are the State Committee on Science and Technology (GKNT), the State Planning Committee (Gosplan), the Central Statistical Administration (CSA), the Military-Industrial Commission (VPK), the U.S.S.R. and Republic Academies of Sciences (AN), and the Ministry of Higher and Secondary Specialized Education.

Other government organizations, for example, the State Committee on Standards and the Ministry of Foreign Trade, are also seriously involved with the computing industry.

Within the GKNT, D. G. Zhimerin, First Deputy Chairman, and V. A. Myasnikov and B. I. Rameev, Chief and Deputy Chief of the Main Administration of Computer Technology and Control Systems, are the three senior officials with the most prominent direct responsibilities related to computing. M. E. Rakovskiy, Deputy Chairman of Gosplan and Chairman of the CEMA Intergovernmental Commission on the Cooperation of the Socialist Countries in the Field of Computer Technology, is the most prominent Gosplan official who is directly concerned with the computer industry. N. P. Lebedinskiy, another Gosplan Deputy Chairman, is Head of the Main Gosplan Computer Center and is apparently in charge of Gosplan's efforts to automate some of its planning activities. For a long time, the late applied mathematician and USSR AN President M. V. Keldysh was the most prominent Academy spokesman regularly advocating increased national computer development and use. This job now seems to be that of G. I. Marchuk, a Vice-President and Chief of the Siberian Section. E. P. Velikhov, another U.S.S.R. AN Vice-President, is in charge of general planning for the physical sciences and technology. It is likely that both the CSA and VPK have officials at or near the Deputy Chairman level with direct and continuing duties in the area of computing.

Responsibility for computing would seem to be distributed among several secretaries of the Central Committee Secretariat of the Communist Party of the Soviet Union (CPSU). These include A. P. Kirilenko, who is responsible for the general supervision of the economy, Ya. P. Ryabov, whose duties include the supervision of the military-industrial complex, K. V. Rusakov, who is concerned with relations with Communist countries, V. I. Dolgikh, whose duties in supervising industry would also include the department responsible for Minpribor, and M. V. Zimyanin, with responsibilities in education and science. Kirilenko, who is also a Politburo member, and Zimyanin were important participants at the Second All-Union Conference on the Use of Computer Technology and Automated Management Systems in the National Economy, held in Moscow during May, 1978.[10] The Ryad and SM undertakings, the important role assigned to computing in

[10] D. G. Zhimerin, Ekonomicheskaya gazeta, No. 22, May 1978, 7.

the Scientific-Technological Revolution, and the commitment to the large scale use of computing to help automate the economy must have received considerable attention at the Politburo level.

It is not clear how the various high level government and Party organizations coordinate their computer-related policy making efforts. The government ministries and agencies seem to pursue their own interests as best they can and squabble with each other quite a bit. The Party must intercede to arbitrate some major conflicts and to approve or initiate national commitments and important projects. The Party is also active in monitoring and pushing the industry at the institute and plant level.[11] Recently, P. S. Pleshakov, MRP Minister, revealed the existence of "an interdepartmental coordinating council consisting of the first deputy ministers of a group of ministries" (see footnote 9). This group has responsibilities for coordinating the development and introduction of automated control/management systems (ASUs, see Subsection IV.A), but we do not know who is on the council or its full range of responsibilities. Although detailed information is lacking, it is not unreasonable to conjecture that the overall institutional and decision-making organization of the Soviet computing community is similar to that of defense procurement,[12] although some important differences must exist since the interface between computing and the entire national economy is so broad.

There has been a partial integration of the Soviet computer industry with those of the other CEMA countries. The primary vehicles for this have been the joint ES and SM undertakings. Unified System political and economic affairs come under Rakovskiy's Intergovernmental Commission. The main Ryad technical planning group is at the Scientific Research Center for Electronic Computing Technology in Moscow, under the directorship of A. M. Larionov. During Ryad's first few years, Larionov had a very high profile as the main scientific spokesman for the project. Little has been heard from him during the last few years, and it is not unlikely that some of the management functions of his Center have been taken over by Rakovskiy's Commission. The smaller SM project is presumably under a similar organization, although details are not yet available. Logically, it would make sense for it to be under Rakovskiy as well. B. N. Naumov of Minpribor is the technical director of the SM undertaking.

Too much should not be made of the integration of the Soviet industry with that of the other CEMA countries, or of the much higher level of publicity given to the computer industry during the last decade. Large segments of the Soviet industry remain very introverted and secretive. MRP, MEP and MPSS are among the ten ministries that form the core of the military-industrial complex. There is much unpublicized and classified work being done for the military, high priority industrial efforts, the space program, the CPSU, the KGB, and other special customers.

On the other hand, there is little evidence to support a conjecture that the Soviet military has its own complete computer industry that is separate from, and vastly superior to, the industry that provides for

[11] For example, Kommunist, Oct. 29, 1978, 2.
[12] Alexander, Arthur J., "Decision making in Soviet Weapons Procurement," Adelphi Papers, Nos. 147–148, International Institute for Strategic Studies, London, Winter 1978–79.

the civilian sector. The military does run facilities for the development and production of special purpose equipment, and they do get special allocation and quality control privileges for general purpose equipment. But the available evidence indicates that the military uses the same hardware as everyone else whenever possible, and this includes almost all of their data processing and scientific computing needs. This has to be made necessary by cost and production constraints. In fact, it probably required CPSU pressure to move the military to demand enhanced computer support during the last 10–15 years. Given the conservative attitude of the military, it seems unlikely that they themselves associated military needs with a requirement for a national industry to serve a broad spectrum of needs.

B. Hardware

During the last decade, the main computer production ministries have substantially improved the quality of the components and systems that they manufacture. Although this progress has been substantial relative to the state of Soviet computing in the late 60s, it has not been particularly impressive by more demanding standards. By world standards, the level of circuit integration and the yields of their integrated circuit manufacturing processes are poor. In spite of many Soviet articles on the use of automated production and test equipment, Western visitors have found that computer production remains highly manual as compared with the U.S. Core memory production suffers from an inability to produce small cores and from stringing problems. Soviet-made core memories have high power requirements. These factors, and general production delays, have resulted in actual core memory deliveries running under half of that planned. Poor environmental and quality control still plague production, although the Soviets seem to be more conscious of these factors and have made improvements. Overall Ryad product quality and reliability have yet to reach the IBM levels of the late 60s.

The computer industry suffers from many of the features that characterize the centrally planned Soviet economy. For example, the centralized, fairly rigid, long term allocation of supplies works reasonably well for some purposes, but does not provide the kind of timely response to parts orders that is needed for effective production if design mistakes or revisions are encountered. Difficulties of this kind are particularly disruptive during the advanced development and early production stages of a new model.

Another kind of chronic supply problem has been the poor support that the Soviet computer industry has received from suppliers of relatively low-level products. Less-than-impressive progress has been made by the ministries that produce paper and magnetic storage media, and air conditioning equipment. Soviet-made punch cards are probably responsible for more card reader jams than the readers themselves. Soviet-made magnetic tapes are so poor that visiting scientists often return home to the U.S.S.R. with suitcases packed with Western-made tapes. Air conditioning problems may cause more installation shutdowns than computer equipment failures. Data transmission is not infrequently via telegraph lines at 50–200 bits/second. It is difficult to get telephone lines that can reliably transfer large volumes of data

over a few kilometers at even 1200 bits/second. The ministries responsible for these problems do not seem responsive to complaints in the open media or whatever other pressure has been exerted to get them to take remedial action.

It is difficult to estimate Soviet computer production. They are very secretive about computer-related production facilities. We do not know what is coming out of many of the plants whose existence we are aware of, and there are no doubt production facilities whose existence has been kept secret. Nevertheless, some useful information is available.

The figures below describe the rate of modernization of the Soviet computer inventory during the Eighth and Ninth Five-Year Plan periods:

[In percent]

	1st generation (vacuum tube)	2d generation (discrete transistors)	3d generation (integrated circuits)
1966	65	35	0
1967	57	43	0
1968	43	57	0
1969	31	69	0
1970	23	77	0
1971	15	85	0
1972	4	95	1
1973	0	96	4
1974	0	91	9
1975	0	83	17

THE EVOLVING SOVIET COMPUTER INVENTORY [13]

The Soviet percentages for 1966 and 1975 are close to those of the United States for 1961–62 and 1966–67 respectively. The Soviet rate of modernization has thus been somewhat slower. However these statistics do represent real growth. There was substantial production of second generation computers during most of the Ninth Five-Year Plan period. The number of known computer related production facilities under Minpribor almost tripled between 1965 and 1977; and those under MRP almost doubled. Although the rate of creation of new facilities is probably past its peak, it has been observed that several major existing facilities have the unused floor space to significantly increase production. Soviet hardware porduction is likely to grow at around 15 percent annually, about the same growth rate of the U.S. data processing industry, into the mid-80s.

Current Soviet Ryad production is probably over 1500 machines per year. The other CEMA countries make a few hundred more, and perhaps a couple hundred Ryad-compatible M–4030s are made by Minpribor each year. Production of these machines may be close to saturating real demand, and certainly seems to be more than can be adequately supported at user installations (see Section IV.C). It is difficult to estimate what fraction of the total value of the output of the Soviet hardware industry is in the form of Ryad CPUs and peripherals, but it is probably no more than a third.

The development pace of the CEMA Ryad ½ program is roughly the same as that of the IBM 360/370 program. The S/360 announcement—early production period was 1964–65. The corresponding period

[13] Cheshenko, N. I., "Kak plannirovat' vnedrenie VT?," Ekonomika i organizatsiya prompshlennovo proizvodstva, No. 4, 1978, 221.

for the Ryad-1 models was 1971–73. For S/370 it was 1970–72; for Ryad-2 it will be 1978–80.

However, the volume of Ryad production has been much less than that for S/360. Ryad CPU production estimates for 1971–78 are about 10–20 percent of comparable statistics for IBM S/360 production during 1964–71. There may be an even larger difference in the production of memory and peripherals. The Ryad development-production effort involves 300,000–400,000 people at about 80 facilities in the USSR and Eastern Europe.[14] In 1977, IBM employed about the same number of people world-wide.[15] The IBM figures include large numbers of people involved with typewriters and other office equipment, sales and marketing personnel, and others (e.g. lawyers) who have little or no counterparts in the CEMA figures. Even granting that the CEMA figures may include people not directly connected with the development and production of computers, and taking into account other difficulties of trying to make a direct comparison based on these crude figures, the difference in productivity is striking.

One senior American computer designer has said that the Ryad-1 family "looks like 360 would have if IBM had not had any competition." There are no "fighting models" like the 360/44, 360/67 or 360/91 that were developed in response to underestimated customer needs that had been ferreted out by competitors. The focus has been on central processors rather than on memory, peripherals, service and a general customer orientation. IBM went from S/360 to S/370 through a process of customer feedback and response to the innovations and market pressures of other firms. The CEMA countries are going from Ryad–1 to Ryad-2 without as deep a learning experience. The primary pressure for this transition may well be from the political and economic leadership who have to borrow ideas from abroad.

Another important relative shortcoming of the Unified System has been with the most powerful machines in the family. The IBM 360/65 was available to customers in a viable form within a couple years of the initial delivery of the smaller S/360 models (1965). Its Ryad counterpart, the ES–1050, came along 4 years after initial delivery of the ES–1020 (1972) and is still rarely seen at user installations. At the top of the S/360 line were the model 91 (1966–67) and models 85 and 195 (1968–69). The ES–1060 supposedly went into production in 1977, and they seem to be extremely rare.

More generally, the Soviet computer industry has been having serious trouble producing digital computers suitable for large scale scientific/engineering computations. Since its introduction in 1965, the BESM–6 has stood virtually alone in this category. At least 150 of these machines were built and an appreciable software library has been assembled over the last 14 years. There were assorted rumors about successors, but nothing was formally announced or produced in respectable quantities before the El'brus announcements.[16] BESM–6 production has apparently stopped, but El'brus production is just beginning, and it is not yet clear what is being done with the substantial former BESM–6 production capacity. When the first El'brus models are de-

[14] Rakovskiy, M. E., Pravda, May 31, 1973.
[15] Rothenbuecher, Oscar H., "The Top 50 U.S. Companies in the Data Processing Industry," Datamation, June 1978, 85–110.
[16] Burtsev, V. S., Pravda, Apr. 4, 1978. The El'brus-1 is believed to be based on the Burroughs B7700 design. The El'brus-2 is a coupled system of El'brus-1 machines.

livered in 1979 or 1980, they will be the first announced Soviet computers to exceed the computing power of the CDC 6600 (1964).

The largest known non-Ryad computer production effort in the U.S.S.R. is minicomputer production under Minpribor. Starting with the later ASVT machines in 1972–73, Minpribor has been building minicomputers and current production may be over 1,000 machines per year. Right now the Soviets seem to be making all four of the SM minicomputers that have been annouced as being in serial production.[17] MRP also has a minicomputer line, the Elektronika models, but this appears to be a much smaller project.

It is impossible to accurately estimate the volume of production of core memory, peripherals, paper and magnetic storage media. However, it is clear that there are serious shortages of everything.[18]

C. Software [19]

Software development would seem to circumvent some of the systemic difficulties that plague other products. Once the basic hardware exists at an installation, software work does not depend to any great extent on a continuing and timely flow of material supply from outside sources. Not surprisingly, Soviet enterprises have a tendency to avoid intercourse with and dependence on the outside. It would seem easier to develop an inhouse software capability than one for spare parts or raw materials. It would also seem that commercial software houses would be able to provide better service than, say, a hardware maintenance group. The software house is not in the middle of a supply chain, the hardware maintenance group is. Since the software industry does not involve the distribution of material products, more casual horizontal vendor-customer relationships would be expected to be less troublesome for the central planners. Finally, the problem of the mass production of copies of a finished product is reduced almost to the point of nonexistence.

But the firm-level advantages just described may be less advantageous than they appear. The development of a broad national software capability is not like the development of a capability to build computing hardware or armored personnel carriers. The nature of software development places considerable emphasis on traditional Soviet economic weaknesses and is not well suited to the "annual plan" form of management that is dominant in the U.S.S.R.

In the United States there are a large number of companies that provide professional software services to customers. They range in size from giants like IBM to one-man firms. Some build systems and then convince users to buy them. Others ascertain customer needs, and then arrange to satisfy them. The sofeware vendors and service bureaus have created a market for themselves through aggressive selling and the competitive, customer oriented, development of general purpose and tailor-made products. The established companies spawn others. Employees who learn the commercial software business at a successful firm not infrequently take this training and some good ideas and start

[17] Ekonomicheskaya gazeta, No. 21, May 1978, 14.
[18] For example: Planovoe khozyaistvo, No. 5, May 1977, 48–53, and Sovetskaya Moldavia, Jan. 1, 1978, 2.
[19] Goodman, S. E., "Software in the Soviet Union: Progress and Problems," Advances in Computers, vol. 18, 1979.

companies of their own. This kind of training is really not available at universities or government R&D institutes.

The Soviets have yet to come up with effective counterparts to these firms for the customer oriented design, development, diffusion and maintenance of software. One enterprise, the Tsentroprogrammsistem Scientific-Production Association in Kalinin, has been publicly identified as a producer and distributor of ES user software. This organization is under Minpribor. Some research institutes, computer production associations and local organizations develop and service software, but complaints about their work is common and praise is rare. We know little about what these places are doing or how they function. The average Soviet computer user does not seem to have many places it can turn to for help. This is particularly true of installations that are not near major metropolitan areas.

In contrast to the U.S., where a large and dynamic commercial software sector balances the academic orientation of the universities, software activity in the U.S.S.R. continues to have a strong academic flavor. Emigres who have claimed employment as programmers usually do not display much capability for practical work. Many are essentially mathematicians more concerned with concepts, rather than with building inelegant working systems against time and cost constraints. The U.S.S.R. clearly has some very able people, such as M. R. Shura-Bura and his group at the Institute of Applied Mathematics in Moscow, who can handle practical problems, but there do not seem to be many such people.

The mere fact that we know so little about Soviet software firms is strong evidence that the volume and pace of their activities must be much below that of the American companies, or at least that benefits to users are limited by a lack of readily available information. Most American computer users are not very sophisticated and need to have their hands held by vendors and service companies. Most Soviet users are less sophisticated. It is inconceivable that the U.S.S.R. has anything comparable to the American software companies that we do not know about, because then there is no way for the thousands of computer users in the Soviet Union to know about such services either. It is simply not the sort of thing that can be successfully carried on in secret on a very large scale.

Considerable potential for improvement exists. Although there do not seem to be many commercially developed software products in widespread, operational use, there have been quite a few articles on systems that are being developed with this goal. Many of these are for management information systems intended for general or industry-specific users. There is high level push for the standardization and increased commercialization of software.[20] Sooner or later, as they gain experience, some of the industrial and academic institutes that are doing software will evolve into viable software houses. There are other possibilities. Right now computer installations are building up in-house software capabilities to meet their own needs. After a while there is bound to be local surpluses of various kinds. We might see the gradual development of an unplanned trade in software products and programmers among enterprises. This sort of trading goes on all over

[20] For example: Myasnikov, V. A., Sovetskaya Rossiya, Dec. 24, 1976, 2 and Zhimerin, D. G., Ekonomicheskaya gazeta, No. 22, May, 1978, 7.

the economy, and there is substantial opportunity for software. Finally, it is not inconceivable that a little unofficial free enterprise might evolve, as it does in plumbing and medicine. Small groups of bright young programmers might start soliciting moonlighting tasks.

The extent of the software service problem may go beyond applications software. We know little about how new operating systems releases are maintained or distributed to users, although in 1976 the All-Union Association Soyuz EVM Komplex was established, along with local affiliates like Zapad EVM Komplex in the Ukraine and Moldavia, to centrally service both hardware and software,[21] and the software group at Larionov's institute in Moscow, which adapted IBM OS/360 to Ryad, regularly produces new releases.[22] But we do not know how the changes are made and how effectively the new releases are used.

The Soviets are not in the habit of soliciting or seriously considering a broad spectrum of customer feedback. The research institutes that maintain the ES operating systems may only communicate with a few prestigious computer centers. New releases are probably simply sent to users who are not likely to get much help should local problems arise. Although all of the ES operating systems have gone through several releases since they were introduced, we cannot really tell to what extent this reflects the addition of significant capability enhancements, academic (i.e. non-cost effective) design optimizing perturbations, or accumulations of fixes. We suspect the Soviets try not to tamper with the operating systems unless they have to in order to get them to function adequately. Similarly, it is likely that many users simply stick with the first release that they can get to work satisfactorily.

User groups are also vehicles for software diffusion. Before Ryad, the Soviets tried several user groups. Lack of interest, the lack of sufficiently large user bases, poor communications, large geographical distances, a lack of hardware vendor support, and assorted bureaucratic aggravations severely hampered these efforts. Furthermore, the existence of many installations were secret, membership in some groups required security clearances, and lists of centers using the same models were probably not readily available. The BESM–6 and M–20/220/222 user groups seem to have been the most successful. These machines were particularly favored by the military and other high priority users, and the importance of the clientele and their applications had to be a significant factor in these relative successes. These two groups hold regular technical meetings and have built up respectable libraries over the last 10–20 years. It is likely that both had active support from the hardware developers and manufacturers. Most of the other user groups do not seem to have worked out as well.

There is a Ryad user group, but current indications are that it may not be much more effective than the others. To be really successful, the Ryad users would have to be supported by the specific enterprises that developed that model's hardware and systems software. Even then a group's effectiveness might be geographically confined.

In addition to the users groups, there are assorted program libraries, conferences, and professional societies. They help develop, diffuse and

[21] Pravda Ukrainy, Sept. 7, 1977.
[22] Peledov, G. V. and L. D. Raykov, "Sostoyanie i perspektivy razvitiya operatsionnoy sistemy OS ES," in M. E. Rakovskiy (ed.), Vychislitel'naya tekhnika sotsialisticheskikh stran. Sbornik statey. vol. 2, 1977, 78–81.

maintain software in the U.S., and no doubt in the U.S.S.R. as well. We know little about their activities, but what we have seen has not been particularly impressive. The software libraries are poorly indexed and quality controlled. Conference proceedings are not rapidly published or widely disseminated. The professional societies do not appear to be anywhere near as numerous or active as their U.S. counterparts.

IV. The Use of Computers in the Soviet Economy [23]

A. Automated Control and Management Systems (ASU)

By far, the most extensive and prominent computer applications activity in the U.S.S.R. relates to what are collectively called automated control/management systems (ASU). The ASU spectrum runs from the simple no-direct-control monitoring of a small production process to a grand national automated data system for planning and controlling the economy of the Soviet Union. The creation of ASUs has become a major nationwide undertaking and there are now hundreds of articles and books on ASUs appearing in the Soviet literature.

A wide range of ASUs are under development.[24] Starting at the top and working our way down the economic/industrial hierarchy, we have—

At the national planning and control levels:

OGAS.—The system for gathering and processing data for planning and controlling the entire economy of the U.S.S.R. Council of Ministers.

ASPR.—The automated planning calculation system of U.S.S.R. Gosplan.

ASUMTS.—ASU for the State Committee for Material and Technical Supply (Gossnab).

ASUNT.—ASU for scientific and technical progress. State Committee for Science and Technology (GKNT).

ASUNT-S.—ASU for scientific and technical progress and planning and design in construction. State Committee for Construction Affairs (Gosstroy).

ASGS.—Automated state statistics system. Central Statistical Administration (CSA).

AIUS-SM.—Automated information control system for standardization and metrology. State Committee for Standards (Gosstandart).

ASU-tsen.—ASU for price setting. State Committee for Prices (Goskomtsen).

At the national industrial branch and department levels:

OASU.—Branch ASUs. All Union and Union Republic ministries.

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[23] This section will be concerned almost exclusively with practical matters. For reviews of the Soviet theoretical literature on the "scientific management of society" and the "scientific-technological revolution," see Hoffmann, Erik P., "Soviet Views of the 'Scientific-Technological Revolution,'" World Politics, vol. XXX, No. 4, July 1978, 615–644, and Hoffmann, Erik P., "The 'Scientific Management' of Soviet Society," Problems of Communism, vol. XXVI, May–June, 1977, 59–67.

[24] Pevnev, N. I., ASU v Moskve i podmoskov'ye, Moskovskiy rabochiy, Moscow, 1976.

VASU.—Department ASUs. Departments of the U.S.S.R.

At the republic planning and control levels:

RASU.—Republic ASUs. Council of Ministers of the Union Republics.

ASPR-r.—Automated planning calculation systems of the Union Republic gosplans.

At the republic industrial branch and department levels:

UASU-r.—Branch ASUs of republic significance. Union Republic and republic ministries.

VASU-r.—Department ASUs. Departments of the republics.

At the national and republic middle management levels:

ASUVPO.—ASUs for the All Union industrial associations of the ministries of the U.S.S.R.

ASUTO.—ASUs for territorial organizations. Territorial main administrations, administrations and trusts of U.S.S.R. ministries, etc.

ASURPO.—ASUs of republic industrial associations.

At local management levels:

ASUPO.—ASUs for local production associations.

ASUK.—ASUs for combines.

ASUP.—ASUs for enterprises.

Finally, we have:

ASUTP.—ASUs for controlling industrial processes.

In addition to this economic/industrial hierarchy, there are others. The military is working on a variety of ASUVs, and we occasionally get a glimpse of how well they are doing, but it is not possible for us to give much detail on what is being developed. The CPSU and KGB no doubt have assorted ASUs of their own.

Computerized information and control systems, which include the entire ASU spectrum, can be categorized by a variety of technical measures of generality, functional capability, flexibility and user transparency. At a high level, there are data base management systems (DBMS). This software is used to manage a collection of interrelated data stored together with controlled redundancy to serve one or more applications. The data are stored so as to be independent of programs which use the data, and a common approach is used to add, manipulate and retrieve data. At a low level, there are simple file storage systems. These can be simple "buckets" for holding information. They have essentially no functional capabilities, tend to be limited to a single application, and the user program has to do all the data management work itself. A wide variety of possibilities exist between these two extremes. Another measure of system sophistication is the presence of significant real-time capabilities. This refers to an application in which response to input is fast enough to effect subsequent input. For example, one can think of an automated control system directly interfaced with a transportation system, say via traffic signals, where computation occurs during the actual time that the related physical process transpires so that results of the computation can be used to guide the physical process. Other features that may characterize system sophistication are telecommunications capabilities and networking (communication between two or more computers). Again, there are many technical possibilities within each category.

Although a great many articles describing a great many ASUs have appeared, by U.S. standards these articles give little substantive information. It is thus difficult to do much more than list a lot of specific ASUs (for examples, see the supplementary references or present some tentative observations.

It is reasonable to assume that the ASUs that are described in the literature and those that are shown to U.S. visitors are well above average. In terms of the technical measures just described, most of these systems are not particularly impressive. They tend to be more like file storage systems than full-fledged data base management systems. There is considerable interest in the U.S.S.R. in DBMS, but much of this work is still developmental and based on foreign, especially U.S., systems. Some important, although somewhat specialized, DBMS seem to be in field testing stages, including one at Gosplan. Not many Soviet ASUs for controlling industrial processes have substantial real-time capabilities, although interest in this area is high and steady improvement is expected. In comparison to U.S. industrial control systems, those in the U.S.S.R. tend to do much less direct real-time control, being limited more to collecting and monitoring information. Part of the problem is a lack of readily available off-the-shelf devices to interface the computer with the process to be controlled, and a lack of experience in building good real-time software.

The Soviets like to count their industrial/economic ASUs. At the beginning of the Tenth Five-Year Plan, there were 2,778 ASUs in operation; of these, 2,364 were created during the Ninth Five-Year Plan.[25] Included were 789 for the control of industrial processes, 989 enterprise management information systems, 692 for territorial management, 187 for the management of ministries and other important agencies, and 121 computerized systems for information processing. The Soviets are investing a great effort in the creation of ASUs, and it would not be surprising if they claimed double these figures at the end of the Tenth Five-Year Plan period.

There are all sorts of other seemingly impressive statistics floating around. In mid-1972 there were 50,000 "specialists" working with ASUs and in 1975 there were to be 200,000.[26] If this number increases roughly in proportion to the increase in the number of ASUs, then this figure was probably achieved and it may currently be much higher. Enterprises that describe their ASUs claim impressive ruble savings.[27] The average cost recoupment period was claimed to be 1.2 years for ASUTP and 3.3 years for management ASUs.[28] The first stage of the main CSA ASU, ASGS, is now operational and has made it possible to handle a 41 percent increase in statistical information during the current Five-Year Plan with only a 14 percent increase in cost, and the time it takes to prepare reports has decreased impressively.[29]

Despite these, and other, statistics we do not have a good, detailed picture of how or how well the Soviets are using the ASUs they have announced. These statistics are not meaningless; no doubt the use of

[25] Ekonomicheskaya gazeta, No. 37, September 1976, 1.
[26] Myasnikov, V. A., Izvestiya, May 27, 1972, 2.
[27] For examples, see Pevnev (footnote 24).
[28] Myasnikov, V. A., Ekonomika i organizatsia promyshlennovo proizvodstva, No. 6, 1974, 87–96.
[29] Volodarskiy, L. M., Ekonomicheskaya gazeta, No. 26, June 1978, 5.

automated information and process control systems is enabling them to save money, increase productivity, and limit the number of nonproductive workers. But we do not know what many of these statistics mean. For example, is a "specialist" working with an ASU a programmer, systems analyst or other data processing professional, or does the term include every economist, engineer, administrator and clerk who reads the output from an ASU?

As rough estimates, there are now 4,000 ASUs and 20,000–25,000 small computers and mainframes in the U.S.S.R. With few exceptions, it appears that most of these ASUs are not widely disseminated, but used only locally.[30] We know very little about the distribution of the ASUs among the computers. We don't even know if the Soviets know themselves. What is clear is that the number of Soviet enterprises and organizations that do not have computers is an order of magnitude greater than the number that have. Furthermore, more than half of the machines are small with small storage capacities and not suitable for much beyond limited engineering computations or simple process control.

Two major obstacles to the successful infusion of ASUs into the economy are the resistance of management, who are comfortable in their pre-automation environment, and the inexperience of Soviet computer scientists and programmers. The Soviets have been making steady progress in overcoming both problems. Industrial managers are beginning to appreciate the potential of computers for doing certain kinds of tasks which need to be done, and the software specialists are beginning to more realistically think about simple, useful systems that are within their capabilities to build. This gradual convergence seems to be getting a lot of small systems built and used. None of this work is particularly imaginative by U.S. standards, but there is no reason to expect it to be. The economic environment is conservative and introverted. The Soviets are cautiously and independently repeating much of the learning experience that took place in the U.S. in the late 50s and 60s. It would be surprising if they were doing anything else.

The national ASU development program has the most distinct Soviet character of anything that the U.S.S.R. has done in computing. Although progress in the pervasive infusion of computing into the national economy has been slow by U.S. standards, Soviet interest in ASUs at all levels is genuine and serious and progress has not been insubstantial relative to their own past. The Soviets started late and it has been taking them quite a bit of time to implement their concepts of ASUs into their centralized, hierarchical way of doing things. But, in theory at least, there is considerable potential in their approach. They have yet to really take advantage of the opportunities afforded by a centralized, hierarchical control structure in such areas as standardization and diffusion of information, products and services. There are enormous technical and systemic problems to be overcome, but the Soviets are persevering and it will be interesting to see how well they will do.

[30] This problem must certainly be a major concern of the "interdepartmental coordinating council . . . of first deputy ministers" mentioned by Pleshakov (footnote 9).

B. Networks

In spite of the publicity that they give to the subject, the Soviets have had trouble building and using computer networks. During the late 1960s and early 1970s, they tried to build several interactive time-sharing and reservations systems. None of the well-publicized projects came to much.

At this time, seven years after Ryad production first began, the vast majority of installations in the U.S.S.R. use batch processing systems built around one computer. There are Remote Job Entry (RJE) systems using dedicated cables over short distances, interactive systems with all terminals connected to a host processor (occasionally processors) via dedicated cables, and elementary "distributed networks" in the form of smart terminals or small computers connected to a large machine via dedicated lines. There are at least two simple long-distance systems in some kind of operational status. They use dedicated 1200 bit/second lines to connect terminals to host computers.

The largest operational computer-communications network in the CEMA countries appears to be the Hydromet-Pogoda system under the Main Directorate of the Hydrometeorological Service (GUGMS) under the U.S.S.R. Council of Ministers. This is a nationwide weather-related data processing network with six main data traffic switching centers (Minsk, Kiev, Moscow, Tashkent, Novosibirsk and Khabarovsk) and more than 30 "subscriber complexes" scattered all over the country. Weather-related data is input to these nodes from thousands of ships, coastal observatories, balloons, satellites (at some main centers only), airfield weather stations, etc. After processing, various reports are output to thousands of user destinations. Although parts of it are still under development, most of this system has been operational for a few years.

Hydromet-Pogoda has the potential to become a major distributed network. However, this seems to be a long way off. As far as is known, the data processing computers are not really coupled to the communications system, and the communication system itself is not a network with a substantial computer component. As late as 1976–77 at least some of the main switching centers were using pre-Ryad computers for their basic data processing chores. The Pogoda–I communications system uses low level equipment by current U.S. standards. There also appears to be a great deal of manual data handling. However, for all its shortcomings as a computer network, this system appears to function tolerably well by Soviet standards.

It is not unreasonable to conjecture that Hydromet-Pogoda represents the state-of-the-operational-art for large-scale networks in the U.S.S.R. This must be a system that is of considerable interest to the Soviet military, and it would make more sense for them to use it and contribute to it through some sort of special status than to have an equivalent, duplicate system for its own use.

Another network in-the-making that should be worth watching is one that is being developed by the Estonian SSR Academy of Sciences.[31] It is anticipated that this will be a large host-processor system

[31] Liyvak, Yu., Izvestiya Akademii i Nauk Estonskoy SSR, fizika, matematika, vol. 26, No. 2, 1977, 225–228, and Sovetskaya Estoniya, June 20, 1978, 2.

built around a B7700-like El'brus-1 with substantial RJE and interactive capabilities located throughout Estonia. Right now, it seems that this project is in its early development stages, and the El'brus has not yet been delivered. On various occasions the Baltic republics have been put forward as laboratories for the development of large, computerized, economic planning networks to be used as models and test beds for the entire U.S.S.R. The Latvian Academy of Sciences claims to have build a substantial time-sharing network in Riga.[32]

U.S.S.R. Gosplan (State Planning Committee) does not seem to be building a computerized, telecommunications network linking its various computer centers and those of localized planning agencies. Such a network has been widely discussed since the late 1950s, and it is no doubt a goal for the future. However, the Soviets have announced work on an experimental computer network, with centers in Moscow, Kiev, Tashkent and Tomsk, that will be used by U.S.S.R. Gossnab (State Committee for Material and Technical Supply).[33]

Another widely publicized form of Soviet network is the "group use computer center." Twenty were supposed to have been built by 1975, but none were.[34] Now the goal is to have six by 1980 (Zhimerin, footnote 10). The objective of these centers seems to be to provide computer services to local or regional uses through a centralized facility with modest network capabilities.

Both the Central Statistical Administration and the railroad system have computer centers distributed all over the country. However, as far as we can tell, almost none of this is networked, and many of the centers are using old equipment with limited capabilities.

It is important to re-emphasize that much of the Soviet computer and telecommunications industry is highly secretive, and that it is possible that there are classified projects which are more impressive and advanced than what has been described here. Furthermore, it has not been possible to get a good look at any of the major network projects, such as those described here, that have been discussed in the open literature.

Soviet networking problems stem from a lack of good off-the-shelf peripherals and telecommunications devices, a very poor national telecommunications system, an underdeveloped software industry, and a small base of relevant experience and know-how. The Ministers of MPSS and communications recently described efforts to create a Nationwide Data Transmission System (OGSPD) which will become the basis for the U.S.S.R. Unified Automated Communications System (EASS).[35] It would seem from their statements that standardized equipment, system design and engineering are at best in developmental stages. One could speculate on how long after such equipment is actually generally available it will take the Soviets to build large operational computer networks. The effort will almost certainly be aided by the exposure of Soviet scientists to Western network software.

C. Service Factors

The use of general purpose computers on a scale large enough to begin to pervade an economy the size of that of the U.S.S.R. requires

[32] Sovetskaya Latviya, Apr. 28, 1978, 3.
[33] Izvestiya, Jan. 3, 1979, 2.
[34] Rakovskiy, M. E., Pravda, Mar. 2, 1977, 2.
[35] Pervyshin, E. K., Ekonomicheskaya gazeta, No. 25, June 1978, 7. Talyzin, N. V., Ekonomicheskaya gazeta, No. 26, September 1978, 7.

a large, sophisticated service structure. The complexity of modern hardware and software systems is such that the great majority of commercial users do not have the resources to take full advantage of available computing capabilities without substantial and continuing outside help. Hardware needs preventive maintenance; failures have to be diagnosed and repaired; spare parts have to be available. Large software systems are never completely error-free, errors need to be ferreted out and corrected for years after a product goes into commercial use. Software also needs to be adapted to new hardware and to be functionally enhanced over its normal life cycle. Of the utmost importance is customer education; they need to be shown how to apply their computers to effectively and efficiently meet the needs of and create new opportuntities for their enterprises.

The Soviet computer industry has not done a good job, at least by Western and Japanese standards, of providing its ordinary customers with hardware installation and maintenance services. Only a third of the computers in Leningrad and the Leningrad Oblast are currently covered by centralized computer services.[36] The services that are provided to even these installations in the U.S.S.R.'s second most important metropolitan area leave much to be desired: the time between a repair request and the arrival of service personnel takes several days, the repair organizations have trouble obtaining spare parts, machines are down for months at a time. The situation seems to be worse in most of the rest of the country.[37]

According to figures from the Central Statistical Administration, the national average for computer use is 12–14 hours/day.[38] Although this is low by U.S. standards, it is not outrageously low. Somehow Soviet installations keep their machines running respectably well, in spite of the facts that their hardware is not especially reliable and service is bad. When outside service is inadequate, the obvious alternative is to support in-house maintenance and repair capabilities. This means finding and retaining trained engineers and maintaining a stockpile of spare parts. As Soviet computer systems become more complex, this becomes increasingly difficult for all but the largest, highest priority or most prestigious installations to do. Service problems for supporting systems (e.g. air conditioning units) no doubt adds significantly to equipment down-time. As time goes on, it will also be more difficult for users of models of pre-Ryad manufacture to obtain replacement parts and find experienced people who can take care of this equipment. We do not know how the CSA national average was computed, and it is possible that the data on which the calculation was based could be easily padded. It would be interesting to see that average broken down in more detail—by geographical region, by computer model, and by "rank" of user installation.

Soviet computer installations seem to be pretty much on their own with respect to both maintenance of centrally distributed systems software and the creation of applications software. The Soviet educational system does not seem to be doing a particularly impressive job of meeting the demand for good, practical programmers. This demand is prob-

[36] Sotsialisticheskaya industriya, July 19, 1977, 2 and Sept. 4, 1977, 2. Izvestiya, Mar. 14, 1978, 2.
[37] For example: Sotsialisticheskaya industriya, Dec. 25, 1971, 2; Izvestiya, Aug. 22, 1975, 3; Ekonomika i zhizn' (Tashkent), No. 6, 1977, 83–86.
[38] Rakovskiy, M. E., Pravda, Mar. 2, 1977, 2.

ably artificially high, for the actual computing power available, because of poor software diffusion mechanisms and the resultant duplication of effort. The users themselves have had limited success in creating substitutes, e.g., user groups, professional societies and informal arrangements to help compensate for the near lack of a commercial software industry.

It is clear that the poor service situation is hurting the efficient use of even existing computing capabilities at most installations in the U.S.S.R. Nevertheless a gradual, and nontrivial, improvement can be discerned over the last 20 years. Although intolerably slow and inadequate by U.S. standards, progress has come in several ways. Soviet vendors are now training field engineers and other hardware service personnel in not insubstantial, but still inadequate, numbers. While these people may not be well trained or motivated or experienced by Western standards, the fact that they exist and eventually answer calls and perform useful functions does represent progress. The hardware itself has also been improved in terms of maintenance and reliability. Newer models have better circuits, built-in hardware diagnostics, and modular structures to facilitate parts replacement. From the applications standpoint, computer usability has been enhanced by new interrupt systems, multiprogramming operating systems, assorted utility and library software, memory protection, a wider assortment of peripherals, greater peripheral availability, etc. The educational system is producing more programmers and computer-conscious managers.

Helpful institutional arrangements are also evolving. Contracting arrangements are more widespread, and can be expected to become more effective as both contractors and customers acquire experience and learn to better appreciate their requirements and capabilities. The aggregation of Soviet enterprises and institutes into the corporation-like research-production associations may be an opportunity to create consolidated in-house programming and maintenance groups that provide better services to the associations and their component organizations that would be possible if these resources were spread out over and hoarded by a large number of independent enterprises.

The aggregation of computer services under the research-production associations is an example of how user installations can try to compensate for systemic deficiencies. The vertical, hierarchial structure of the Soviet political-economic system makes it difficult to establish useful, functioning horizontal relationships. This is particularly true of those that cross ministry boundaries or which involve long physical distances. Thus the flexible, low-level, user-industry-independent horizontal user-support services that characterize the American computer sector are effectively precluded. Given the Soviet economic structure, the obvious alternatives would be highly centralized, inflexible, standardized service that flows downward parallel to the management hierarchy, or local efforts to build up and protect in-house capabilities. In both cases, fluid horizontal exchange, which is so hard for the central planners to control, is avoided. Since progress along the lines of the first alternative has been slow, the users have little choice but to do the best they can with the second. Available computing resources are spread much too thinly in this way at the enterprise

level. At the association level, resources might be better consolidated, yet local and ministerial control preserved.

In the U.S.S.R., not all customers are equal. The military, the CPSU, and other special users have extraordinary privileges. Special computer users in the Soviet Union can regularly exercise peacetime prerogatives that would be almost beyond comprehension in the U.S. When a special user makes a special request of a hardware manufacturer, software developer, Academy of Sciences research facility, etc. that request is attended to, even if it plays havoc with the normal work load. A military customer might, for example, show up at a plant building computer parts and request a certain number of parts with testable performance characteristics. That customer can shut down production for all other customers until it gets what it wants. Little is known about the computer user support services that special users can command, but indications are that these are significantly better than what is available for ordinary users. Nevertheless, the creation of a complete computer user support structure is not like building tanks. Special users in the U.S.S.R. may not have much trouble getting spare parts, but they have to be suffering from a lack of a large volume and variety of commercial quality, customer-tested, software such as what has been built up among the civil computer users in the U.S. This represents an immense reservoir of talent and products that could be tapped for much of the needs of special users. The civil reservoir in the Soviet Union has much less to offer, and the special users cannot build up a capability like that of the U.S. by themselves.

V. Prospects for Further Development

Although changes in perceptions and technological progress have been slow and not particularly impressive in comparison with what has taken place in computing in the U.S., there has been substantial progress in both areas from the Soviet point of view. There are still some hardware deficiencies, particularly in telecommunications, but most of the necessary hardware is available for them to get on with their ambitious plans. In terms of quantity, the output of computer equipment in the U.S.S.R. is quite impressive in comparison with that of any other country, with the exception of the U.S. and its multinationals abroad. The U.S.S.R. is now in a position to concentrate on improvements in quality rather than on sheer quantity. As has been the case in the West, further progress in hardware will come primarily by pushing technology to make it economically practical to do things that are already well into the development stage.

The real problem is now more broadly and deeply systemic; the pervasive and effective integration of computing into the fibre of their national economy. This system is poorly structured to support many of the practices that work well in the U.S. If the Soviets are to realize their proclaimed goals, it will be necessary for them to solve some difficult problems themselves.

A major reason for U.S. success in developing and using computing is the existence of a social and economic environment that is precisely what the Soviet leadership wants to avoid. In fact, it is the hope of the leadership that this technology can help strengthen the existing system by making it more efficient and by providing new opportunities

and capabilities. Nevertheless, we have seen that the substantial progress that the Soviets have made during the last dozen years has been dependent on the U.S. example. It seems likely that further progress will be in the form of hybrid Soviet-Western solutions to an assortment of problems.

But how far might the Soviets drift toward the Western side of these hybrid solutions? Probably not very far, except perhaps in the narrow technical sense of following hardware designs, borrowing software, etc., and certainly not very quickly. A major problem, from the standpoint of the political leadership and planners, is that computer development and use on a national scale cannot be isolated like most of the narrowly focused military-related industries, or even like industries such as electric power, steel, cement, etc. whose products are used relatively passively as compared with computers. In particular, major reforms that would greatly improve the quality and availability of computing services would be difficult to keep contained. If changes were made to enable a Western-style service sector to exist among thousands of computer installations cutting across the domain of every ministry and geographic fiefdom, then (if successful) how could there not be pressure to extend these changes beyond computing! Attempts to institute such reforms could possibly make things worse, at least for a while; it could take Soviet vendors and their customers decades to learn to play well by the new rules.

It is not even clear if decentralization is the best direction for the Soviets to move toward. American vendors and users have shown that computing can be either centralizing or decentralizing. Parts of the U.S. computer industry seem to function well under effective centralized control (e.g. IBM and general purpose mainframes); other parts do well with a highly decentralized structure (e.g. applications software companies and the manufacture of circuits). Centralization and decentralization together make possible progress that would not be possible under only one or the other, and the combination keeps them both honest. Similarly some U.S. user enterprises have used computers to centralize operations, and others have used them for decentralization. It is even possible to do both simultaneously (e.g. a hierarchical network of distributed data bases).

An important point to be made here is that the Soviet vision of using computing as a means of implementing more effective centralized control on a national scale is neither hopelessly ill-conceived nor unattainable (to some extent at least) by the end of the century. Furthermore, this goal could possibly be achieved concurrently with a considerable amount of politically acceptable economic decentralization. This paper has tried to show that, thus far, the gap between Soviet theoretical aspirations and practical implementations has remained large and that progress in closing that gap has had to wait for foreign examples. But the Soviets have yet to take full advantage of the opportunities, which exist in theory at least, afforded by national centralized control.

In the meantime, the Soviets have some difficult problems to overcome if they are to continue to progress at their current rate. Two of the most important of these are the prevalent users' attitude toward computer-related vendors and the attitude of Soviet law and middle level management towards the introduction of computers as an important element within their domains.

There is a users' attitude that accepts the poor service situation, and is thus a major obstacle to progress. Most complaints disappear into bureaucratic oblivion, and complaints that would get at the heart of the problem are politically unacceptable. Soviet vendors have little responsibility (or even guilt feelings) toward their customers. Ordinary Soviet users have little choice but to do the best they can with whatever they have, and passively wait in the hope that the leadership will get around to doing something about their problems.

Much of the reason for this problem lies in the fact that the Soviet computer industry lacks both the concept and reality of "vendors" as it exists in the U.S. We have used the term, perhaps overgenerously, to describe Soviet organizations that might be more accurately labeled "manufacturers," "warehousers," and "distributors." These organizations are not interested in users' problems or in promoting the use of new products, and the users have learned not to expect much from them.

There is room for improvement within small perturbations of the current system. As noted earlier, users appear to be getting some relief as a result of gradual improvements in contracting arrangements, and through consolidation of resources into more viable and self-sufficient units. At least two major organizations, Minpribor and the Central Statistical Administration, have given serious attention to servicing their computing facilities. Perhaps others will find it necessary to follow suit? We might also expect to see the gradual establishment of an unofficial trade in computer services and products among installations that have built up capabilities of one form or another, and perhaps even some after-hours entrepreneurial activity among programmers.

Soviet low and middle level management does not have the kind of motivation that has driven the desire to use computers in the U.S. For the most part, they are unconcerned with competition or finding suppliers and customers. They are not stimulated to acquire and use information to create or take advantage of unexpected opportunities in a changing market environment. Their incentive system seems to be such as to encourage the deliberate falsification of statistical reporting and the concealment of capabilities. Soviet management tends to be older and more inhibited than their American counterparts, and political reliability and service has been an important criteria for advancement. Taken together, and reinforced by the poor service situation, this has led to a deeply entrenched conservative, introverted posture highly resistant to the prospect of integrating complex, risky, initially disruptive computer systems into the heart of their operations. A clear case of this sort was recently described;[39] other examples are probably more abundant than the Soviets would ever admit. In spite of a substantial influx of new blood into management in the late 70s and early 80s, and talk about improving managerial training along the lines of American models, progress here will be slow and evolutionary. It is difficult to imagine how the American models could be effective in the context of Soviet economic structure or how such re-education could take place on a national scale in a short time.

[39] Pravda, Mar. 13, 1978, 2.

One peculiarly Soviet technique for increasing the computer consciousness of management is via the ideology of the "scientific-technological revolution," in which computing is a centerpiece technology. Whatever its philosophical merits, in terms of promoting the practical enterprise-level use of computing, the new ideological framework is useful in two ways. It must provide at least some form of indirect guidance as to what kinds of applications are off limits. Soviet production facilities are to be discouraged from modeling alternative supply and marketing strategies on their own. They might discover that the arrangements handed down by Gosplan are far from optimal or rational. This sort of thing has not been much of a problem since most computer installations do not have the required technical expertise, Soviet management has been reasonably well conditioned to avoid such activity, and much of the necessary information is classified or otherwise unavailable to potential modelers. In fact, it is the exact opposite kind of consideration that provides the most practical arguments for the new ideology. Enterprise-level management needs to be prompted into trying to seriously use the technology. In the Soviet economy, it is apparently a necessary, although by no means sufficient, condition that such high level exhortation exist in order to obtain a significant, broadly based response to new ways of doing things. It may be particularly necessary now since the serious integration of automation into an organization's activities is often a source of monumental trouble for management and workers alike.

The U.S.S.R. has lots of talent and lots of need. The two need to be brought together in some effective way. Various forms of technology transfer from the West might serve as catalysts to help bring this about. However, the changes that will come will take time and have to fit in with the way things are done in the Soviet Union. Simple foreign transplants will not work. No reforms in a country that is as self-conscious as the U.S.S.R. can be successful if they are divorced from Russian and Soviet traditions. This is now the crux of Soviet computing problems, at least as they relate to general purpose use on a national economic scale.

Acknowledgments

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N. C. Davis of CIA/OSI made several helpful suggestions.

Appendix

A Short Glossary [40]

In addition to the definitions given below, others have been incorporated into the main body of the article where convenient.

Hardware consists of the physical devices of a computer system. *Software* is the control logic used to internally manage computer resources (most of this

[40] For a much more comprehensive introduction to computing terminology, see Ralston, Anthony and C. L. Meek, Encyclopedia of Computer Science, Petrocelli Charter, N.Y., 1976.

type of software comes under the heading of *operating systems*), facilitate the use of applications programs (e.g. translators for English-like programming languages), and the applications programs themselves.

Cybernetics and computing are not the same. The subject matter of the science of *cybernetics* is the dynamic control of complex, including social, processes. Cyberneticists see computing/communications as the technological means for implementing the practical application of cybernetic concepts.

Telecommunication is a general term for data transmission between remotely located computing units and other devices via a system that performs the necessary format conversion (e.g. digital to analog) and controls the rate of transmission.

A *computer network* is a somewhat structured conglomeration of digital, computer-based systems, subscribe devices and intercommunication circuit, which perform information storage and retrieval, processing, transmission and/or exchange to achieve a desired set of results within a dynamic environment constrained by geography, supply and demand, and resources.[41]

As the terms imply, *minicomputers* tend to be smaller systems than "full-size" computers (*mainframes*). However, the distinctions between the two have become blurred as some minicomputer systems have become more powerful and complex, and as models are added to the lower end of mainframe families. As rough distinctions, minicomputers tend to use word lengths of 32 bits or less and are often used for dedicated applications. Mainframes have word lengths of 32 bits or more, and are simultaneously used for a variety of data processing and scientific/engineering applications (general purpose use).

A *storage (memory) hierarchy* consists of small, fast storage units linked together with relatively large and slow storage units to form a system in which data is moved from the large slow levels to the small fast levels as required. Listed below is a modern storage hierarchy based on currently available United States cost/performance parameters.

Memory type	Volume (millions of bits)	Cost per bit (cents)	Acess time (microseconds)
Register	0.001	1,000	0.01
High-speed buffer	0.01	100	0.1
Main (primary) memory	0.1–10	1.0	0.5–1.5
Large core storage	1–100	1	5
Fixed-head disk/drum	10–100	.1	10
Movable-head disk	100–10,000	.01	100
Magnetic tape	1,000–10,000	.001	[1]1
Mass store	100,000–1,000,000	.0001	[1]10

[1] Seconds.

A *bit* is a binary unit of information (a *byte* is 8 bits). *Access time* is essentially the time it takes to retrieve a data item from memory. The memory devices listed below the dotted line are commonly called *secondary storage.*

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SOVIET MACHINE TOOLS: LAGGING TECHNOLOGY AND RISING IMPORTS

(By James Grant*)

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FIGURES

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Summary

The Soviet machine tool industry, developing independently of Western assistance, has become the world's largest producer of machine tools. However, emphasis has been on large-scale production of relatively simple-to-produce, general-purpose machine tools at the expense of special-purpose and complex types. Soviet machine tools are qualitatively inferior to their Western counterparts, and Soviet machine tool technology is less advanced.

In numerically controlled machine tools, Soviet production has leaped ahead but technology has moved slowly. The U.S.S.R. now produces about 50 percent more numerically controlled machine tools than the United States but most are relatively simple types capable of simultaneous operations in only two axis. Only about 3 percent of Soviet NC output in 1977 consisted of 3-axis machine tools, compared with an estimated 40 percent for the U.S. Moreover, most of U.S. multiaxis machine tools were capable of operating in 4 and 5 axis: U.S. NC technology is increasingly characterized by Computer Numerical Controls whereas few Soviet units have such capability.

Soviet imports of Western machine tools have mushroomed since about 1967, from an estimated $75 million to nearly $700 million in 1977. During 1970–77, total imports of machine tools from the West amounted to about $3.3 billion. About three-fourths of total imports were conventional types of machine tools—mostly, automatic lathes, precision grinders, high-productivity gearmaking machines and transfer lines. Transfer lines, mainly for the Soviet automotive industry totalled over U.S. $550 million.

Numerically controlled machine tools constituted about one-quarter of total imports and these were predominantly NC lathes and machining centers.

An overwhelming share of machine tools imported by the U.S.S.R. during 1970–77 originated in Western Europe, principally in West Germany. The United States was important as a supplier of special-purpose grinding and gearmaking equipment, and transfer lines.

The U.S.S.R. apparently perceives little hope of catching up with Western machine tool technology, and is relying on Scientific and Technical agreements with Western firms for design and manufacturing technology needed to produce machine tools currently imported. The Soviets are receiving assistance in two areas of machine tool technology that might be especially useful to military industry—precision internal grinders for minature bearings, and NC machining centers.

The Soviets will continue to import machine tools from the West to meet priority or specialized needs, although probably not in the volume that characterized imports during the 1970's. Imports of gear-cutting machinery from the U.S. should phase down unless the Soviets launch construction of new heavy truck plants. Soviet imports of transfer lines and automatic lathes probably will decline, possibly dramatically, after 1980, as new domestic production facilities come on-stream. Imports of advanced types of NC machine tools will continue and possibly accelerate if embargo restrictions are relaxed.

I. Introduction

Until the late 1960's, the Soviet machine tool industry had developed independently of Western sources of supply. Unlike Western countries which tend to produce those machine tools in which they have a comparative advantage in price, quality or technology, the U.S.S.R. tried to produce its own machine tools across the whole spectrum of machine tool technology.

In the late 1960's, large quantities of Western machine tools were purchased for the Tol'yatti Passenger Car Plant, indicating that long-term reliance on a policy of autarchy had failed to keep the U.S.S.R. abreast of Western advances in machine tools, and that the Soviets needed or preferred many types of Western machines for precision and high productivity applications. This need or preference was underscored in the early 1970's when the U.S.S.R. again turned to the West for machine tools for a second large, highly publicized investment program—the KAMA Truck Plant.

Tol'yatti and KAMA, however, are only the most visible projects that have required Western machine tools. In addition to those programs, Soviet imports of Western machine tools have been large and growing. This paper examines the production, use, and technological level of Soviet machine tools, including extensive comparisons with the U.S., to illuminate the forces driving this expanding import program.

Two major Western studies of the Soviet machine tool industry exist. The first, a pioneering effort by Daukas nearly 20 years ago, was a comprehensive survey of the industry that pulled together most of the information on production, product-mix and organization available up to that time.[1] The second, by Berry and Cooper, also is a comprehensive survey article that updates much of the information in Daukas.[2] In addition, it provides a fuller treatment of imports, and a more extensive assessment of Soviet machine tool technology.

This study differs from that of Berry and Cooper (and Daukas) in several respects. It provides greater detail, as well as more recent data, on Soviet imports of machine tools. Unlike trade statistics in Berry and Cooper which is taken from Soviet sources, data in this study has been compiled mostly from Western sources.[3] Western data is considerably more disaggregated than Soviet data, making it possible to identify import patterns. Also, this study focuses more narrowly on quality and technological differences between Soviet and U.S. machine tools, especially numerically-controlled types. Finally, the data presented in this study leads to an interpretation of Soviet technological capabilities that is less sanquine than that of Berry and Cooper who conclude that "technological lags can be very quickly narrowed and overcome once their existence has been acknowledged and priority granted to their elimination."[4]

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[1] A. Daukas, Dimensions of Soviet Economic Power, Joint Economic Committee of the U.S. Congress, Washington, D.C., 1962, pp. 165–180.

[2] M. J. Berry and Julian Cooper, "Machine Tools," in *The Technological Level of Soviet Industry*, ed. by Amann, Cooper, and Davies (New Haven: Yale University Press, 1977), pp. 121–198.

[3] See Appendix for a discussion of sources of import data.

[4] M. J. Berry and Julian Cooper in The Technological Level of Soviet Industry, loc. cit., p. 198.

II. The Soviet Machine Tool Industry

Production

The U.S.S.R., the world's largest producer of machine tools, turned out roughly 290,000 units in 1977, or more than three times as many as the United States. (See Table 1.) Annual output of metalcutting machine tools, in particular, is enormous by international standards.[5] In 1977 the U.S.S.R. produced 236,000 metalcutting machine tools, or about four times the number produced in the United States (58,200).[6] Even with the inclusion of very large U.S. net imports,[7] Soviet output of metalcutting machine tools was over twice as large as the combined U.S. total.

TABLE 1.—UNITED STATES AND U.S.S.R.: PRODUCTION OF MACHINE TOOLS, 1960, 1965, 1970–77

[In thousand units]

	1960	1965	1970	1971	1972	1973	1974	1975	1976	1977
Total:										
United States[1]	62.2	93.3	73.5	51.8	62.8	88.5	106.0	92.7	80.4	89.6
U.S.S.R.[2]	185.9	220.6	243.3	249.3	255.0	260.5	274.9	281.5	284.9	290.3
Metalcutting:										
United States[1]	42.9	68.0	49.3	32.4	41.8	57.8	69.0	65.9	53.7	58.2
U.S.S.R.[2]	156.0	186.0	202.0	207.0	211.0	214.0	226.0	231.0	233.0	236.0
Metalforming:										
United States[1]	19.3	25.3	24.2	19.4	21.0	30.7	37.0	26.8	26.7	31.4
U.S.S.R.[2]	29.9	34.6	41.3	42.3	44.0	46.5	48.9	50.5	51.9	54.3

[1] "Current Industrial Reports, Metalworking Machinery," Department of Commerce, Bureau of the Census, selected years.
[2] "Narodnoye Khozyaystvo SSSR," selected years.

The U.S.S.R. also produces metalforming machine tools in large quantity—54,300 in 1977 compared to 31,400 in the United States—but they account for only about 19 percent of total Soviet machine tool output, compared to about 35 percent in the United States. In many applications, metalforming machine tools are more productive, require less labor input that metalcutting types, and save on metal. For these reasons, the Soviets have planned unsuccessfully for several years to increase the share of metalforming machines,[8] and to expand the product mix. Soviet production has long been geared toward production of heavy forge and press equipment,[9] and relatively simple types of metalforming equipment such as general-purpose mechanical presses, hammers, shears, and bending machines.[10] The U.S.S.R. has neglected more complex types such as hydraulic presses, precision forging machines, hot and cold stamping machines, and other modern, automated types of metalforming machinery.

[5] Machine tools are generally classified as metalcutting—used to machine castings; and metalforming—used to shape forgings and press or stamp rolled sheet metal.
[6] Excluding those valued at less than $1,000—mainly household types that have no direct counterparts in the U.S.S.R.
[7] In 1977 the United States imported, on net, nearly as many metalcutting machine tools as it produced (an estimated 50,000 units, excluding imports of machine tools having a value of less than US$1,000). Despite a large trade deficit in units, the U.S. maintains a sizable trade surplus in value.
[8] Metalforming was planned to be 21 percent of machine tool output by 1975. See *Gosudarstvennyy Pyatiletniy Plan Razvitiya Narodnogo Khozyaystva S.S.S.R. na 1971–75 gody*, Moscow, 1972, p. 126.
[9] The U.S.S.R. is the world's foremost producer of large presses and has built two of the world's largest—a 75,000 ton press for domestic use, and a 65,000 ton press for Interforge, a French company.
[10] See Kuznechno Shtampovochnoe Proizvodstvo, No. 5, 1976, p. 4.

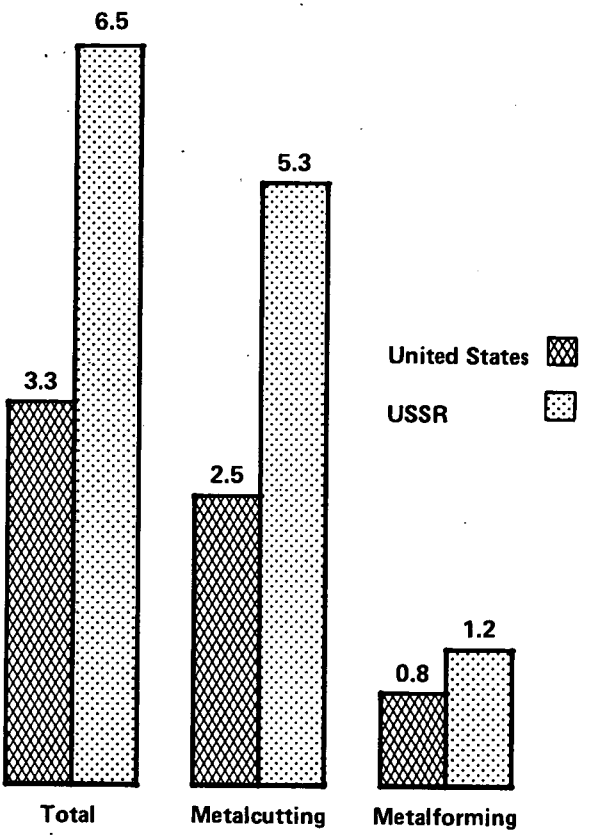
At the end of 1977 the Soviet inventory of machine tools amounted to an estimated 6.5 million units, including 5.3 million metalcutting machines.[11] Both the total inventory and the inventory of metalcutting types were roughly twice as large as corresponding inventories in the United States (see figure 1).[12] These relationships are striking because Soviet industrial output is substantially less than that of the United States.

[11] Estimates based on an extrapolation of the last Soviet published inventory of machine tools in 1972. See *Narodnoe Khozyaystvo S.S.S.R. v. 1973,* Moscow, 1974, p. 61.
[12] To an extent, the relatively greater complexity of U.S. machine tools compensates for the smaller U.S. stock. See below.

Figure 1

United States and USSR: Machine Tool Inventory, 1978

(Million Units)



Sources: Data for the United States are taken from "The 12th American Inventory of Metalworking Equipment" American Machinist, December 1978, p.135. Soviet data are author's estimates based on an extrapolation of the last Soviet published inventory of machine tools in 1972.

Uses

The U.S.S.R. produces and uses more machine tools, especially metalcutting machine tools, than the United States because of differences in the structure of machinery production in the two countries; the existence in the U.S.S.R. of an extraordinary repair and spare parts industry, which, in effect, constitutes a separate sector of production alongside that of machinery; differences in the size and quality of the overall stock of machine tools; and differences in the level of utilization of machine tools. These four major uses are discussed in greater detail below.

First, the U.S.S.R. has a relatively greater need for metalcutting machine tools than the United States because of its large emphasis on capital goods production, including military durables. In many cases, heavy machinery items can be produced only by metalcutting techniques. By contrast, the United States produces relatively greater quantities of consumer durables than the U.S.S.R.—output that is especially suited to the use of metalforming machinery. Nevertheless, a greater use of metalforming machine tools could be expected even with the Soviet product mix.[13]

Second, the U.S.S.R. requires a large stock of general-purpose machine tools to supply the needs of a huge, largely unspecialized repair and spare parts industry, which is itself the result of poor quality of original equipment. Virtually every plant and farm in the U.S.S.R. has a workshop set aside to repair machine tools and other machinery. In 1970, more than two and one-half million workers and more than one million metalcutting tools, or nearly one-third of the entire Soviet stock of 3.4 million metalcutting tools, were used in repair and to produce spare parts.[14] This is a matter of grave concern to the Soviets because machine tools are used inefficiently in this application; according to official Soviet data, they are used only about 40 percent of the time, and then only to 15 to 20 percent of capacity.[14a]

Third, a large quantity of machine tools also is needed annually to replace the aging and obsolescent portion of the machine tool stock. In 1978, roughly 25 percent of the metalcutting stock was 20 years of age or older.[15] Nearly all of these machine tools were obsolescent by world standards when originally produced and are of limited usefulness today.[16] Another 35 percent of the inventory was 10 to 20 years of age and many of these machine tools require replacement because rapidly rising maintenance costs and declining productivity, relative to new machines, no longer justifies their use.

In recent years, about 2 percent of the stock of obsolescent metalcutting machine tools has been replaced annually.[17] This rate has not been sufficient to reduce substantially the proportion of machine tools 20 years of age or older and needing to be replaced. According to a 1966 article in the official journal of the Soviet machine tool industry, a 6.5 percent replacement rate is needed to modernize the stock of metalcutting machine tools.[18] Such a rate is unattainable in practice

[13] The Soviets estimate that because of shortages of metalforming equipment 7 to 8 million tons of metal are wasted annually. Planovoye Khozyaystvo No. 1, 1979, p. 34.
[14] Ekonomiki i Organizatsiya Promyshlennogo Proizvodstva, No. 1, 1970, p. 34.
[14a] Voprosy Ekonomiki, No. 10, 1970, p. 113.
[15] Estimates. See Footnote 11. For earlier Soviet data on age distribution, see Narodnoye Khozyaystvo, 1973, p. 61.
[16] A. Daukas, Dimensions of Soviet Economic Power, loc. cit., p. 177.
[17] Traktory i Sel'khozmashiny, No. 12, 1975, p. 34.
[18] See Vestnik Mashinostroyeniya, No. 7, 1966, p. 79.

because it would require virtually the entire annual output of metal-cutting machine tools and leave only token quantities available for installation in new plants and for export.

In the United States, the total inventory of machine tools is older than in the U.S.S.R.—the overall average age is more than 20 years—but it is more modern. Older machine tools tend to be taken out of production in the United States and used for machinery repair and reconditioning, permitting newer machines to be used for production. And the new U.S. machine tools are so much more productive that the total number of machine tools in use in metalworking industries has actually declined by 14 percent since 1973.[19] In the U.S.S.R., by contrast, older machine tools are retained in basic production while new general-purpose machine tools are used for repair work (as well as for production). Hence, the inventory of machine tools in use in the repair sector is actually younger than that in use in production.[20]

Finally, demand for an increased stock is created by the low level of utilization of machine tools, as reflected in the average shift coefficient for the machinery industry.[21] Since 1965, when the average shift coefficient for metalcutting machine tools stood at about 1.7,[22] a figure that the Soviets consider desirable, the rate steadily declined to 1.4 by the end of the 1960's and was still at that level in 1978.[23] Although comparative data are lacking, the corresponding figure for the U.S. almost certainly is higher. The level of utilization is affected by stoppages during shifts, and the proportion of machines not in use because they are awaiting installation or are undergoing maintenance and repair work.[24]

III. Quality and Technology

General

Machine tools may be classified in two broad groupings—conventional and advanced. Conventional machine tools are types that traditionally have been produced, mainly: lathes, drilling and boring, grinding and milling machines, and also transfer lines.[24a] Advanced machine tools are conventional types that have been enhanced in one or more key aspects (flexibility, productivity, precision) through the use of electronics and computers. In general, Soviet conventional machine tools do not differ *technologically* from those of the developed West—in design and principle of operation they follow world-wide practice—but mainly in *quality;* that is, in performance, durability, and reliability.

Advanced machine tools, in contrast, differ from those of the West in technology as well as in quality. Where technological differences exist, machine tools differ in functional capabilities. For example, two advanced machine tools may both be capable of move-

[19] 12th American Machinist Inventory of Metalworking Equipment," American Machinist, December 1978, p. 133.
[20] Ekonomiki i Organizatsiya Promyshlennogo Proizvodstva, No. 1, 1970, p. 34.
[21] The shift coefficient is a measure of the average number of shifts a machine is worked each day.
[22] Voprosy Ekonomiki, No. 5, 1978, p. 46.
[23] Planovoye Khozyaystvo, No. 3, 1978, p. 99.
[24] Berry and Cooper in "The Technological Level of Soviet Industry," loc. cit., p. 143.
[24a] Transfer lines consist of a number of machine tools and associated conveyance mechanisms for automatically transferring parts from one machine tool to another in a pre-determined sequence.

ments in three different planes (axes). They are qualitatively different if one is faster and more accurate than the other; they are technologically different, if one machine is capable of operating in all three planes simultaneously and the other is not. The inability to operate in all planes simultaneously limits the range of parts and shapes that can be formed. In the paragraphs below, quality, as reflected in Soviet conventional machine tools is discussed first, followed by a discussion of Soviet technology, as reflected in advanced machine tools. The discussion of technology includes definitions for major categories of advanced types.

Conventional Machine Tools

Soviet conventional machine tools are ruggedly built but lack the durability, precision, and flexibility of their U.S. counterparts. For example, Soviet machine tools require a major overhaul every 6 to 8 years, compared with 12 to 15 years in the United States.[25] Reportedly, about one-third of the metalcutting machine tool stock in the U.S.S.R. is under constant repair.[26] Furthermore, users of Soviet tools complain that initial levels of accuracy of many models are quickly lost. Soviet gearcutting machines installed at the Gor'kiy Motor Vehicle Plant in 1969 lost their original levels of precision within 6 months.[27]

The Soviets have officially acknowledged that quality, on the average, lags behind world standards. In 1975, only 8.2 percent of the machine tools produced received the "State Seal of Quality"; [28] that share was scheduled to rise to 17 percent in 1977.[29] Other data indicate that the accuracy of Soviet machine tools is increasing, but has a long way to go. For example, only 6.7 percent of all the metalcutting machine tools produced in 1960 met Soviet standards for precision.[30] In 1975 the share may have been roughly 30 percent.[31] Most of the machine tools that reach Soviet standards can be assumed to be less precise than Western counterparts. That is because Soviet accuracy requirements for precision machine tools tend to be less stringent than corresponding Western requirements.[32]

In some cases, deficiencies in accuracy and durability of Soviet machine tools appear to be the result of poor workmanship and quality control and manufacturing procedures, or because plant managers attempt to cut corners to reduce costs and increase plant profits. For example, castings frequently are not properly stress-relieved

[25] U.S. figures are based on industry sources. For Soviet figures see Voprosy Ekonomiki, No. 2, 1978, p. 40, and for a confirmatory evaluation, from Western sources, of the relatively inferior quality of Soviet machine tools, see M. R. Hill, "Technological Level and Quality: Machine Tools and Passenger Cars," in *The Technological Level of Soviet Industry*, loc. cit., pp. 547–548.

[26] Promyshlennost' Armenii, April 1974, p. 57.

[27] Pravda, December 3, 1969, p. 2.

[28] Ekonomicheskaya Gazeta, No. 44, 1975, p. 2 .The State Seal of Quality is awarded to those products which the Soviets believe are on a par with Western counterparts.

[29] Plants that are attempting to produce machine tools for export to world markets tend to have a higher percentage of quality output. For example, in one of the most modern Soviet plants, Krasnyy Proletariy, 67 percent of output (mostly lathes) were said to meet world standards in 1977; that figure was planned to reach 80 percent in 1978. In the Sverdlov plant in Leningrad, 35 percent of output will reach parity with counterpart Western models in 1980.

[30] Calculated from data in *Narodnoye Khozyaystvo S.S.S.R. v. 1962*, p. 169.

[31] The U.S.S.R. has not published data on the production of machine tools by classes of precision since 1972. However, the percentage increases in the output of precision machine tools, announced periodically, indicate that their production has increased nearly 7-fold during 1960–75.

[32] See M. R. Hill, "Technological Level and Quality: Machine Tools and Passenger Cars" in *The Technological Level of Soviet Industry*, loc. cit., p. 537.

(affecting durability) and slide components are not properly hardened (affecting accuracy).[33]

Failure to reach Western standards of quality in four major categories of metalcutting machine tools—automatic lathes, transfer lines, grinding machines, and gear making machine tools—have resulted in exceptionally large purchases of these types of machine tools from the Developed West since 1970. The relatively inferior quality of automatic lathes and transfer lines may be inferred from the fact that the U.S.S.R. has entered into joint development and production arrangements with Western firms to produce them in the U.S.S.R.[34] The quality of grinding machines and gear making machines can be ascertained directly from unsucessful Soviet efforts to duplicate the precision of U.S. grinders, and the design and performance of U.S. gearcutters. In general, dissatisfaction with existing Soviet state-of-the-art for these categories of machine tools probably explains the failure of the Soviet machine tool industry to expand substantially their production since 1960, as discussed below.

AUTOMATIC LATHES

During 1960–75, manual-type lathes as a share of total output of metalcutting machine tools, increased from 26 to 34 percent, while the share of automatic and semiautomatic lathes declined from 3 percent to 2 percent (table 2). There is some evidence to suggest that this product mix was contrary to plan and took place even though user demand for automatic lathes was growing far more rapidly than that for manual-types.[35] This need to increase the output of automatic lathes had been recognized for many years, and as early as 1963, officials of the machine tool industry were calling for construction of a new specialized plant to produce automatic lathes.[36] For nearly twenty years, however, three Soviet plants have continued to account for Soviet production of automatic lathes.[37]

TABLE 2.—U.S.S.R.: OUTPUT OF SELECTED CATEGORIES OF METALCUTTING MACHINE TOOLS, SELECTED YEARS

Type of machine tool	Output			
	Thousand units, actual		Share (percent)	
	1960 [1]	1975 [2]	1960	1975
(1)	(2)	(3)	(4)	(5)
Lathes, manual	40.5	78.6	26	34
Lathes, automatic and semiautomatic	4.2	5.7	3	2
Grinding	7.4	14.0	5	6
Gearmaking	3.3	4.6	2	2

[1] "Narodnoye Khozyaystvo SSSR," 1962, p. 169.
[2] "Soviet Machine Tool Market 1976–80," Chase World Information Corp., unpublished report (1977).

[33] The Tenth Five-Year Plan (1976–80) calls for Soviet manufacturers to begin equipping machine tools with hardened steel guides to increase reliability and service life. See Stanki i Instrument, No. 5, 1977, p. 3.
[34] See discussion on technical assistance, below.
[35] See Berry and Cooper in *The Technological Level of Soviet Industry*, loc. cit., pp. 154–155.
[36] Ekonomicheskaya Gazeta, Feb. 16, 1963, p. 17.
[37] The Automatic Machine Tool Plant in Leningrad, the Gor'kiy Machine Tool Plant in Kiev, both specialized producers of automatic and semiautomatic lathes; and the Ordzhonikidze Machine Tool Plant in Moscow which produces automatic lathes as only one product among many.

TRANSFER LINES

Transfer lines, which are common in large-scale or mass-production industries, have been produced in the U.S.S.R. since World War II. The first Soviet transfer lines were manufactured in 1946 at Stankokonstruktsiya—an experimental production plant attached to ENIMS,[38] the machine tool industry's main development facility. Those lines were designed for machining engine blocks for ZIL and Moskvich motor vehicles, and for tractor engines.[39]

Until recently, Soviet production capacity for transfer lines had never been very large. In addition to Stankokonstruktsiya, transfer lines were produced at the Ordzhonikidze and Stankoliniya plants in Moscow, and at a plant in Minsk.[40] An indication that production capacity in these plants was insufficient to meet domestic needs first surfaced in 1961 when the U.S.S.R. attempted, without success, to purchase transfer lines from the United States for the production of V–8 engines at the Likachev Truck Plant (ZIL). In the late 1960's, spiralling demand for transfer lines for the automotive industry swamped the supply capacity of those plants.

In 1971 plans were announced to construct six new plants dedicated to the production of transfer lines or of the standardized subassemblies of transfer lines ("aggregate" machine tools) in Baranovichi, Orsha, Pinsk, Sasovo, Sukhinichi, and Svetlogorsk.[41] The first four plants have since been constructed and probably are in operation. When all six plants are in full-scale operation, probably after 1980, the Soviets may have adequate capacity to meet most domestic needs.

GRINDERS

25. Although primary production capacity for grinders has been shared by the same five plants for many years,[42] output as a share of total metalcutting production increased from 5 percent in 1960 to 6 percent in 1975. This growth may have been adequate to meet demand for most types of grinders. However, the supply of high precision grinders from these plants has been limited by persistent shortages of such key components as spindles and precision bearings. High speed and precision spindles, for example, are produced at only one plant and in small and inadequate quantities.[43] Indeed, the grinding industry has been caught in a classic catch-22 dilemma; the supply of high-precision grinders is limited by the supply of precision components; and the supply of precision components depends upon the supply of high-precision grinders. Lacking adequate deliveries of needed components, producers of high-precision machines have substituted lesser quality spindles and bearings which contributed to reduced productivity, reliability, and accuracy. Also, output of high-speed grinders

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[38] Acronym for Experimental Scientific-Research Institute for Machine Tools.
[39] Stanki i Instrument, No. 11, 1947, unnumbered page preceding page 1.
[40] The former two plants have limited capacity for the production of transfer lines since they produce a varied mix of other machine tools as well. The latter two plants produce only transfer lines, but Stankoliniya is a specialized producer for the Soviet bearing industry. Only the plant in Minsk produces transfer lines for industry generally.
[41] Trud, Feb. 27, 1971, p. 2.
[42] The Ilyich Plant in Leningrad (mostly grinders for the bearing industry); the Kosior Plant in Kharkov (cylindrical and crankshaft grinders); the Moscow Grinding Machine Tool Plant (mostly gear grinders); the Vil'nyus Grinding Machine Tool Plant; and the Krasnyy Borets Plant, in Orsha.
[43] Stanki i Instrument, No. 12, 1977, p. 1.

has been hampered by shortages of electronic feedback subsystems for automatic sizing; that is, for continuously evaluating the size of the parts and the amounts of metal remaining to be cut.[44]

GEARMAKING MACHINE TOOLS

Output of gearcutters as a share of metalcutting production did not change during 1960–75, despite explosive changes in Soviet motor vehicle production. It is reasonable to suppose that dissatisfaction with the quality of domestic gearcutters, especially types used by the automotive and tractor industries, discouraged expansion of production capacity. Spiral bevel gears are a case in point. The U.S.S.R. first imported machine tools for spiral bevel gears from the U.S. firm of Gleason in the 1930's, a fateful decision that effectively tied the U.S.S.R. to future purchases from the same firm if domestic copying efforts proved unsuccessful.[45] In the event, Soviet copying efforts were not wholly successful. The U.S.S.R. did duplicate the Gleason design in the late 1960's and is known to have produced counterparts at a plant in Saratov. However, the Soviet model apparently does not duplicate the performance of the Gleason machine since the Soviets have continued to buy such machines from Gleason in large quantities.[46]

Advanced Machine Tools

SOME DEFINITIONS

Advanced machining techniques may be grouped under four headings: Numerical Control (NC), Computer Numerical Control (CNC), Direct Numerical Control (DNC), and Flexible Manufacturing Systems (FMS). These terms are defined briefly below followed by a discussion centered on Soviet progress in NC production and state-of-the art, as illustrative of the gap between Soviet and Western advanced machining capabilities.

NC is a revolutionary machining technology that was first developed in the United States by the Massachusetts Institute of Technology under the auspices of the U.S. Air Force in 1952. NC machine tools are conventional machines (lathes, milling, drilling, and boring) whose movements are controlled automatically instead of by a human operator. Generally, controllers are electronic, although some devices that are essentially electromechanical in operation—so-called "plugboard" or "dial-programmed" systems—also sometimes are classified as numerical controllers.

Normally, a numerical controller is dedicated to the control of a single machine tool and is not a computer. Where the controller is a computer, the system is called Computer Numerical Control (CNC). If the controller is a computer that exercises simultaneous control over the operations of more than one machine tool, the system is termed Direct Numerical Control (DNC). A system involving a computer to control the flow of parts among several NC machine tools, in effect a

[44] Vestnik Mashinostroenlya, No. 1, 1977, pp. 68–70.
[45] Spiral bevel gears produced on equipment of other major manufacturers of this type gearcutting machinery—Oerlikon of Switzerland and Klingelnberg of West Germany—are not compatible with gears produced on Gleason equipment.
[46] Soviet Business and Trade, Jan. 17, 1979, p. 4.

numerically-controlled transfer line, is referred to as a Flexible Manufacturing System (FMS).

Two types of control over the movement of the machine tool may be distinguished. First, point-to-point (or positioning) control, the most common type, is basically a point locating system used primarily with drilling or boring machines to machine a workpiece at one or more discrete points. The system is relatively uncomplicated, uses a small volume of input data, and is manufactured at relatively low cost. Second, contouring (or continuous path) control generally is used with lathes or milling machines to machine a workpiece continuously into complex shapes or contours. Contouring requires constant synchronization of the tool's motion in at least two axes. Hence, it needs a large amount of input data, high-speed control logic, and powerful servomechanisms. Contouring control of three or more axes usually demands a computer to prepare the machining program.

Increasingly, NC machine tools are being produced as complex integrated systems that provide for automatic changing of cutting tools, perform multiple machining operations (for example, milling, drilling and boring), and can be designed for either point-to-point or contouring operations. Such a system is called a "machining center." Machining centers are especially used under conditions of batch production.

SOVIET NC TECHNOLOGY

NC technology generally languished until 1968, when the U.S.S.R. belatedly announced a major new program to catch up with the West in NC development and production.[47] The relatively small number of NC machine tools that had been built—about 250 units—were mostly "plugboard" types of relatively simple design and very limited capability. Stimulated by the new (and higher) priority, however, output accelerated, increasing from an annual level of less than 200 units in 1968—about 7 percent of the U.S. level—to more than 2,500 units in 1971, exceeding U.S. production. By 1977, Soviet output of 6,300 units exceeded that of the United States by nearly 50 percent (see table 3).

TABLE 3.—U.S.S.R. AND UNITED STATES: PRODUCTION OF NUMERICALLY CONTROLLED MACHINE TOOLS, SELECTED YEARS

[In units]

	1960	1965	1970	1971	1972	1973	1974	1975	1976	1977
U.S.S.R.[1]	16	49	1,687	2,538	3,062	3,788	4,410	5,532	5,995	6,300
United States[2] including:	402	2,138	1,901	1,238	1,630	2,865	4,210	4,136	3,856	4,221
Point-to-point	368	1,871	1,116	527	641	NA	NA	NA	NA	NA
Contouring	34	267	785	711	989	NA	NA	NA	NA	NA
Machining centers[3]	NA	NA	651	344	475	1,162	1,692	1,460	1,225	1,226

[1] "Narodnove Khozyaystvo, SSSR," selected years.
[2] "1978–79 Economic Handbook of the Machine Tool Industry," National Machine Tool Builders' Association, McLean, Va., 1978, pp. 96–98.
[3] Machining centers include both point-to-point and contouring types.

[47] Izvestia, April 26, 1968, p. 1.

Growth in output, however, has been achieved at the expense of technological progress. In the early 1970's when growth rates were highest, Soviet NC machines were obsolete by U.S. standards as soon as they were produced. Most were 2-axis point-to-point types, many still of the "plugboard" variety. Moreover, all were hybrid machines, built by mating a new controller with an already existing model of conventional machine tools. Conventional machine tools that are modified to accept controllers perform adequately in applications where the workload is light and high precision is not required, but have slower speeds and are less accurate and reliable than fully integrated units. In the United States most NC machine tools are highly integrated units designed and built from the ground up as a single machine.

By 1974, some second-generation (transistorized) 3-axis contouring machines had been produced in the U.S.S.R., but these required careful monitoring by a skilled attendant [48] and lacked precision in contouring.[49] In the United States, by 1974, most NC machine tools were third-generation types (based on integrated circuits), operated in 3 or more axes, and were closed-loop systems.

As with conventional machine tool production, the Soviets have emphasized production of those NC machine tools that are easiest to produce (such as lathes), neglecting output of complex types that are more difficult to produce and in relatively greater demand (such as machining centers). For example, of the total number of NC machine tools planned for production during 1971–75, more than four-fifths were lathes (35 percent), drilling and boring machines (28 percent), and milling machines (22 percent). These were either simple point-to-point or 2-axis contouring units. Only 4 percent of planned output was for machining centers.[50] By contrast, in the United States after 1973, highly productive machining centers constituted more than 40 percent of U.S. output of NC machine tools.

In the event, the simplified Soviet product mix satisfied few users. Most of the NC lathes produced during this period were designed for large diameter parts, whereas users were clamoring for lathes to handle small parts. Similar complaints were directed against drilling, boring, and milling machines. Apparently the production of machining centers fell short even of the relatively small number that were planned. Officials of the machine tool industry, itself a prime user of the machining centers that it produces, complained in 1974 that centers made up only one percent of their inventory of machine tools.[51]

The year 1974 was an important milestone for Soviet NC technology. The Soviets, to reduce their reliance on hybrid NC machine tools, introduced into production eleven new models especially designed

[48] These are called "open-loop" systems. An operator is required to adjust the machine tool to meet required tolerances. By contrast, "closed-loop" systems contain feedback mechanisms that provide an automatic adjustment of the machine tool to achieve desired cutting objectives.

[49] These NC machine tools were incapable of "circular interpolation," and could achieve circular designs only through successive straight cut approximations ("linear interpolation)

[50] The relatively low share of NC production planned for machining centers is surprising since the Soviet machinery industry produces about 70 percent of its output by the batch method. Since 1975, the Soviets have developed a relatively large number of prototype machining centers—including 15 new models in 1978 alone—and is planning to increase output by 25 percent in 1979.

[51] Mekhanizatsiya i Avtomatizatsiya Proizvodstva, No. 7, 1974, p. 11.

for use with numerical controls.[52] In addition, a new series of controllers based on integrated circuits was put into limited production.[53] The new especially-designed systems—faster, more accurate, and more reliable than their hybrid predecessors—were put into series production at six machine tool plants.[54] The 1974 models continue to represent most of the output of NC machine tools in the U.S.S.R.

Since 1974, Soviet NC technology has advanced slowly and the technology gap with the United States has widened. For example, in 1977, Soviet output of 3-axis NC machine tools was still quite small, roughly 200 units annually, and was made up mostly and perhaps entirely of open-loop systems.[55] The only NC units capable of operating in more than three axes simultaneously were prototypes. By comparison, the United States produced 2,600 multiaxis numerical controllers, all of the closed-loop variety. About 40 percent of these were capable of operating in 4- and 5-axes.[56] Thus, annual Soviet production of multiaxis NC control units were less than 8 percent that of the United States.

In a recent appraisal of Soviet NC state-of-the-art, the general director of the RYAZAN Machine Tool Production Association acknowledged that "we are lagging behind today in the technical level [of NC machine tools] and there is no certainty that we will not lag behind tomorrow." [57] This source acknowledges a lag in the technical parameters of Soviet NC open-loop systems—speed is said to be less than half that of Western equipment, and accuracy an order of magnitude less—and in the production of closed-loop (feedback) systems. According to this source, production of closed-loop systems has been delayed because the Soviets do not produce a critical component—high torque motors—even though the Minister of the Machine Tool Industry had called for their production in 1974,[58] and production was accorded a priority in the 1976–80 Plan.[59] A solution to this pressing problem is not imminent, since responsibility for the production of high-torque motors, and other NC sub-assemblies is scattered among various ministries and lacks centralized direction and control.

In the most advanced areas of machine tool technology the U.S.S.R. has made little progress and lags far behind the West. The U.S.S.R. is only now experimenting with DNC, a technology that was available in the U.S. in the early 1970's, but bypassed in favor of FMS. There is no evidence that tne Soviets have developed or produced FMS systems.

IV. Factors Contributing to Lag in Quality and Technology

Emphasis on Standardization

Two characteristics of production sharply distinguish the Soviet machine tool industry from that of the United States. First, emphasis

[52] Mekhanizatsiya i Avtomatizatsiya Proizvodstva, No. 8, 1974, p. 1.
[53] G. A. Monakhova, *Obrakotka Metallov Rezaniem,* Moscow, 1974, pp. 223.
[54] Lathe models at Krasnyy Proletariy in Moscow and in Ryazan; milling machine models at machine tool plants in Gor'kiy and L'vov; drilling machine models at Sterlitamak and Charantsavan.
[55] All models of NC machine tools that have been seen in Soviet literature as capable of 3-axis simultaneous control are open-loop systems.
[56] According to U.S. manufacturers.
[57] Sotialisticheskaya Industriya, March 22, 1978, p. 2.
[58] Mekhanizatsiya i Avtomatizatsiya Proizvodstva, No. 7, 1974, p. 3.
[59] Pravda, March 7, 1976, p. 4.

is placed on mass production with more than 60 percent of all metalcutting machine tools mass-produced.[60] In the United States, most machine tools are produced in small lots. Second, emphasis is placed on output of highly standardized, general-purpose machines of relatively simple design. Basic models are kept in production, without major modification, for protracted periods—many for 15 to 20 years. Nearly 50 percent of all metalcutting machines are simple types—lathes and simple drill presses—that are easiest and, by both Soviet and Western experience, least costly to produce. In 1975, the U.S.S.R. produced more than 84,000 lathes, over one-third of the output of metalcutting machines and more than six times the number produced in the United States (see table 4).

TABLE 4.—U.S.S.R. AND UNITED STATES: 1975 OUTPUT OF METALCUTTING MACHINE TOOLS, BY MAJOR CATEGORY

[In units and percent]

	Thousands of units		Percent	
	U.S.S.R.[1]	United States[2]	U.S.S.R.	United States
Total	232.0	65.9	100.0	100.0
Lathes	84.3	[3] 13.0	36.3	19.7
Drilling	27.6	5.3	11.9	8.0
Milling	23.0	[3] 9.8	9.9	14.9
Grinding	14.0	14.0	6.0	21.2
Boring	5.7	1.5	2.5	2.3
Gearmaking	4.6	.9	2.0	1.4
Other	72.8	21.4	31.4	32.5

[1] "Soviet Machine Tool Market 1976–80," Chase World Information Corp., unpublished report (1977).
[2] "Current Industrial Reports, Metalworking Machinery Summary for 1975," Department of Commerce, Bureau of the Census. Figures exclude items valued at less than $1,000.
[3] Estimated. Census data for 1975 for lathes and milling machines include items valued at less than $1,000. In 1970, however, physical quantities were reported separately for items valued at over $1,000 and under $1,000. The relationship between these 2 value categories in 1970 was used to separate out items valued at less than $1,000 in 1975.

Again, the U.S.S.R. produced upward of 27,000 upright, floor-type drill presses, its second largest category of output (12 percent), more than five times as many as in the United States. By contrast, most U.S. machine tools are specialized types that have been tailored to customer specifications and needs. Hence, U.S. machine tools are not only more productive but are also more complex than Soviet machine tools.[61]

The U.S.S.R. tends to be relatively more efficient than the U.S. in the production of simple types of machine tools, and relatively less efficient in the production of more complex types. This may be seen from a comparison of the ratios of ruble and dollar prices for machine tools. Table 4a shows the prices and ratios for 19 models of Soviet machine tools taken from a forthcoming CIA study [61a] grouped according to general levels of complexity. The average unweighted ruble-dollar ratio for simple machine tools is .18, rises to .25 for machine

[60] Ekonomicheskaya Gazeta, No. 10, 1969, p. 16.
[61] Michael Boretsky has argued, using much earlier data, that when complexity is taken into account, differences in production between the U.S.S.R. and the U.S. tend to disappear. Using data on output of metalcutting machine tools for 1958, and indexes of complexity derived from Soviet sources, Boretsky shows that whereas Soviet output was 26 percent greater than U.S. output in physical units, U.S. production exceeded that of the U.S.S.R. by about 3 percent when complexity was figured in. Although Boretsky's indexes of complexity are deficient in some respects, his findings are valuable empirical support of the importance of complexity in machine tool production. See Michael Boretsky in Dimensions of Soviet Economic Power, Joint Economic Committee of the U.S. Congress, Washington, D.C. 1962, p. 118.
[61a] U.S.S.R. and U.S. : Price Ratios for Machinery, 1967 Rubles/1972 Dollars.

tools of moderate complexity, and to .38 for those of relatively high complexity. As complexity increases, ruble costs increase faster than dollar costs, and the average ratio rises.

TABLE 4a.—PRICES AND PRICE RATIOS FOR SOVIET AND U.S. MACHINE TOOLS

Type	Model No.	Degree of complexity	Ruble price (1967 rubles)	Dollar price (1972 dollars) [1]	Ratio (R per dollar)	Average ratio
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Milling	6N81	Simple	2030	26,739	0.08	
Do	6M82	do	2570	28,980	.09	
Lathe	163	do	4420	26,071	.17	0.18
Shaper	7M36	do	4460	19,778	.23	
Lathe	1K62	do	2260	7,161	.32	
Vertical broaching	776	Moderate	8930	86,300	.10	
Cylindrical grinding	3B151	do	6070	42,426	.14	
Automatic lathe	1416	do	5660	35,788	.16	
Gear hobber	5A312	do	8100	36,605	.22	.25
Internal grinding	3A228	do	9200	36,263	.25	
Planer	7210	do	23650	76,395	.31	
6-spindle bar machine	1A225-6	do	14870	39,997	.37	
Centerless grinder	3G182	do	4470	9,394	.48	
Vertical boring	1541	High	18050	167,377	.11	
Bevel and hypoid gear generator	528S	do	23950	98,195	.24	
Horizontal boring	2622P	do	28350	85,664	.33	.38
Horizontal copy milling	LR-93A	do	72830	151,120	.48	
Jig borer	2A450	do	21090	43,412	.49	
Spur and helical gear grinder	5851	do	82360	129,488	.64	

[1] Price for a counterpart U.S. model.

Complexity drives costs up relatively more in the U.S.S.R. than in the U.S. for at least three reasons: first, complexity increases the requirements for quality control in the manufacture of subsystems and in each stage of assembly. The greater the complexity, the higher the requirements for quality control, and hence, for skilled labor and high performance test and measuring equipment. In the United States, quality control equipment and procedures tend to be high even for simple machine tools which minimizes the cost of moving to high levels of complexity. In the U.S.S.R., quality control is not practiced to the same degree, and its introduction sharply raises costs. Second, if precision parts are being manufactured with standard accuracy machine tools, as frequently is the case in the U.S.S.R., greater inputs of both skilled labor and machining time are required which tends to raise costs. Third, the U.S.S.R. tends to use relatively unskilled labor to produce simple types of machine tools, whereas, in the United States, labor tends to be skilled in all machine tool manufacturing. High levels of complexity increase requirements for skilled, and thus more costly, labor to a relatively greater extent in the U.S.S.R. than in the United States.

By mass-producing general-purpose machine tools and neglecting special-purpose types, the U.S.S.R. drives up production costs for users of machine tools. Because general-purpose machines frequently are inadequate, users are forced to make costly modifications, or to build their own specialized machinery. It is extraordinary that an estimated one-sixth of all the metalcutting machine tools produced in the U.S.S.R. in 1977 were manufactured by "user plants" outside the Soviet machine tool industry.[62] More than four-fifths of all the "trans-

[62] Cited for 1973 in Ekonomicheskaya Gazeta, No. 16, April 1973, p. 4. The "machine tool industry" refers to specialized producers of machine tools under the Ministry of the Machine Tool Industry. Other industries that produce specialized machine tools in sizable quantities include the automotive industry, the aviation industry, and the tractor industry.

fer lines" produced in the U.S.S.R. in 1970 were manufactured in user plants or by machine tool plants as a sideline.[63] In fact, most of the specialized machine tools produced in the U.S.S.R. probably were built by user facilities.

As noted earlier, the U.S.S.R. has continued its penchant for standardization in the production of numerically-controlled machine tools in order to increase output faster. As with conventional machine tools this has resulted in the production of general-purpose machines where specialized machines are needed, in effect, freezing technology and design and discouraging innovation. In U.S. practice, NC machine tools tend to be customized for a specific application.

Organization of Supply

In the U.S.S.R. new machine tools are rationed to user plants from above [64] and users have little influence on the design or quality of the machine tools they receive. Moreover, the producer-user relationship tends to be fixed, and it is generally not possible for a user to shift to an alternate supplier.[65] Further, users have little say in the development of new machine tools as advances in technology almost wholly originate with the producer. Operating as monopolistic developers and suppliers, producers tend to produce machine tools most favorable to their costs and profit structure and output goals.

In advanced machine tools, production is not highly integrated vertically,[66] and the supply of components and parts to manufacturers of NC machine tools frequently is chaotic. Here also, the producer-user relationship is fixed by plan, and NC producers have no control over the quality of parts received. That is, producers of NC machine tools have little contact with supplier plants in other ministries. Plants in different ministries tend to "interact with higher ministerial authorities rather than with each other." [67]

Incentives [68]

Throughout most of the post-World War II period, machine tool producers have sought to meet quantitative output norms set by central planning authorities. Since physical goals are more easily met by continuing older models in production, this policy constituted a disincentive to technological change. Starting in 1965, the U.S.S.R. attempted to create new incentives for plants to bring quality and product-mix closer to customer need. Bonuses were tied to sales, meeting targets for key products, and other indicators, in addition to quantity targets. And, producers could retain a share of the profits for distribution to

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[63] In 1970, plants of the machine tool industry had capacity for production of roughly 100 automatic lines (Trud, Feb. 20, 1969, p. 1) whereas a total of 579 lines were produced.

[64] According to one emigre source, the State Committee for Science and Technology, jointly with Gosplan, decide which plants will receive new numerically-controlled machine tools.

[65] As a result of the 1965 economic reforms, an attempt was made to do away with the rationing system for a few products, but was quickly aborted. Similarly, greater use of interfirm contracts was encouraged but proved difficult to achieve in a continuing environment of taut planning and sellers' markets. Organization and Management in the Soviet Economy: The Ceaseless Search for Panaceas, CIA, 1977, p. 18.

[66] Subassemblies for NC machine tools are produced in at least two other ministries: the Ministry of the Instrument Building Industry (controllers), and the Ministry of the Electrotechnical Industry (motors, transducers, inductosyns, etc.).

[67] See Paul Cocks, *Organizing for Innovation in the 1970's,* Kennan Institute for Advanced Russian Study, Washington, D.C. (1978), p. 8.

[68] This discussion is based on a recent article in this volume by Professor Schroeder of the University of Virginia. G. S. Schroeder, *The Soviet Economy on a Treadmill of "Reforms."*

workers and investment as they saw fit. For a variety of complex reasons, quality and technology were not greatly enhanced by these reforms. In 1973, additional reforms were introduced, notably ministries were required to classify their products in three quality categories, and enterprise plans were geared to raising the share of quality goods in total output. In 1976, the proportion of higher quality category goods in total output became an indicator. These reforms resulted in an explosion in statistics for industry generally in the number of products awarded the State Seal of Quality which, however, contrasted sharply with the rising chorus of press complaints about the quality of goods offered for sale. In the machine tool industry the economic reforms appear to have had little effect in improving quality or promoting technological change. In this industry, as in industry generally, adherence to physical output goals continued to be the dominant feature of production. The Minister of the Machine Tool Industry has recently complained that:

> The current practice of planning without sufficient consideration for raising the qualitative indices of output acts as a brake on the development of new and more productive machine tools * * *. Under the present practice of planning the production of machine tools in units, the organization of the production of fully equipped machine tools is objectively impossible.[68a]

VI. Imports

Value, Growth, and Structure

In addition to being the world's largest producer and user of machine tools, the U.S.S.R. has become the world's largest importer. During 1970–77, the U.S.S.R. imported machine tools valued at $5.7 billion—60 percent or about $3.3 billion from the West and the remainder mostly from Eastern Europe.[69] Exports of machine tools during this period totaled about $1.5 billion, mostly to Eastern Europe, yielding a net trade deficit in machine tools of about $4.2 billion—an average of over $500 million annually. By comparison, yearly imports by the United States—normally a net exporter—range from $200 to $400 million.

The U.S.S.R. has been importing machine tools from the Developed West for three decades, but in most years the volume was well below $50 million. A major shift toward greatly accelerated purchases of Western machine tools took place in 1967 when imports, for the first time, exceeded $50 million.[70] By 1970, imports had gone over the $200 million mark, and by 1977, were approaching the $700 million mark (see table 5). Much of the growth in imports during the late 1960's was in response to requirements generated by construction of the

[68a] Izvestiya, Mar. 14, 1979, p. 3.

[69] Purchases from the Developed West represent hard currency outlays. In a few cases, Western suppliers have taken Soviet machine tools as partial payment. These transactions are negligible as a share of total value of imports.

[70] Actually about $75 million using a $/R ratio of 2.46. This ratio was derived by comparing the ruble value of Soviet imports from the West in 1970, with the dollar value of Western exports to the U.S.S.R. in that year. This ratio, which will vary from year to year, provides a rough but probably more accurate approximation of dollar value than official exchange rates. At official rates the value of imports in 1967 would be about $34 million.

FIAT-designed passenger car plant at Tol'yatti. Similarly, the construction of the KAMA Truck Plant, and the modernization of other plants in the automotive and tractor industries were catalysts for continued growth in imports during the 1970's. Even so, the Tol'yatti and KAMA projects, and associated supplier plants, probably accounted for less than one-third of the value of all the machine tools imported.[71]

TABLE 5.—U.S.S.R.: IMPORTS OF MACHINE TOOLS AND TRANSFER LINES FROM THE WEST, 1970–77

[In millions of U.S. dollars]

	1970	1971	1972	1973	1974	1975	1976	1977	1970–77
Total	201.1	132.9	290.5	401.6	402.1	618.9	612.7	665.3	3,325.1
United States [1]	6.2	13.6	20.2	47.5	64.8	110.9	73.9	51.6	388.7
Metal cutting	5.9	12.8	14.0	11.9	15.0	24.4	18.0	21.7	123.7
Metal forming	.3	.8	2.2	4.3	23.3	21.2	16.3	8.4	76.8
Transfer lines			4.0	31.3	26.5	65.3	39.6	21.5	188.2
Japan [2]	12.8	8.3	39.5	42.5	38.5	29.0	23.9	81.9	276.4
Metal cutting	8.9	3.8	11.0	11.6	14.3	12.4	7.8	32.6	102.4
Metal forming	3.9	4.5	21.6	30.9	24.2	16.6	16.1	49.3	167.1
Transfer lines			6.9						6.9
Western Europe [3]	182.1	111.0	230.8	311.6	298.8	479.0	514.9	531.8	2,660.0
Metal cutting	77.1	48.7	127.0	168.4	164.5	224.1	314.5	[4] 292.0	[4] 1,416.3
Metal forming	73.6	50.4	62.3	106.2	128.1	147.8	146.5	[4] 172.0	[4] 886.9
Transfer lines	31.4	11.9	41.5	37.0	6.2	107.1	53.9	67.8	356.8

[1] Department of Commerce, Bureau of Census, FT410—Schedule B, 1970–77.
[2] Ministry of Finance, Japan Exports and Imports, 1970–77.
[3] Foreign Trade Statistical Tables, Series J. Statistical Office of the European Community, 1970–77; data for Sweden and Switzerland have been taken from Vneshnyaya Torgovlya SSSR, 1970–77.
[4] Estimated.

Of the Soviet imports from the West during 1970–77, metalcutting machine tools accounted for about one-half of the total, metalforming machine tools a little more than one-third, and transfer lines (which can combine both types) the remaining 16 percent. Although growth in imports dropped off sharply during 1976–77 the annual level remains high at more than $600 million.

Western Europe, overwhelmingly, was the major supplier of machine tools to the U.S.S.R., accounting for 80 percent (in value) of total Soviet imports for the eight years as a whole. The United States and Japan contributed roughly one-eighth and one-twelfth, respectively. Western Europe was the leading supplier in each of the three categories of machine tools, accounting for 86 percent of metalcutting imports, 78 percent of metalforming imports, and 63 percent of transfer lines (see figure 2).

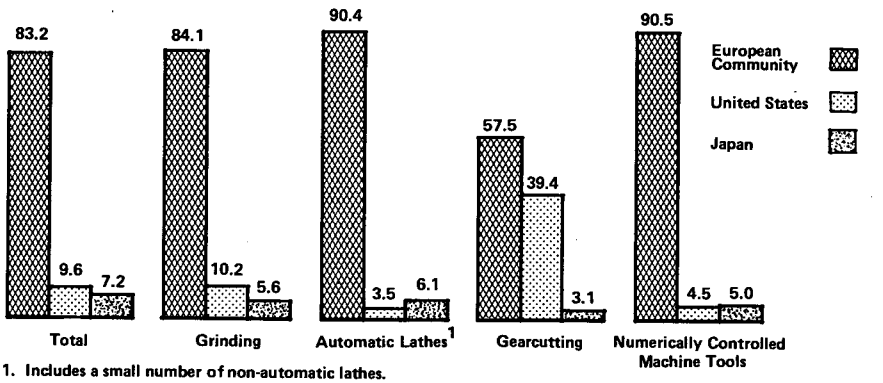
West Germany was by far the leading West European supplier with nearly 60 percent of total West European sales, including: more than half of all the metalcutting machine tools and transfer lines, and nearly three-fourths of metalforming machines (table 6).

[71] Estimate, based on fragmentary data.

Figure 2

Origin of Soviet Imports of Metalcutting Machine Tools, 1970-77

(Percent)



1. Includes a small number of non-automatic lathes.

TABLE 6.—SOVIET IMPORTS OF MACHINE TOOLS FROM WESTERN EUROPE, BY COUNTRY, 1970–77 (IN SHARES)

Total imports		Metalcutting		Metalforming		Transfer lines	
Country	Share (percent)	Country	Share (percent)	Country	Share (percent)	Country	Share (percent)
West Germany	59.9	West Germany	55.2	West Germany	68.9	West Germany	56.5
Switzerland	11.0	Switzerland	16.0	Italy	11.6	United Kingdom	15.5
Italy	9.9	Italy	10.2	France	7.2	Sweden	10.3
France	7.8	France	8.8	Switzerland	4.0	Switzerland	8.2
United Kingdom	6.6	United Kingdom	6.8	Sweden	3.8	France	5.1
Sweden	3.4	Sweden	1.4	United Kingdom	2.8	Italy	4.4
Belgium-Luxembourg	.8	Netherlands	1.1	Belgium-Luxembourg	1.6		
Netherlands	.6	Belgium	.5	Netherlands	.1		

The United States was important to the U.S.S.R. as a source of high-precision grinders, gearmaking machinery, and transfer lines—especially for the Soviet truck industry. In 1960, the U.S.S.R. sought, unsuccessfully, to acquire high-precision internal grinders from the United States for use in the manufacture of miniature bearings. Failing in their own efforts during the 1960's to produce grinders capable of manufacturing bearings of the desired precision, the U.S.S.R. persisted in efforts to purchase U.S. equipment. In a landmark 1972 trade control case that proved to be highly controversial, the Soviets finally acquired at least 150 of the highest precision grinders.[72] U.S. gear-cutting machinery was especially desired by the U.S.S.R. for its superior productivity and reliability relative to Soviet gearcutters. Imports of gearmaking machine tools include purchases from the U.S. firm of Gleason of at least $100 million.

[72] See "U.S. Reportedly Sold Russians Means to Make MIRV Part." The Washington Post, Feb. 26, 1976, p. A–3. For additional background, see Proposed Shipment of Miniature Ball Bearing Machines to Russia, U.S. Congress, Judiciary Committee, United States Senate, Washington, D.C., 1961; and "Ball Bearing Gap . . . Should We Help Russian's Close It?" The Washington Post, Mar. 1, 1961, p. C–8.

Even though U.S. exports of transfer lines did not begin in volume until 1973, they still accounted for nearly half of all U.S. machine tool exports to the U.S.S.R. during 1970–77, and one-third of total Soviet imports of transfer machinery. U.S. exports of transfer lines peaked in 1975 and declined sharply in both 1976 and 1977. By comparison, West European exports were up substantially over 1975. The juxtaposition of these two developments suggest that the special U.S. role as a supplier of high-speed transfer machinery to the Soviet industry is winding down. Indeed, all U.S. exports of machine tools to the U.S.S.R. have fallen off since 1975, while those of both Japan and West Europe have been increasing. This decline in imports from the U.S. could reflect Soviet displeasure with U.S. legislation which denies Moscow most favored nation treatment and credits from the U.S. export-import bank. In any event, the U.S.S.R. appears to be interested in purchasing U.S. machine tools (e.g., for truck manufacturing) only where the superior performance and productivity of the U.S. machines are preferred by the Soviets.

Soviet imports of conventional types of metalcutting machine tools have vastly exceeded imports of technologically advanced types (table 7).[73] During the 1970–77 period, conventional machine tools from the West (excluding Switzerland and Sweden) amounted to $1.1 billion, or more than 80 percent of the total compared with $270 million of NC machine tools. Three categories of machine tools made up more than three-fourths of *conventional* imports: automatic lathes (32 percent); grinding machines (36 percent); and gearmaking machines (12 percent). Two categories of machine tools made up more than four-fifths of imports of *advanced* types: machining centers (44 percent), and NC lathes (38 percent).

[73] To facilitate discussion, conventional metalcutting machine tools—types that traditionally have been produced (lathes, milling, grinding, etc.)—are distinguished from advanced types such as NC and machining centers.

TABLE 7.—U.S.S.R.: IMPORTS OF METALCUTTING MACHINE TOOLS FROM THE WEST, BY MAJOR TYPES, 1970–77

[In millions of U.S. dollars]

Type	1970	1971	1972	1973	1974	1975	1976	1977	1970–77	Shares, 1970–77 (percent)	
Total (excluding Sweden and Switzerland) [1]	79.9	53.9	138.9	163.7	172.0	226.8	281.1	294.5	1,410.8	100	
Conventional	79.1	51.0	133.0	139.1	157.7	190.1	185.2	204.5	1,139.7	80.8	100
Automatic lathes [2]	13.8	8.4	46.3	72.3	56.1	53.4	55.5	58.8	364.6	25.9	32.0
Grinding	38.5	17.7	36.4	33.4	57.9	79.2	71.4	72.3	406.8	28.8	35.7
Gearcutting	4.9	15.9	28.0	12.9	15.2	22.5	16.0	18.5	133.9	9.5	11.7
Milling, drilling, boring	8.5	3.4	9.1	11.1	17.6	21.6	26.3	38.1	135.7	9.6	11.9
Other	13.4	5.6	13.2	9.4	10.9	13.4	16.0	16.8	98.7	7.0	8.7
Numerical control	.8	2.9	5.9	24.6	14.3	36.7	95.9	90.0	271.1	19.2	100
Lathes		.9	1.9	14.6	1.4	9.6	39.8	35.2	103.4	7.3	38.1
Machining centers	.4	1.4	2.9	9.1	9.2	15.3	36.9	42.8	118.0	8.4	43.6
Other	.4	.6	1.1	.9	3.7	11.8	19.2	12.0	49.7	3.5	18.3
Sweden and Switzerland, total	12.0	11.4	13.1	28.2	21.8	34.1	59.2	51.8	231.6		
Grand total	91.9	65.3	152.0	191.9	193.8	260.9	340.3	346.3	1,642.4		

[1] Breakdown by type is not published in available statistical sources

[2] Includes a small amount of nonautomatic lathes.

To an unknown extent, Western controls on sales of strategic commodities to Communist countries have kept Soviet imports of NC machine tools lower than they otherwise would have been.[74] During 1976–77, following some relaxation in embargo controls, Soviet imports of NC machine tools surged, reaching nearly a third of total metal-cutting imports. To an unknown extent also, actual imports of NC machine tools are larger than shown since acquisitions from Sweden and Switzerland are not included in the NC totals.[75] Under any assumptions about the level of imports from these two countries, however, conventional imports would continue to predominate as a share of the total.

Technical Assistance

The U.S.S.R. has concluded a large number of technical assistance agreements with Western firms. Only a few of the participating Western firms are known, and details are lacking on all agreements. Available data are presented in Table 8. As indicated, most Science and Technology (S&T) agreements provide the Soviets with help in R&D; almost certainly this includes the transfer of existing design technology and assistance in developing new designs. Some agreements provide, in addition, manufacturing technology. Generally, the Soviets are receiving help with the design of both conventional and advanced machine tools, and manufacturing technology for conventional types.

Among conventional categories the Soviets are gaining manufacturing technology for two priority areas—automatic lathes and grinding machines. In the case of grinders, two critical types are being developed with Western aid,—internal grinders for the manufacture of miniature bearings and high speed grinders. In the past, the U.S.S.R. has been a major importer of both types. And in the case of automatic lathes, the large West German firm, Gildemeister, is helping construct a plant especially for their manufacture. The Soviets also are receiving manufacturing assistance for electronic measuring devices used to improve the precision of conventional machine tools.

[74] Several types of machine tools are embargoed by the U.S., Japan, and NATO countries (excluding Iceland). Generally these are either NC machine tools capable of 3 or more axes of continuous path control or machine tools capable of very high levels of precision.

[75] Sweden and Switzerland, which are not bound by the West's embargo, have sophisticated machine tool industries capable of supplying the U.S.S.R. with advanced types of NC machine tools. Swiss exports to the U.S.S.R. are not publicized. The most recent reference to Swedish exports of NC machine tools to the U.S.S.R. is in Soviet Business and Trade, Aug. 2, 1978, p. 10.

TABLE 8.—SOVIET SCIENTIFIC AND TECHNICAL ASSISTANCE AGREEMENTS WITH FOREIGN COUNTRIES

Country and partner	Type of agreement: R. & D.	Type of agreement: Manufacturing	Area of cooperation
France:			
Alcatel	X		Numerical controls for machine tools.
Construction de Clichy S.A.	X	X	Internal grinding machines for miniature bearings.
Line	X	X	NC machining centers.
G.S.P. Ratier Forest	X	X	NC planomilling machines.
	X	X	NC boring machines.
Ernault Somua		X	Grinding machines and heavy lathes.
Great Britain:			
Plessey	X		NC control system interfaces.
Ferranti	X		Control and measuring devices.
Italy:			
Olivetti		X	Electronic measuring devices for high-precision machine tools.
San Georgio, Marposs, SAIMP	X	X	NC grinding machines.
Unknown	X		Adaptive controls for NC machine tools.
Japan: Fujitsu, Ltd		X	Stepping motors.
West Germany:			
Gildemeister	X	X	Single-spindle automatic lathes.
	X	X	NC, special purpose "aggregate" machine tools.
Pittler	X	X	Multispindle automatic lathes.
Leibherr	X	X	High-speed grinding machines.
Seimens	X		Automatic control systems.
Unknown	X		NC programming.
	X		NC control systems.
	X		Industrial robots.

In the area of advanced, numerically controlled machine tools and related technologies, the Soviets are getting help where the technology lag is most pronounced. The first and most publicized agreement—signed nearly ten years ago with Alcatel of France—provided the Soviets with over 300 numerical control units and little else. Since that time, the Soviets have received assistance in the development, and possibly in the production, of numerically controlled machining centers as well as NC milling, grinding, and boring machines. More recently, they have concluded agreements which would provide technology for mating NC controllers with machine tools, for the preparation of NC program tapes (including programming languages), and technology for adaptive control systems.[76] In addition, the Soviets have acquired manufacturing know-how from Fujitsu of Japan for the production of stepping motors, a major component of open-loop NC systems.

VI. Impact and Prospects

Imports of machine tools have made an important contribution to the successful completion of the two largest civilian investment programs of the past decade—the Tol'yatti Passenger Car Plant and the KAMA Truck Plant. These projects, without Western machine tools, would have taken longer to bring on-stream, and, probably would have imposed severe strains on domestic machinery production programs. Moreover, Western machine tools are making it possible for the production of cars and trucks qualitatively closer to Western standards than otherwise would have been possible. In addition, imports have permitted the U.S.S.R to meet spot shortages of special-purpose machine tools, and in the case of machining centers, have provided advanced machining capabilities beyond the current domestic state-of-

[76] An advanced technique for maintaining optimum metalcutting efficiency and precision by automatically adjusting the speed and feed of the cutting tool according to sensor feedback.

the-art. Machining centers, which are widely used in the U.S. areospace industry may also be making an important contribution to Soviet aerospace manufacturing. Imports of high precision grinding equipment provided the U.S.S.R. with an instant industry for the production of miniature bearings that is not markedly smaller than that of the United States. Almost certainly it improved Soviet capabilities for producing miniature bearings for specific military applications.

Imports, however, are only a short-term solution to an essentially long-term problem. The Soviets need to raise the productivity, precision, and reliability of conventional machine tools across-the-board, and to stay abreast of world-wide developments in advanced machine tool technology. This task will not be easy as the dismal Soviet record of improving the state-of-the-art in gearcutting and grinding machine tools after long effort, amply testifies. At a minimum the Soviets will need to accelerate investments in R&D and in the renovation of machine tool production facilities. However, a recent sharp cutback in investment of new plant and equipment for the machine tool industry in 1979, which the Minister of the Machine Tool Industry has labeled "incomprehensible", indicates that progress on this front is likely to come slowly.[77]

Under existing Soviet priorities and conditions of production, it is unlikely that the Soviets could catch up with the West in machine tool technology by its own efforts. The penchant for copying Western innovations, rather than advancing state-of-the-art through indigenous efforts, tends to condemn the U.S.S.R. to a permanent "catch-up" role. Indeed, the Soviets appear to have abandoned efforts to bring about needed technological change exclusively through their own efforts and are banking heavily on Western help through S&T agreements. These agreements have not had dramatic impact as yet but can be expected to contribute substantially to a gradual rise in the general level of Soviet machine tool technology over the long term.

The Soviets will continue to import machine tools from the West to meet priority or specialized needs, although probably not in the volume that characterized imports during the 1970's. The need for gearcutting machinery, especially from the U.S. probably will phase down unless the Soviets launch construction of a new heavy truck plant possibly under consideration. It seems probable that the Soviets will attempt to acquire additional quantities of high precision grinding equipment, the more so if embargo restrictions are relaxed. Similarly, the scale of imports of machining centers and multi-axis NC machine tools will hinge partly on the level of embargo controls. A factor that could reduce future Soviet purchases of machining centers from the West in favor of purchases from Eastern Europe is the imminent rise of Poland as a large producer.[78]

Soviet purchases of transfer lines and automatic lathes which figured heavily in Soviet imports during 1970–77, very probably will decline, possibly dramatically, after 1980. By that time the six new Soviet plants for transfer lines should be in full operation. However, trans-

[77] Izvestiya, Mar. 14, 1979, p. 3. These cutbacks may be related to sharp increases in Soviet investment in energy development.

[78] Poland has been licensed by Japan to produce Japanese-designed machine centers. These centers will include controllers to be produced under license from Sweden, and parts of servo-mechanisms under license from a U.S. firm.

fer lines are only as productive as the machine tools that make them up. To the extent that the quality of Soviet machine tools continue to lag behind that of the West, the Soviets will continue to experience shortages of advanced types of transfer machinery. Soviet production of automatic lathes should accelerate in the early 1980's as the joint production agreements with Gildermeister of West Germany takes root.

Appendix

Data on imports of machine tools have been compiled from several sources. Imports from the United States were taken from Bureau of the Census data.[79] Imports from Western Europe were taken from two sources: publications of the European Economic Community for EC members,[80] and Soviet trade handbooks for Sweden and Switzerland.[81] Imports from Japan were taken from Japanese sources.[82] Data on imports of "transfer lines" for all countries were also taken from Soviet trade handbooks.

Much of the data in the listed sources had to be converted to dollars. All U.S. Census data, and EC data for 1970 and 1971 are given directly in dollars. EC data for 1972–77 are given in Units of Account and were converted to dollars at prevailing rates.[83] All data from Soviet and Japanese sources were converted to dollars at official exchange rates.[84]

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[79] Exports, Commodity by Country, U.S. Department of Commerce, Bureau of the Census, Corresponding years.

[80] Foreign Trade Statistical Tables, Series J, Statistical Office of the European Community, corresponding years.

[81] Vneshnaya Torgovlya U.S.S.R., corresponding years.

[82] Japan Exports and Imports, Ministry of Finance, corresponding years.

[83] A unit of account is a synthetic unit of currency that EC countries use for statistical accounting purposes. Conversion rates in dollars per Unit of Account, are: 1972—$1.12; 1973—$1.23; 1974—$1.19; 1975—$1.24; 1976—$1.12; and 1977—$1.14.

[84] Rates for Japan in yen per dollar: 1970—358; 1971—315; 1972—302; 1973—280; 1974—301; 1975—305; 1976—293; and 1977—240. Rates for the U.S.S.R. in dollars per ruble: 1970 and 1971—$1.11; 1972—$1.21; 1973—$1.35; 1974—$1.32; 1975—$1.38; 1976—$1.33, and 1977—$1.36.

SOVIET OIL DEVELOPMENTS

(By J. Richard Lee and James R. Lecky*)

CONTENTS

TABLES

I. SUMMARY

The Soviet Union, the world's leading oil producer, faces serious problems that are likely to result in a no-growth position by 1980 and a steady production decline beginning in the early 1980s. A major shift in energy policy was initiated at the December 1977 plenum of the Central Committee of the Communist Party. This policy called for a crash program to concentrate oil industry resources in West Siberia, the only region where major output increases have been obtained in recent years or projected by the Soviets in the foreseeable future. In other important regions, such as the Volga-Urals, production is on the decline.

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Despite the massive resource shift, Soviet oil prospects are uncertain at best. The failure in recent years to conduct adequate exploratory drilling to locate new oilfields is lowering the reserves-to-production ratio to the point where short-term growth in output is unlikely. No new major oil finds have been made in the last 6 years, despite Soviet admissions that new giant oilfields must be discovered regularly if growth in oil production is to be sustained. Large untapped resources may exist in the offshore arctic areas of the Barents and Kara Seas, in the deeper waters of the Caspian Sea, in East Siberia, and in the deep onshore Caspian depression. Exploration is only in the initial stages in most of these areas, however, so any discoveries would not affect production until the late 1980s or early 1990s.

The stepped-up campaign to develop West Siberian oil and gas resources faces two major problems. Given tight constraints on the supply of drilling rigs and skilled crews, more resources for this region will inevitably force older regions to do with less and lead to a more rapid falloff in their output. At the same time, Moscow's failure to create an adequate infrastructure in West Siberia will greatly reduce the effectiveness of new increments of investment. The Soviets have not created the production and support structure required to produce the many smaller and less productive fields from which much of West Siberia's oil output must come in future years—now that Samotlor, the U.S.S.R.'s largest oilfield, apparently will peak this year.

Until the 1970s the Soviets relied for the most part on their own equipment and know-how for oil production. In recent years, they have begun to import Western equipment and acquire Western technology to cope with more difficult oilfield problems. But even a much greater effort to buy or acquire Western equipment and technology would avail little in the way of increased production capacity before the mid-1980s.

As the rate of growth of oil production slows further, this year probably will mark the beginning of a trend of declining oil exports to the West. Higher oil prices may still allow the U.S.S.R. to maintain or increase hard currency earnings from oil sales in 1979 at or above 1977–78 levels. By the mid-1980s, if production declines to a level of 10 million b/d, the U.S.S.R. may have enough oil for its own needs but would have to procure from the West almost all of the oil it delivers to other Communist countries. At that time the U.S.S.R. would spend rather than earn hard currency in its oil trade.

II. Introduction

Although the U.S.S.R. leads the world in crude oil production—11.43 million b/d [1] in 1978—growth in oil output is slowing sharply. A controversial shift in oil policy was ordered in late 1977 to focus oil industry resources in West Siberia in an attempt to avert a seemingly inevitable oil production decline during the 1980s. The future of Soviet oil production has immense importance for the Soviet economy and the world oil market.

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[1] Includes gas condensate.

NOTE.—Soviet oil production data are reported in millions of metric tons. The conversion from metric tons per year to barrels per day (b/d) is made by multiplying by 0.02. $\left(\frac{\text{metric tons/year} \times 7.3 \text{ barrels/metric ton}}{365 \text{ days/year}}\right)$

This paper reports recent oil production trends and discusses the conflicts among policymakers over how best to manage the future development of the oil industry. The failures in the exploration program and major technical problems that confront the Soviets are then examined, with a close look at how these problems impact on major producing regions. Finally, an evaluation is made of prospects for production in the short run (through the mid-1980s).

III. Recent Production Trends

Oil production in the current plan period (1976–80) has continued to grow, but at decreasing rates—from 5.9 percent in 1976 to 4.7 percent in 1978. In the first half of 1979, oil output rose only 2.7 percent over that in the first half of 1978, but is only about the same—11.6 million b/d—as in the last 6 months of 1978. During the Ninth Five-Year Plan (1971–75) growth averaged 6.8 percent although annual goals were not fulfilled after 1971. (Details of plans and actual production during the present five-year plan period are given in table 1.)

In 1977, the U.S.S.R. failed to reach the 11 million b/d oil output goal by about 80,000 b/d. Only in the new northern oil regions—West Siberia and the Komi A.S.S.R.—did production increase substantially. In the older regions, output declined from 6.6 million b/d to less than 6.4 million b/d.

The 1978 goal, originally set in December 1975 at 11.6 million b/d, was lowered in December 1977 to 11.5 million b/d. Actual output was 11.43 million b/d, about 70,000 b/d below the revised plan and 170,000 b/d under the original annual goal.

The 1979 production target also has been lowered from 12.2 million b/d to 11.86 million b/d, calling for about the same annual increase as in 1978. However, output at the end of the first six months of 1979 is running about 250,000 b/d behind plan; production in 1979 probably will not reach 11.7 million b/d.

TABLE 1.—SOVIET OIL PRODUCTION PLANS AND RESULTS, 1976–80

[In millions of barrels per day]

Year	Original goal [1]	Revised goal [2]	Revised annual goals	Actual output
1976	NA	10.4	10.4	[3] 10.39
1977	NA	11.0	11.0	[3] 10.92
1978	NA	11.6	[4] 11.5	[5] 11.43
1979	NA	12.2	[6] 11.86	[7] (11.7)
1980	12.4–12.8	12.8	NA	[7] (11.6–11.8)

[1] Pravda, Mar. 7, 1976, pp. 2–8.
[2] Ekonomicheskaya gazeta, No. 8, Feb. 1977, p. 1.
[3] Narodnoye khozyaystvo S.S.S.R. v 1977g., Moscow, 1978, p. 145.
[4] Pravda, Dec. 16, 1977, p. 1.
[5] Ekonomicheskaya gazeta, No. 2., January 1977, p. 1.
[6] Pravda, Nov. 30, 1978, pp. 1–3.
[7] Estimated.

The 1980 target also seems unattainable and probably will be lowered by the end of this year. It was originally set in 1975 at 12.4–12.8 million b/d. Soviet planners raised the target to the upper limit of the range (12.8 million b/d) in 1976, but in late 1977 re-established the range.

The shortfall in 1978 and the further slowdown likely in 1979–80 reflect the continuing decline in output from the older producing areas west of the Urals Mountains and the peaking of large West Siberian oilfields. Output at the supergiant Samotlor oilfield in the Middle Ob region of West Siberia probably will peak this year,[2] and the smaller, more remote oilfields are not being developed as rapidly as needed.

Production shortfalls apparently have prompted the Soviets to reduce statistical reporting in recent years. Since 1976, regional oil output data from older regions where production is declining have been withheld. For example, no quarterly or annual output figures have been reported in newspapers from Azerbaydzhan, Turkmenia, and Kazakhstan. Moreover, for the first time since monthly reports began in 1966, no national monthly production figures were reported for January or February 1979 at all.

IV. Conflict Over Soviet Oil Policy

An outspoken article on West Siberian oil development problems was published in June 1977 by Dr. L. P. Guzhnovskiy, an economist at the Tyumen' Department of Economic Research of the Institute for Economics and Organization of Industrial Production of the Siberian Branch of the U.S.S.R. Academy of Sciences.[3] Guzhnovskiy revealed substantial disagreement over technical policies in the oil industry, the balance of investment between the Volga-Urals and West Siberian oilfields, and oil planning issues.

Since the early 1970s oil industry specialists and administrators have argued about the proper balance that should be struck between investment in the increasingly depleted Volga-Urals oilfields and in new fields in Siberia. Confronted by large cost increases in the oil industry during the 1971–75 Plan, Soviet oil policymakers decided in 1974–75 to commit relatively more capital investment, drilling rigs, and crews than might have seemed justified from a longer range perspective to maintain output in the Volga-Urals fields during 1976–80. This decision, publicly supported by Soviet planning chief, N. K. Baybakov,[4] represented a gamble that enhanced recovery from older fields would outweigh the additional production that might be anticipated from more rapid exploration and development of West Siberian fields.

In attacking this position, Guzhnovskiy: (*a*) indicated a strong undercurrent of anxiety that oil and gas production plans would not be met, or met only at excessive cost; and (*b*) doubt that the Soviet Union had an effective planning strategy for meeting oil needs after 1980.

The December 1977 plenum of the Central Committee of the Communist Party initiated an important shift of emphasis in Soviet energy policy.[5] This policy, inaugurated in the middle of the 1976–80 plan period, calls for concentrating resources on oil and gas development in West Siberia's Tyumen'Oblast. This crash program—attributed to Brezhnev—represents a major political victory for advocates

[2] Pravda, Nov. 28, 1978 ; p. 3.
[3] Ekonomika i organizatsiya promyshlennogo proizvodstva, No. 6, 1977, pp. 35–43.
[4] Ekonomicheskaya gazeta No. 11, Mar. 1974, pp. 7–8.
[5] Pravda, Dec. 18, 1977, p. 1.

of accelerated West Siberian development. It marks a defeat for those—including Baybakov—who have resisted this course of action in the past.

A *Pravda* editorial featured the plenum decision as follows:

> Among the interbranch problems there is none more important than the fuel and power problem. In the next 10 years, the decisive role in ensuring fuel and power for the country will remain with oil and gas, first and foremost from Tyumen'. The first stage for the all-round mastering of underground resources and the development of production forces in West Siberia has been completed successfully. Now the need to implement the next stage arises with the greatest urgency. It is important to concentrate resources and the possibilities for capital construction on this truly great construction site of our time, to back up economic measures with mass political measures, and to strengthen the attention drawn to them by the Komsomol and the press.

The most immediate consequence of the December plenum has been the decision to pull drilling brigades out of Volga-Urals fields (Bashkir, Tatar, Kuybyshev, and Saratov) and fly them to drilling sites in Tyumen'. Forty such brigades were mobilized for 1978, to conduct about one-seventh of total development drilling during the year. The reasons behind this abrupt concentration of attention upon Tyumen' appears to include a belated appreciation of: (*a*) the declining prospects for the Samotlor oilfield; (*b*) the critical rundown of West Siberian oil reserves following a decade of insufficient exploration; and (*c*) the steeply rising level of resources and manpower needed to drill more and more wells in increasingly less productive deposits farther and farther from established support bases and transportation.

In the short run the Soviet leadership now is gambling that production increases from Tyumen' will more than compensate for the likely shortfall in Volga-Urals output arising from the reallocation of resources. It may, however, have overestimated the speed at which Tyumen' can be further developed. In the longer run, concentration on Tyumen' could weaken a more broadly based exploration and development effort that might hold greater promise for the future. Whether the oil resources needed to support the Soviet economy for the foreseeable future can be discovered remains uncertain. No giant oilfields have been found in West Siberia in the last 6 years, while all of the large, promising structures in West Siberia reportedly have been drilled.[6]

During the past two to three years Gosplan officials have emphasized the importance of fuel conservation in the USSR. However, at the November 1978 plenum Brezhnev admitted that no important energy savings had been made.[7] Only limited opportunities for oil savings are available. Some substitution of natural gas for oil as a fuel in thermal power plants and some industrial boilers is possible, depending on the extent of the urban gas distribution network. Such savings would result primarily in increased supplies of residual fuel oil, but the petroleum products now in short supply are the light distillates—

[6] Pravda, Aug. 10, 1977, p. 2.
[7] Izvestiya, Dec. 1, 1978, pp. 2–3.

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gasoline, jet fuel, diesel fuel. Secondary refining capacity is presently inadequate to convert larger volumes of residual fuel oil to the desired light products and this situation probably will prevail for several years.

V. Slowdown in Exploration

The Soviet Union has large potential oil reserves, but most of them are relatively inaccessible or in complex and difficult geological formations. These areas include the Barents and Kara Seas, deep waters of the Caspian Sea, East Siberia, and the deep onshore Caspian depression. None of them have been explored intensively; any oil finds will have little impact on oil production until the late 1980s or early 1990s at the earliest.

In the short run, reserves in existing producing areas must be relied on, but the situation appears to be tight. The volume of exploratory drilling has stagnated since 1965, and the success rate for prospecting wells in new fields has declined.[8] Emphasis has been placed on development drilling to meet oil production goals. To replace reserves scheduled to be produced during 1976–80, the Soviets must find 21 billion barrels, an amount that exceeds estimated gross discoveries during 1971–75 by almost 50 percent.[9] If production were to continue to increase during the early 1980s, the equivalent of a new giant Samotlor oilfield would have to be discovered every other year. No new giant oilfields have been reported since 1973. F. K. Salmanov, Chief of Glavtyumengeologiya, decried the cutback in exploratory drilling in West Siberia during the late 1960s and early 1970s as it reduced the rate of oil discoveries needed for future growth.[10]

Intensifying the problem of the slowdown in exploratory drilling is the imbalance between drilling to confirm reserves at existing fields and prospecting (wildcatting) to locate new fields. The Soviet system encourages drillers to concentrate on the more profitable confirmation drilling. The lack of effort in wildcatting has been criticized in the Soviet press, and efforts are being made to increase this activity for locating new oil deposits.

Exploration is also hampered by inadequate geophysical and drilling equipment. The average depth of exploratory drilling has increased from 2,540 meters in 1970 to 2,774 meters in 1976,[11] and an average of 3,180 meters is anticipated for 1980.[12] At these greater depths, higher pressures are encountered and drilling speeds are reduced. Moreover, as the largest, most easily accessible, and geologically-simple structures are found, an increasing share of remaining reserves lies in smaller, more complex stratigraphic traps which are more difficult to locate. In mid-1977 the Soviets admitted that the search for stratigraphic traps in West Siberia was proceeding blindly because of inadequate exploration equipment.[13] The lack of sophisticated seismic equipment and digital computerized processing equipment are the major shortcomings.

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[8] Campbell, Robert W., "Trends in the Soviet Oil and Gas Industry." John Hopkins University Press, Baltimore, 1976, pp. 9–10.
[9] CIA, "Prospects for Soviet Oil Production: A Supplemental Analysis." ER–77–10425, July 1977, p. 23.
[10] Sovetskaya rossiya, Dec. 8, 1978, p. 2.
[11] Bureniye, No. 9, 1977, p. 4.
[12] Ekonomika neftyanoy promyshlennosti, No. 11, 1978, p. 13.
[13] Pravda, Aug. 10, 1977, p. 2.

Another factor limiting available oil reserves, is producibility. In the U.S.S.R. during the 1961–76 period, a larger share of oil reserves was found in smaller reservoirs that are more difficult to produce and where anticipated oil recovery is lower.[14] The Soviets also admit that original calculations of oil yields from reservoirs where waterflooding methods were used were optimistic, and new efforts have to be made to increase oil yields by tertiary recovery methods.[15] Throughout the country the majority of large fields discovered in recent years contain heavy oils, some of which are non-flowing.[16] Such oil is not easily produced by standard Soviet techniques of waterflooding. The share of heavy oil reserves in the total for two major producing associations in the Volga-Urals region—Tatar, and Bashkir—is high and increasing. In West Siberia, much of the remaining reserves of major producing fields lie in unproductive reservoirs.

Exploratory drilling has been underway for some time to locate oil beneath the gas deposits in northern Tyumen' Oblast, but the lack of sophisticated equipment and drilling mud technology to deal with the high pressures and greater depths has slowed the pace of exploration.[17] However, F. K. Salmanov claims that a "second Tyumen" will be found within Tyumen' Oblast despite the pessimism expressed by some geologists in the Ministry of the Petroleum Industry.[18] A recent report indicated that six oil deposits had been discovered under the gas fields, but there is considerable uncertainty about the size and extent of these structures. For example, at the Urengoy field alone 1.2 million meters of exploratory wells are required to complete the study of the oil and gas deposits.[19] Such extensive exploratory drilling at one field is unprecedented for the Soviets; it is almost equivalent to total exploratory drilling in all of West Siberia during 1976–77.

VI. Constraints on Production

A. General

Essentially all of the major oil producing regions in the Soviet Union are faced with similar problems: major oilfields have reached peak production or are in decline, new fields are less productive and are more difficult to produce, and the proved and probable reserves appear to be limited. Development of new deposits that could have any significant effect on total output is unlikely before the late 1980s. Enhanced recovery methods, which were to increase oil yields from existing deposits during 1976–80, have had but little success to date. Increasing efforts are required simply to maintaining production levels or to minimize declines in most producing areas. As the rate of depletion of producing capacity in older fields soars, the probability for oil production growth beyond 1980 is exceedingly slim.

During the present five-year plan period (1976–80) the bulk of Soviet oil will be produced from two regions—West Siberia and the Volga-Urals. In 1978, these areas produced almost 9.3 million b/d,

[14] Neftegazovaya geologiya i geofizika, No. 6, 1977, pp. 3–6.
[15] Ibid.
[16] Sotsialisticheskaya industriya, Jan. 31, 1979, p. 2.
[17] Sotsialisticheskaya industriya, Mar. 3, 1978, p. 2.
[18] Sovetskaya rossiya, Dec. 8, 1978, p. 2.
[19] Komsomol'skaya pravda, Mar. 11, 1979, p. 1.

about 81 percent of national output. The major tasks facing Soviet planners are to continue rapid growth of West Siberian oil output and to minimize production declines in the Volga-Urals region. In 1978, only 5 of 26 Soviet oil-producing associations—Tyumen', Tomsk (West Siberia), Komi (north European region), Georgia (Caucasus), and Udmurt (lower Volga-Urals)—increased oil output,[20] and except for West Siberia, growth was very small. Since 1975, West Siberia has provided all of the new growth in oil output, offsetting an accelerating decline in most other areas. The importance of the Eastern regions in the Soviet Union's oil production is shown in table 2.

TABLE 2.—U.S.S.R.: REGIONAL PRODUCTION OF CRUDE OIL,[1] 1970, 1975–78, 1979–80 PLANS

[In millions of barrels per day]

						Plan	
	1970	1975	1976	1977	1978	1979	1980
U.S.S.R., total	7.06	9.82	10.39	10.92	11.43	11.86	[2] 12.4–12.8
Eastern regions	1.28	3.84	4.48	5.18	5.87	6.46	[3] 6.9–7.2
West Siberia	.63	2.96	3.63	4.37	5.08	5.69	6.0–6.3
Central Asia	.60	.83	.80	.76	.74	.72	.86
Sakhalin	.05	.05	.05	.05	.05	.05	.05
Western regions and Urals	5.78	5.98	5.91	5.74	5.56	5.40	[3] 5.5–5.6
Volga-Urals	4.17	4.52	4.51	4.39	4.20	3.99	3.8–3.9
Komi	.15	.22	.26	.30	.33	.35	.50
Belorussia	.08	.16	.12	.10	.10	.10	.10
Ukraine	.28	.26	.23	.21	.19	.18	.17
North Caucasus	.70	.48	.46	.42	.43	.46	50
Azerbaydzhan	.40	.34	.33	.32	.31	.32	.44

[1] Includes gas condensate.
[2] Original plan.
[3] Rounded to 2 significant digits.

Sources: 1970, 1975, Ekonomika neftyanoy promyshlennosti, No. 7, 1976 pp. 47–49. 1976–1977: U.S.S.R. total: Narodnoye khozyaystvo SSSR v 1977 g., Moskva, 1978, p. 145. West Siberia: Ekonomicheskaya gazeta, No. 17 Apr. 78, p. 1. Komi: Neftyanoye khozyaystvo, No. 4, 1977, p. 13. (1976) Ekonomicheskaya gazeta, No. 8, Feb. 78 (1977), p. 2. Other regions: preliminary estimates. 1978, preliminary estimates.

B. Drilling

The increasing depletion rate of old producing capacity is a major problem in the Soviet oil industry. During 1961–70, 45.8 percent of new production capacity was required to offset depletion.[21] In 1971–75 the share rose to 65.8 percent and during 1976–80 a 74 percent depletion rate is anticipated.[22] Most of this new capacity must be created by drilling new wells, and as a result drilling requirements have increased sharply. Moreover, as old fields become depleted, well productivities decline. New areas are being developed and well depths are increasing, all adding to the rising drilling needs. As increasingly larger shares of new capacity are required just to maintain output, new growth becomes increasingly more difficult. The increase in drilling by the Ministry of the Petroleum Industry during 1970–78 and plans for 1979–80 are shown in table 3.

[20] Ekonomicheskaya gazeta, No. 2, January 1979, p. 2.
[21] Neftyanoye khozyaystvo, No. 7, 1974, p. 2.
[22] Neftyanoye khozyaystvo, No. 7, 1976, p. 4.

TABLE 3.—U.S.S.R.: OIL DRILLING BY THE MINISTRY OF THE PETROLEUM INDUSTRY

[In thousands of meters]

	Exploratory	Development	Total
1970 [1]	2,831	6,198	9,029
1971 [1]	2,953	6,291	9,244
1972 [1]	2,904	6,951	9,855
1973 [1]	2,868	7,677	10,545
1974 [1]	2,921	8,060	10,981
1975 [1]	2,733	8,927	11,660
1976 [1]	2,546	9,521	12,067
1977	NA	NA	[2] 12,400
1978	2,400	11,300	[2] 13,700
1979 plan	2,400	14,600	[3] 17,000
1980 plan	NA	NA	[3] 19,800

[1] Bureniye, No. 9, 1977, p. 4.
[2] Neftyanik, No. 3, 1979, pp. 1–4.
[3] Estimated as residual from total of 75,000,000 meters for 1976–80, as reported in Khimiya i tekhnologiya topliv i masel, No. 1, 1977, pp. 8–9.

During 1971–75, total drilling by the Oil Ministry was 52.3 million meters, almost 4 million meters below the plan of 56 million.[23] Plans for 1976–80 call for the Ministry to drill 75 million meters, an increase of more than 4 million meters per year during the five-year period. Almost all of the increase is planned for West Siberia, where drilling meterage is to rise from a total of 9.5 million during 1971–75 to 30 million meters in 1976–80. These goals appear to be unrealistic as they project unprecedented jumps in the last two years (1979 and 1980).

C. Waterflooding

Over the past 20 years the U.S.S.R. has claimed that, because of advanced practices, it recovers a much higher percentage of the original oil in place than does the United States or other Western oil producing countries. The Soviets attribute their reported high recovery rates—40–45 percent—to their production practices, especially the early employment of water injection to maintain a rapid flow of oil through the reservoirs to producing wells. More than 230 deposits are now being waterflooded, and 86 percent of total Soviet oil output is obtained by this means. Nonetheless, the Soviets have recently acknowledged that, even at best, oil recovery from waterflooding does not exceed 40 percent of oil in place.[24] Such a reduction from earlier claims could sharply lower recoverable oil reserves.

Water injection has enabled the Soviets to minimize their initial oil field investment, obtain a higher initial level of output per well, and drill fewer producing wells. Although these practices yield high production rates in the early years of an oil field's life, problems develop as the fields age. Injected water breaks through the oil-bearing formations into the producing wells, and additional wells must then be drilled (in-fill drilling) to locate the oil, or expensive pumps must be installed to life the large volumes of fluid (water and oil) needed to maintain oil production. The average water cut for all producing fields in the country exceeded 50 percent in 1977.[25] For some of the large older producing fields in the Volga-Urals region, the water cut is considerably higher. As water cuts soar, increasing amounts of fluid

[23] CIA "Prospects for Soviet Oil Production: A Supplemental Analysis" July 1977, p. 23.
[24] Sotsialisticheskaya industriya, Jan. 31, 1979, p. 2.
[25] Neftyanoye khozyaystvo, No. 1, 1979, p. 7.

must be lifted for the same volume of oil. More infill drilling can ease the problem. Because the ambitious drilling requirement for the 1976–80 period is unlikely to be achieved, however, total fluid lifting requirements will have to increase more than the 56 percent planned.[26]

D. Enhanced Recovery [27]

The Soviets are counting on enhanced recovery methods to boost oil production at older fields and to produce previously undeveloped deposits that contain heavy oil. Plans for 1976–80 call for a greater expansion of enhanced recovery operations. In September 1976, Deputy Chairman of Gosplan, A. Lalayants, outlined a comprehensive plan for increasing oil recovery at existing fields.[28] Soviet experience with enhanced recovery is relatively limited although they have experimented with all of the basic methods. Soviet data indicate that various methods of enhanced recovery (primarily thermal) accounted for an additional output of about 117 million barrels of oil during 1966–78—less than 0.3 percent of the total produced during those years.[29]

According to recent Soviet technical discussions, ultimate oil recovery via enhanced recovery techniques could reach 85–90 percent.[30] Levels this high, however, are theoretical and unlikely to be attained in any commercial operation.

U.S. interest in enhanced recovery, for example, soared after the 1973 OPEC embargo, but pilot projects revealed that the costs of such methods were very high. One major study concluded that the use of enhanced recovery methods in existing fields in the U.S. could boost the average oil recovery rate by the year 2000 to only about 40 percent, compared with 33 percent now.[31]

Enhanced recovery methods are very expensive, require specialized equipment and chemicals, and take a long time to become effective. Despite the importance the Soviets attach to enhanced recovery, a newspaper article reported this year that only two percent of the necessary equipment to conduct such work was available in the country, and much of the equipment supplied was inferior.[32] Moreover, the necessary chemicals for these operations are in short supply.

To overcome domestic shortages, the Soviets are making a concerted effort to obtain Western technical assistance and equipment. In the fall of 1977 an Italian firm, Pressindustria, was awarded a $24.5 million contract to build a plant for production of 250,000 tons per year of surfactants for tertiary oil recovery. The plant was to be completed in 1979.[33] Two carbon dioxide (CO_2) liquefaction plants, valued at $38 million, were ordered in early 1978 from a West German company, Borsig, to support a miscible flooding operation. One plant with a capacity of 1 million tons/year is to be built east of Moscow for use in the Volga-Urals fields and the second with a capacity of 400,000

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[26] Neftyanoye khozyaystvo. No. 7, 1977, p. 5.
[27] Enhanced oil recovery is defined as the additional recovery of oil from a petroleum reservoir over that which can be economically recovered by conventional primary and secondary methods. Chemical flooding, carbon dioxide miscible flooding, and thermal methods are the general classifications employed.
[28] Sotsialisticheskaya industriya. Sept. 11, 1976, p. 2.
[29] Guzhnovskiy, L. P. "Ekonomika Razrabotki Neftyanikh Mestorozhdeniy." Moscow, Nedra, 1977, p. 139; Neftyanik, No. 3, 1979, pp. 1–4.
[30] Voprosy ekonomiki, No. 10, 1978, p. 12.
[31] "Enhanced Oil Recovery," National Petroleum Council, December 1976.
[32] Sotsialisticheskaya industriya Jan. 31, 1979, p. 2.
[33] Ecotass 43, Oct. 24, 1977, p. 11; Wall Street Journal, Nov. 3, 1977.

tons/year will be installed near Kemerovo in Siberia. Completion of both plants is expected in 1980.[34]

VII. Developments in Major Producing Regions

A. West Siberia

Increases in Soviet oil output for the foreseeable future will have to come from West Siberian oilfields in Tyumen' and Tomsk Oblasts. Production in this region began in 1964 and has increased rapidly, accounting for 44 percent of national production in 1978. Maximum annual growth was reached in 1977 at about 740,000 b/d; plans for 1979 and 1980 call for increments of about 610,000 b/d (see Table 4). The decline in growth stems from the fact that the supergiant Samotlor oilfield apparently will reach peak production in 1979 at about 2.9 million b/d. Greater output is required from smaller remote fields where the infrastructure—pipelines, powerlines, roads, housing—has not been developed as rapidly as needed.

TABLE 4.—U.S.S.R.: WEST SIBERIAN OIL PRODUCTION[1]

[In millions of barrels per day]

Year	West Siberian production			
	Total	Tyumen' Oblast	Tomsk Oblast	Samotlor Oilfield
1964	(2)	(2)	0	0
1965	.02	.02	0	0
1966	.06	.06	Negl.	0
1967	.12	.11	.01	0
1968	.24	.23	.01	0
1969	.43	.40	.03	.03
1970	.63	.56	.07	.09
1971	.90	.80	.10	.20
1972	1.25	1.14	.11	.42
1973	1.75	1.65	.10	.78
1974	2.33	2.20	.13	1.22
1975	2.96	2.83	.13	1.73
1976	3.63	3.50	.13	2.20
1977	4.37	4.22	.15	2.56
1978	5.08	4.91	.17	2.86
1979 plan	5.69	5.50	.19	[3] 2.9
1980 plan	6.3	NA	NA	[3] 2.9

[1] Includes gas condensates.
[2] 4,000 barrels per day.
[3] Estimate.

Sources: 1964–70, Neftyanik, No. 7, 1971. 1971–75, Ekonomikia i organizatsiya promyshlennogo, proizvodstva, No. 6, 1976, p. 80. 1976–77, Ekonomicheskaya gazeta, No. 17, April 1978, p. 1. 1978, 1979 plan, Ekonomicheskaya gazeta, No. 2, January 1979, p 2. 1980 plan, Sovetskaya rossiya December 8, 1978, p. 2.

Soviet production strategy in the near term is to maintain high levels of production at Samotlor and to rapidly develop new smaller fields. High production levels at Samotlor possibly can be maintained through the extensive use of submersible electric centrifugal pumps, gas-lift equipment, and continued drilling of less productive formations. In 1975, however, Tyumen' specialists warned that accelerating output at Samotlor to a level of 2.5 million to 3 million b/d and maintaining it at that level would result in a sharp decline in its production after a short time.[35]

The Soviets repeatedly emphasize the speed at which Siberian fields have been brought to maximum production. Samotlor, for example,

[34] European Chemical News, Apr. 7, 1978; Soviet Weekly, Apr. 22, 1978; Chemical Marketing Reporter, Apr. 17, 1978.
[35] Pravda, June 11, 1975, p. 2.

attained its maximum production rate in 9–10 years, compared with 20 years for the giant Romashkino field in the Tatar A.S.S.R. (Volga-Urals region). Such rates have been achieved by water injection from the start of production, concentrating on the best formations, and using submersible pumps. These production methods have caused rising water cuts. Although the water cut in all producing oilfields in West Siberia was only 15.8 percent in 1976,[36] it is rising and some older wells at Samotlor now have water cuts of 50 percent.[37]

1. DRILLING

West Siberian oil producers now face the same drilling problems that other regions present—rapidly increasing depletion of oil producing capacity, increasing well depths, and declining well productivities. Capacity depletion is perhaps the key problem. In 1976, one-third of total new West Siberian production capacity was needed to offset depletion. By 1980, the depletion offset is to reach more than half of total new capacity.[38] Thus, the increase of 600,000 b/d in oil production growth planned for 1980 over the previous year would require more than 1.2 million b/d of new capacity. New well productivity in West Siberia has declined since 1972 and probably will fall further. Wells in new fields are only one-third as productive as wells drilled previously in older West Siberian fields and wells in less developed reservoirs of old fields are also significantly less productive, sharply raising the drilling effort to obtain one unit of new production capacity. Average well depth has also been increasing throughout the region, and will continue to do so as deeper reservoirs, such as Paleozoic formations in Tomsk Oblast, are tapped.

Table 5 shows the growth of the drilling effort attained and planned in West Siberia compared with the total for the Ministry of the Petroleum Industry.

TABLE 5.—U.S.S.R. REGIONAL DRILLING RESULTS AND DRILLING PLANS FOR THE MINISTRY OF THE PETROLEUM INDUSTRY, 1970–80

[In million meters]

Year	West Siberia	Other Regions [1]	Total oil Ministry
1970	[2] 1.0	8.0	[3] 9.0
1971	[2] 1.2	8.0	[3] 9.2
1972	[2] 1.4	8.5	[3] 9.9
1973	[2] 1.8	8.7	[3] 10.5
1974	[2] 2.3	8.7	[3] 11.0
1975	[2] 2.8	8.9	[3] 11.7
1976	[4] 3.4	8.7	[3] 12.1
1977	[5] 3.8	9.0	[6] 12.4
1978	[5] 5.0	8.7	[6] 13.7
1979 plan	[7] 7.5	9.5	[8] 17.0
1980 plan	[9] 10.0	9.8	[8] 19.8

[1] Total Oil Ministry less West Siberia.
[2] Muravlenko, V.I., Kremneva, V.I., Sibirskaya Neft', Moscow, Nedra, 1977, p. 29.
[3] Bureniye, No. 9, 1977, p. 4.
[4] Neftyanoye khozyaystvo, No. 5, 1977, p. 7; Bureniye, No. 10, 1977, p. 7.
[5] Neftyanoye khozyaystvo, No. 5, 1978, p. 4.
[6] Neftyanik, No. 3, 1979, p. 1–9.
[7] Sotsialisticheskaya Industriya, Feb. 1, 1979. p. 1.
[8] Khimiya i tekhnologiya topliv i masel, No. 1, 1977, pp. 8–9 states that the Ministry of the Petroleum Industry must drill 75,000,000 meters during 1976–80. Data for 1979 and 1980 are apportioned as the residual of 75,000,000 less the total for 1976–78.
[9] Neftyanoye khozyaystvo, No. 4, 1978, p. 8.

[36] Ekonomika neftyanoy promyshlennosti, No. 3, 1978, p. 8.
[37] Neftyanoye khozyaystvo, No. 5, 1978, p. 54.
[38] Voprosy ekonomiki, No. 8, 1978, p. 16.

Whether the increased drilling requirements from the drive to keep West Siberian production up can be met is doubtful, given present Soviet drilling technology and practices. Nonetheless, an all-out effort is being made to achieve the drilling goals in West Siberia. By January 1978, 83 drilling brigades were operating in West Siberia; 180 were required to meet the 1980 drilling goal.[39] New West Siberian brigades were formed, but brigades from other regions were needed on a large scale if declines in production were to be averted.[40] These drilling crews, flown in from the Volga-Urals region beginning in 1977, work by the "expedition" method. They stay for 2 weeks or more in West Siberia and then go to their home base for a week or two, and the cycle is repeated. In 1978, these "expedition" brigades were to drill 700,000 meters [41] of the five million meters scheduled for West Siberia. They fell short of their goals in the first half of 1978—hampered by the lack of drilling equipment, shortage of housing, and unfamilarity with West Siberian drilling practices.[42] Nevertheless, the new brigades are to drill half of the total annual increases in drilling in 1979 and 1980.[43]

West Siberian requirements for drilling equipment are not being met. Complaints of poor quality drill pipe and casing appear regularly in the Soviet press, but the lack of drilling rigs is the severest constraint. V. I. Muravlenko, former director of Glavtyumenneftegaz (Main Administration for Tyumen' Oil and Gas), stated in 1976 that Soviet rig production would have to double in order to meet the West Siberian drilling goal of 6 million meters in 1980.[44] Meanwhile the West Siberian drilling target for 1980 has been raised to 10 million meters and there are no signs of a substantial growth in rig production. On the contrary, reports indicate severe shortfalls in the supply of rigs to West Siberian drillers.[45]

Increased drilling productivity could reduce the number of rigs needed, but productivity is falling rather than improving. West Siberian drilling brigades averaged 48,000 meters/year in 1977, about twice the national average,[46] but about 10,000 meters/year less than in 1974.[47] In late 1978 drilling indices were deteriorating further as brigades moved away from the developed infrastructure of older fields to smaller, more remote ones.[48]

2. INFRASTRUCTURE

Part of the West Siberian problem is that oil production has run ahead of the installation of the infrastructure necessary to support the oil and gas industries. In mid-1978, of the ten new fields that were developed after January 1976 in the more remote areas, none had roads and only two had electric power connections.[49] Pipeline construction to these fields is lagging, and many of the field preparation and treating units to process crude oil before it enters a pipeline are not being built.

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[39] Sotsialisticheskaya industriya, Jan. 22, 1978, p. 2.
[40] Pravda, June 5, 1978, p. 2.
[41] Pravda, May 6, 1978, p. 2.
[42] Pravda, June 5, 1978, p. 2.
[43] Neftyanik, No. 9, 1978, p. 2.
[44] Sotsialisticheskaya industriya, Jan. 1, 1976, p. 1.
[45] For example—Sovetskaya rossiya, Feb. 25, 1978, p. 1; Pravda, June 5, 1978, p. 2.
[46] Ivestiya, Feb. 17, 1978, p. 2.
[47] Murvalenko, V. I., Kremneva, V. I., Sibirskaya Neft', Moscow, Nedra, 1977, p. 164.
[48] Pravda, Dec. 30, 1978, p. 2.
[49] Ekonomika i organizatsiya promyshlennogo proizvodstva, No. 2, 1979, p. 26.

As a result, some salt and water are apparently delivered along with crude oil. Refineries, therefore, must install desalting and dewatering facilities to treat the oil before it can be processed, and the operating life of the pipelines is being shortened by corrosion. West Siberian construction organizations do not have the capacity to handle increasing demands.[50] The inadequate road construction program, for example, seriously endangers the entire drilling plan.[51]

Demands on the transport sector also cannot keep pace with West Siberian development. Drilling alone requires one ton of freight per meter drilled.[52] One kilometer of large-diameter pipeline uses 3,000 tons of cargo.[53] The construction requirement—combined with the supplies needed in the cities and industrial sites—has placed an overwhelming burden on the transportation system. River transport facilities are inadequate, but railroads are the most serious bottleneck. The 1980 targets for freight transport have been declared impossible to reach.[54] Demands on the railroads are especially heavy in the four or five winter months because much of the equipment must be delivered to the remote oilfields when the surface is frozen, since few all-weather roads are available.

A new large-diameter (48″) pipeline is being constructed from Surgut to Polotsk, extending some 3,300 kilometers; about 2,000 kilometers are to be built in 1979.[55] There are currently four crude oil pipelines from West Siberia, with an annual throughput capacity of some 5 million b/d, about the same as the 1978 West Siberian output. The new line, when completed in 1980, would allow the Soviets to handle the 6.3 b/d of oil planned to be produced in that year, although not all of the capacity may be used in view of the expected production shortfall.

B. Volga-Urals

The Volga-Urals was the Soviet Union's largest oil producing region from the mid-1950s until 1978, when West Siberia took the lead. The older Volga-Urals fields are in the "late" stage of development, characterized by rapidly rising water cuts and declining output. Considerable drilling is necessary to limit the decline. A Soviet geologist, S. P. Maksimov, analyzed the oilfields of this region. His study showed that many oilfields discovered in the region have not yet been produced, but these fields appear to be small and have relatively low commercial potential.[56]

The fact that Soviet planners decided to send many drillers from the Volga-Urals area to develop new West Siberian fields suggests the limited potential of the Volga-Urals fields. The situation is especially bleak in the four major producing associations in this area—Tatneft' (Tatar A.S.S.R.), Bashneft' (Bashkir A.S.S.R.), Kuybyshevneft'

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[50] Sovetskaya rossiya. Mar. 3, 1978. p. 2.
[51] Pravda, June 5, 1978, p. 2.
[52] Trud, April 11, 1978. p. 2.
[53] Sovetskaya rossiya, May 16, 1978, p. 2.
[54] Pravda, Sept. 27, 1978. p. 1. The plight of rail transport was illustrated by events in January 1979. The West Siberian oil industry requires 4,000–5,000 railroad cars of freight per month for delivery to remote fields. The January plan called for only 3,157 rail cars of deliveries. Even so, because of the severe weather, only about half of the planned number of cars actually arrived, seriously shortchanging the development plans. Sotsialisticheskaya industriya, Feb 1, 1979, p. 1.
[55] Stroitel'naya gazeta, Jan. 26, 1979, p. 1.
[56] Maksimov, S. P., ed. Geologiya Neftyanykh i Gazovykh Mestorozhdeniy Volga-Ural'skoy Neftegazonosnoy Provintsii, Moscow, Nedra, 1970.

(Kuybyshev Oblast), and Permneft' (Perm Oblast)—that account for about 90 percent of Volga-Urals oil production.

1. TATAR

Oil production in the Tatar A.S.S.R. reached a peak of 2.07 million b/d in 1975 and has been declining slowly ever since. Sharper declines are expected. In 1976–80, plans call for this association to produce about 3.36 billion barrels (460 million metric tons), about 10 percent less than production in 1971–75. An ever steeper fall off is possible in the early 1980s.[57] The giant Romashkino field, which provides most of Tatar's production, began commercial production in 1952. Output rose continuously through the 1950s and 1960s, reaching a maximum level of 1.63 million b/d in 1970. Production began to decline in the mid-1970s, and the water cut reached 56 percent by 1977.[58] The reserve situation in Tatar is tight. In 1971–75, geologists did not fulfill their plan for increasing reserves. Moreover, of the oil found, 98.5 percent was heavy oil that is difficult to produce using standard techniques.[59]

2. BASHKIR

Bashneft' is the second leading oil producing association in the Volga-Urals with an output of about 800,000 b/d. The predominant development in this region has been the rapid decline of its largest oil fields. In 1967, six large fields produced most of Bashkir's 960,000 b/d.[60] By 1975, these same fields had an average water cut of 79 percent, and were producing only 472,000 b/d.[61]

Developments at the Tuimazy oilfield illustrate what has happened to the larger fields in this area. Tuimazy is one of Bashkir's oldest producers, containing Devonian sandstone reservoirs, characteristic of Romashkino and other large fields in the Volga-Urals. Production rose rapidly between 1945 and 1965, reaching a peak of about 277,000 b/d in 1965. After 1966, output plummeted—to 54,000 b/d in 1975.[62] The water cut rose rapidly, reaching 86 percent in 1977.[63] This field was one of the first in which the Soviets used water injection, and its history may indicate what is in store for similar mature fields in the Volga-Urals. Production has also fallen at Arlan, Bashkir's largest oilfield, from a maximum of about 400,000 b/d in 1971–72, to 300,000 b/d in early 1975, and 62,000 b/d in 1978.[64]

Meanwhile, a number of strategies are being applied in Bashkir to maintain production at 800,000 b/d, Soviet sources indicated that 1,000 new wells had to be drilled[65] annually in 1976–80 and 470–500

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[57] Sovetskaya tatariya, Nov. 7, 1976, p. 3, reported that 500 million tons (about 3.6 billion barrels) would be produced in Tatar in the next 10 years. If more than 400 million tons were produced during 1976–80, then a very sharp drop in oil output after 1980 is apparent.

[58] Neftepromyslovoye delo, No. 4, 1977, p. 14.

[59] Geologiya nefti i gaza, No. 5, May 1977, p. 19.

[60] Gallyamov, M. N. and Rakhimkulov, R. Sh., Povysheniye Effektivnosti Ekspluatatsii Neftyanykh Skvazhin na Pozdney Stadii Razrabotki Mestorozhdeniy, Moscow, Nedra, 1978, p. 12.

[61] Ibid.

[62] Starodubtseva, B. A., and Yegorov, V. S., Effektivnost'Novoy Tekhniki i Tekhnologii v Dobyche Nefti, Moscow, Nedra, 1977, p. 88.

[63] Neftyanoye Khozyaystvo, No. 4, April 1979, p. 3.

[64] Gallyamov and Rakhimkulov, op. cit., p. 12; Sovetskaya rossiya, Feb. 11, 1979, p. 1.

[65] Organizatsiya i upravleniya neftyanoy promyshlennosti, No. 8, Aug. 1976, p. 9.

submersible electric pumps installed.[66] The average depth of wells in Bashkir is about 1,400 meters, and to drill the 1,000 wells would take about 10 percent of the total Oil Ministry drilling effort. This will be difficult, if not impossible since Bashkir drilling brigades are being shifted to West Siberia. At the same time, only a few of the required pumps reportedly are being delivered to Bashkir producers.[67] Thus with the current emphasis on West Siberian development, it is unlikely that Bashkir will receive either the drilling equipment or pumps required to maintain the production level near 800,000 b/d.

The Soviets are turning to enhanced recovery projects in several Bashkir fields to increase oil recovery. Improvement in oil recovery will be expensive and take a long time. In some instances the water flooding methods already employed will interfere with enhanced recovery techniques.

3. KUYBYSHEV

Kuybyshev oilmen face problems similar to those encountered in other parts of the Volga-Urals—oil production from major fields is declining, water cuts are high, the bulk of remaining reserves occur in smaller, less productive fields.[68] Output from this association peaked at 710,000 b/d in 1972 and has since declined slowly.[69] Planned output for 1980 is 500,000 b/d with a water cut exceeding 75 prcent.[70] Keeping production at the planned 1980 level depends on increased drilling, improved water injection techniques, greater use of submersible pumps, and use of enhanced recovery methods.

4. PERM

Oil production in Perm Oblast has been a major disappointment to Soviet planners. This association was the only major producer in the Volga-Urals region that was scheduled to increase oil output during 1976–80—from 445,000 b/d in 1975 to 620,000 b/d in 1980. Production has lagged badly behind plans, however. After missing the 1976 and 1977 targets, Perm oil workers were given more modest goals, but they still fell short as output apparently declined rather than increased.[71] Rapidly rising water cuts and problems in developing less productive fields are the major problems.[72]

5. OTHER REGIONS

Modest changes are expected in the output of other producing associations in the Volga-Urals region. Small increases are expected in the Udmurt A.S.S.R. and Orenburg Oblast, while declines will continue in Saratov Oblast and the Lower Volga area. Total production in these areas will average about 400,000 b/d in 1979 and 1980.

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[66] Pravda, May 8, 1977, p. 2.
[67] Ibid.
[68] Neftyanoye khozyaystvo, No. 5, 1977, pp. 25–30.
[69] Ekonomika neftyanoy promyshlennosti, No. 7, July 1976, p. 47.
[70] Neftyanoye khozyaystvo, No. 5, 1977, pp. 25–30.
[71] Trud, Jan. 1979, p. 1.
[72] Sotsialisticheskaya industriya, Feb. 14, 1978, p. 2.

C. Potential Growth Areas

1. KOMI

The Komi A.S.S.R. is one of the few areas outside of West Siberia where production is planned to rise in 1976–80. The 1980 goal is 500,000 b/d of crude oil, more than twice the 220,000 b/d produced in 1975. Output, however, is behind plan, and the 1980 target probably will not be met. Production has been concentrated in only a few fields—Vozey, Usin, and Yarega (where very heavy oil is mined)—while other areas have been neglected. Exploratory drilling has lagged seriously, and no major new fields have been found in recent years. In mid-1978, Komi officials declared that "exploratory drilling cannot be considered as being even minimally sufficient, and drilling crews have practically no known major structures in reserve to plan deep exploratory drilling for the near future. Geologists have no idea where to explore after developing Usin and Vozey." [73] One proposed solution is to develop small fields intensively in the less accessible areas of Komi, but this would require shifting crews from other areas, as in West Siberia.[74] Given the priority of West Siberian development, Komi will likely have to make do with the crews it has.

2. GEORGIA

The Georgian S.S.R. is one of five oil producing associations showing gains in production. This small Transcaucasus republic has been seeking to find commercial oil deposits for years, and its persistence finally paid off. From a production of 500–600 b/d in the early 1970s, output rose to 50,000 b/d in 1978 [75] and is to reach 60,000 b/d in 1980. The largest producing field is located near Samgori and was discovered in mid-1974. Extensive geological and geophysical work is being carved out in the eastern part of the republic along the Black Sea coast, where favorable prospects for small discoveries appear likely. Even if the 1980 goal is achieved, however, Georgian production would amount for only about 0.5 percent of total Soviet production in that year.[76]

D. Offshore

The U.S.S.R. has produced oil from offshore fields in the Caspian Sea for more than 20 years, although most drilling and production has been conducted from man-made islands or fixed trestles extending from the shore. At present the Soviets have five jack-up drilling platforms, all operating in the Caspian Sea, and one semi-submersible rig being outfitted in Astrakhan for use in the Caspian. Plans call for the number of mobile offshore platforms to reach 12 by 1980, including at least two semi-submersibles.[77] This goal probably is out of reach unless the Soviets decide to purchase four or five such rigs from the West.

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[73] Sotsialisticheskaya industriya, May 17, 1978, p. 2.
[74] Ibid.
[75] Neftyanoye Khozyaystvo, No. 4, April 1979, p. 3.
[75] Neftyanoye Khozyaystvo, No. 4, April 1979, p. 3.
[77] CIA, Prospects for Soviet Oil Production: A Supplemental Analysis, op. cit., p. 27.

Of total production of about 310,000 b/d of oil in the Azerbaydzhan S.S.R. in 1978, more than two-thirds—at least 210,000 b/d—comes from offshore fields in the Caspian Sea.[78] This output has been rather stable for the last several years, and until more modern offshore equipment is made available to explore and develop potential oil deposits in the deeper water of the Caspian, higher levels are unlikely.[79]

In the offshore area around Sakhalin, Japanese firms are working on a cooperative venture with the Soviets to explore for and develop oil and gas deposits. In late 1977, oil finds were reported in the waters off the northeast coast of Sakhalin but commercial production is not expected before the mid-1980s.[80]

VIII. Outlook

Based on the analysis of the major producing oilfields and the failure to discover large new reserves, prospects for continued oil production growth in the Soviet Union are dim. Indeed, the recently announced plans for 1979 indicate that there will be very little growth in average monthly yields beyond those achieved in late 1978 and that production is likely to peak soon.

Severe winter weather throughout much of the U.S.S.R. from mid-December 1978 through mid-February 1979 slowed oil production, boosted oil consumption, and sharply limited rail transport of oil products to consumers and equipment to the oilfields—placing a further strain on the already overburdened oil industry. Making up for this poor start will be difficult, and the 1979 national oil production goal very probably will not be met, as was the case in 1977 and 1978.

Barring any major changes in present consumption patterns and sizable fuel savings through conservation—both of which are unlikely—the increase in domestic oil consumption is likely to exceed growth in oil output, resulting in a lower level of exports to the West in 1979. Despite such a decline, higher prices may permit the U.S.S.R. to increase hard currency earnings from oil above 1977–78 levels of $5.5–6 billion, about half of total Soviet hard currency sales.

Because of the persistent and worsening problems in exploration and development reviewed above, Soviet oil production in 1980 is unlikely to reach 12 million b/d, a 400,000–800,000 b/d underfulfillment of the original goal. Moreover, we estimate that production will begin to decline in the early 1980s and drop to a level of about 10 million b/d in 1985. Output could continue to fall through the 1980s, level off, or even rise temporarily by the late 1980s or early 1990s if large new fields are discovered and brought into production in frontier areas.

Although in the mid-1980s, the U.S.S.R. may well be self-sufficient in oil as far as meeting domestic demands—even at the lower production level—oil deliveries to the West will have ceased and shipments to Eastern Europe and other Communist countries will have to be supported by Soviet imports from OPEC countries. Thus, in the ab-

[78] Bakinskiy rabochiy, Dec .15, 1978, p. 2.

[79] During 1976–78, Azebaydzhan geologists underfulfilled the plan for increasing reserves in the entire region by about 600 million barrels, equivalent to almost 2 years output, assuming recovery rates of about 33 percent. (Bakinskiy rabochiy, Dec. 15, 1978, p. 2.)

[80] The Economist, Oct. 22, 1977, p. 93.

sence of a high priority campaign to save oil domestically and reduce oil use, the Soviet Union will probably shift from earning to spending hard currency in oil trade.[81]

Our conclusion rests in part on the belief that imported equipment can only slow the rate of decline in oil production once it begins. In past successful efforts to increase oil production, the U.S.S.R. relied on domestic resources for equipment and know-how. More recently, the Soviets have encountered more difficult exploration and development problems that have forced them to turn to the West for modern equipment and technology to maintain increases in oil output. As greater emphasis is placed on deeper drilling, offshore exploration and development in Arctic regions, and enhanced recovery operations in older producing regions, the Soviet Union will have to rely more heavily on imports of Western equipment and technical assistance.

Most of the imported equipment and technology, however, will have little effect on short run oil production potential, i.e., through the mid-1980s. For example, the sophisticated seismic equipment and digital processing units could facilitate the mapping of complex traps—both structural and stratigraphic—in the permafrost areas of East and West Siberia and in the Barents and Kara Seas. But even if this equipment and know-how were made available fairly soon, new discoveries within a year or two could not be put into commercial production for 6–7 years thereafter. The same situation prevails with respect to the time needed to adapt Western offshore drilling equipment and technology, deep drilling equipment, oil equipment manufacturing facilities, and enhanced recovery techniques. The payoff is more likely to be in the late 1980s and early 1990s.

[81] For further details on the implications for foreign trade, see "Soviet Economic Problems and Prospects," A study prepared for the Joint Economic Committee, Congress of the United States, Aug. 8, 1977.

REGIONAL EMPLOYMENT TRENDS IN THE U.S.S.R.: 1950 TO 1975

(By Stephen Rapawy*)

CONTENTS

This paper presents statistical materials on employment in the U.S.S.R. and in the 15 union republics and a brief discussion of the patterns and trends shown by the data. The data include figures on employment in the state sector, which is comprised of state-owned enterprises, and on employment on collective farms. In Soviet statistics, collective farm employment is reported separately, since these farms are considered to be cooperatives and not state-owned establishments. Together, collective farms and the state sector constitute the socialized sector. In addition to employment in the socialized sector, economic activities are conducted by independent artisans, who at the present time comprise an extremely small group, and by individuals farming private plots. Labor inputs into private agriculture were estimated at 10.6 million work-year equivalents in 1975.[1] Most of it is contributed by individuals employed in the socialized sector or by pensioners.

In table 1, employment in the state sector is disaggregated by branch of the economy. Tables 2 through 5 present data on employment in selected branches of industry, the proportion and distribution of employed women, and the number of workers and employees with higher and specialized secondary education.

*Foreign Demographic Analysis Division, U.S. Bureau of the Census.

[1] Feshbach, "Employment," 1978, p. 16.

A. Annual Average Employment in the U.S.S.R.

During the 25-year period under discussion, total employment rose by 2.2 percent annually, according to the figures in table 1. This rate of increase exceeded both the 1.4 percent average annual growth rate of the total population and the 1.3 percent growth rate of the population of able-bodied ages (defined as males 16 to 59 years of age and females 16 to 54 years of age, inclusive).[2] The rapid expansion of the labor force was achieved primarily by recruiting women employed in households and on private plots to work in the socialized sector. The changing sex composition of the population was another factor contributing to the growth of employment. Due to war losses and purges, the proportion of males in the able-bodied ages in 1950 amounted to only 43.4 percent of the total, notwithstanding a retirement age five years later than that for women. The percentage rose to 49.4 by 1975. Since males participate in the labor force at a higher rate than females, the increasing share of males in the able-bodied ages contributes to an expansion of the labor force more rapid than the growth of the population of able-bodied ages itself.

Growth of employment varies considerably by republic, but with the exception of Moldavia, the European republics manifest a lower rate of growth than the Asian republics.[3] The R.S.F.S.R. shows the lowest annual rate of increase in employment, 2.0 percent. This low rate shows that campaigns and incentives to retain new workers in Siberia and the Far East have not been successful. It also indicates a considerable outmigration of Russians, particularly to Kazakhstan and the Ukraine. The annual growth rate of 3.7 percent in Kazakhstan was the highest for any republic during this period. This rate resulted from the high natural increase of the Kazakh population and from substantial inmigration. Migration into the republic was especially heavy during the late 1950's as a result of the Virgin Lands Program, which converted Kazakhstan into one of the leading grain producing regions of the country. (See table 2 in the paper by Murray Feshbach in this compendium for annual estimates of net migration during the period 1950–1977.) The rate of growth of employment has been declining in recent years. During the 1970–75 period, for example, the annual rate of growth of employment in the socialized sector declined to 1.9 percent in the U.S.S.R. as a whole; among the republics, the 1.1 percent rate in Estonia was the lowest.

Continued emphasis on industrialization significantly reduced the proportion of the Soviet population employed in socialized agriculture (i.e., collective farms, state farms, or subsidiary agricultural establishments of nonagricultural state enterprises or organizations). Agricultural employment accounted for 45.6 percent of total employment in the socialized sector in 1950 but had decreased to 21.8 percent by 1975. This is still a high share for an industrialized country. The proportion of agricultural employment varies considerably between European and Asian republics. In 1975, only two European republics

[2] Population growth rates are computed from unpublished estimates prepared by the Foreign Demographic Analysis Division, U.S. Bureau of the Census.

[3] The European republics are Estonia, Latvia, Lithuania; R.S.F.S.R., Belorussia, the Ukraine, and Moldavia; the remaining eight republics are classified as Asian.

had a proportion of agricultural employment greater than 30 percent while only two Asian republics had a proportion less than 30 percent. All of the decline in agricultural employment is due to a decrease in collective farm employment from 27.6 million in 1950 to 15.4 million in 1975. Employment in state agriculture during the same period rose from 3.4 to 10.3 million, largely due to the conversion of collective farms to state farms. The changeover has not been uniform throughout the country but there is no noticeable pattern of differences between western and eastern republics. Kazakhstan had the lowest share of collective farm employment in agriculture in 1975 (21.5 percent) while Turkmenia had the highest (89.2 percent).

Employment in selected branches of industry is presented in table 2. During the 15-year period covered, employment in industry increased at a faster rate than that in the socialized sector as a whole, and by 1975 industry was the largest branch of the economy. Machine-building and metalworking is the largest branch of industry, constituting 40.6 percent of all industrial employment in 1975. Industrial employment is distributed quite unevenly by republic in the U.S.S.R. The R.S.F.S.R. accounted for 62.9 percent of all industrial employment in the country in 1975 and 56.3 percent of employment in the socialized sector. Other republics have rather unequal shares of the employment in particular branches of industry. Some have a much larger proportion of the total employment in a given branch of industry than they have of all industrial employment. For example, the Ukraine accounts for only 19.4 percent of all industrial employment, but it has 35.8 percent of all employment in ferrous metallurgy and 36.3 percent of all employment in fuels. The high figure for fuels is due to the fact that the Ukraine has a large share of the Soviet Union's resources of coal, and coal mining is more labor intensive than other fuels industries.

Perhaps the most distinguishing feature of Soviet employment is the high participation of women in the labor force (see table 3). They accounted for 59 percent of all employment on collective farms in 1950 and 48 percent in 1975. In the state sector, however, the proportion of women increased from 47 to 51 percent during the same period. This increase took place in spite of the growing percentage of males in the population of able-bodied ages.

The level of female participation varies significantly both by republic and by branch of the economy. The proportion of female employment in the state sector is considerably higher in the European republics than in the Asian republics. For example, by 1975 a high of 54 percent female was attained in Latvia and Estonia, while the lowest figure, 40 percent, was that for Turkmenia. In the predominantly Muslim republics of the Asian region, the lower proportion of women in the labor force may be explained by traditional religious attitudes which tend to relegate women to a less active role. In the non-Muslim republics of Georgia and Armenia, however, low female employment rates are more puzzling, particularly because the population of these two republics has a comparatively high educational attainment. The distribution of female employment by branch of the economy in the U.S.S.R. as a whole indicates a high concentration of women in the low-wage service sector. Women accounted for 84 percent of the total employment in health services in 1975, 82 percent in credit and insurance, 76 percent in trade, and 73 percent in education.

B. Educational Level of the Labor Force

The educational level of the Soviet labor force has greatly improved in recent years. Between 1960 and 1975 there was a 160-percent increase in the number of specialists with higher and specialized secondary education employed in the national economy compared to a 39-percent rise in overall employment (see table 4). Data from the 1970 census indicate that 6.5 percent of all employed persons had completed higher education and 11.8 percent had either incomplete higher or specialized secondary education. These figures represent a significant increase since 1959, when census data showed only 3.3 percent with higher education and 7.6 percent with either incomplete higher or specialized secondary education. In addition, the number of persons who had less than 8 years of schooling declined substantially from 56.7 percent in 1959 to 34.7 percent in 1970.[4] The educational attainment of the labor force does not differentiate east from west as do other labor force characteristics. In 1970, for example, the Transcaucasian republics—Georgia, Armenia, and Azerbaydzhan—had the highest proportions of persons with higher education: 11.5, 10.0, and 8.3 percent, respectively. These three republics also had the smallest proportions of employed persons with less than 8 years of schooling. Overall, the Transcaucasian republics have the most educated labor force in the Soviet Union, followed by Estonia and Latvia. Belorussia, Lithuania, and Moldavia are at the lower end of the spectrum.

Table 5 shows the numbers of employed women specialists with higher and specialized secondary education. A comparison of these figures with the total employment of specialists reported in table 4 shows that women specialists accounted for 58.8 percent of the total in 1970. The percentage of female specialists is higher in the western republics, but women comprise over 50 percent in four of the eight eastern republics.

TABLE 1.—ANNUAL AVERAGE EMPLOYMENT IN THE U.S.S.R., BY REPUBLIC AND BRANCH OF THE NATIONAL ECONOMY: 1950 to 1975

[In thousands; components may not add to totals due to rounding]

Republic	1950	1960	1965	1970	1971	1972	1973	1974	1975
SOCIALIZED SECTOR									
U.S.S.R.	68,020	84,332	95,815	107,186	109,299	111,442	113,566	115,680	117,560
STATE SECTOR									
Total, U.S.S.R.	40,420	62,032	76,915	90,186	92,799	95,242	97,466	99,780	102,160
R.S.F.S.R.	26,749	39,505	47,474	54,376	55,770	57,071	58,240	59,441	60,662
Ukraine	6,943	10,659	13,397	16,200	16,692	17,144	17,534	17,917	18,356
Belorussia	1,038	1,887	2,437	3,075	3,190	3,293	3,390	3,490	3,577
Uzbekistan	889	1,565	2,083	2,642	2,744	2,881	3,007	3,176	3,343
Kazakhstan	1,388	2,942	4,119	4,692	4,837	4,971	5,123	5,254	5,375
Georgia	629	940	1,202	1,490	1,546	1,576	1,608	1,659	1,733
Azerbaydzhan	571	748	1,045	1,273	1,304	1,348	1,404	1,457	1,506
Lithuania	339	674	931	1,166	1,198	1,231	1,261	1,293	1,325
Moldavia	253	439	677	944	1,034	1,100	1,143	1,197	1,251
Latvia	452	725	916	1,033	1,053	1,071	1,087	1,108	1,127
Kirgizia	247	434	617	780	816	839	870	905	936
Tadzhikistan	178	320	444	586	620	651	682	714	745
Armenia	237	427	631	838	870	915	936	964	991
Turkmenia	217	314	390	478	498	517	537	553	574
Estonia	290	453	552	613	627	634	644	652	659

[4] Figures are either reported in TsSU, *Itogi*, vol. VI, 1973, pp. 620–794; TsSU, *Itogi*, vol. V, 1973, pp. 66–83; and TsSU, *Nar. obraz.*, 1971, p. 23, or were derived from data in these sources.

TABLE 1.—ANNUAL AVERAGE EMPLOYMENT IN THE U.S.S.R., BY REPUBLIC AND BRANCH OF THE NATIONAL ECONOMY: 1950 to 1975—Continued

[In thousands; components may not add to totals due to rounding]

Republic	1950	1960	1965	1970	1971	1972	1973	1974	1975
INDUSTRY									
Total, U.S.S.R.	15, 317	22, 620	27, 447	31, 593	32, 030	32, 461	32, 875	33, 433	34, 054
R.S.F.S.R.	10, 827	15, 335	18, 082	20, 206	20, 403	20, 630	20, 830	21, 117	21, 433
Ukraine	2, 509	4, 056	5, 047	6, 036	6, 143	6, 234	6, 336	6, 454	6, 602
Belorussia	346	569	781	1, 030	1, 070	1, 106	1, 132	1, 160	1, 194
Uzbekistan	254	371	492	579	598	613	639	669	697
Kazakhstan	365	626	849	1, 052	1, 075	1, 095	1, 106	1, 131	1, 161
Georgia	175	272	330	385	388	385	388	396	402
Azerbaydzhan	173	219	281	308	309	313	323	334	342
Lithuania	97	212	313	414	425	434	440	449	458
Moldavia	51	124	185	260	273	287	294	308	320
Latvia	171	279	347	397	400	399	400	403	405
Kirgizia	66	109	150	204	212	218	223	232	240
Tadzhikistan	44	75	105	131	134	137	141	146	153
Armenia	81	142	199	273	282	287	295	304	314
Turkmenia	51	67	80	91	93	94	98	100	102
Estonia	106	164	207	226	227	229	230	230	232
AGRICULTURE									
Total, U.S.S.R.	3, 437	6, 793	8, 704	9, 180	9, 499	9, 647	9, 885	10, 102	10, 265
R.S.F.S.R.	2, 133	3, 974	4, 888	5, 081	5, 262	5, 253	5, 342	5, 389	5, 393
Ukraine	611	941	1, 110	1, 183	1, 207	1, 226	1, 252	1, 278	1, 328
Belorussia	66	365	405	439	443	444	453	457	444
Uzbekistan	121	304	365	414	421	461	480	545	582
Kazakhstan	219	662	1, 032	968	983	1, 002	1, 044	1, 054	1, 060
Georgia	38	68	140	194	207	220	226	242	274
Azerbaydzhan	32	45	146	185	187	200	218	228	235
Lithuania	34	99	131	132	131	131	130	132	130
Moldavia	32	39	78	127	177	202	213	235	250
Latvia	30	72	94	91	94	96	96	98	100
Kirgizia	43	74	107	116	123	124	132	138	145
Tadzhikistan	20	30	39	68	78	84	90	96	103
Armenia	14	37	83	95	96	115	116	119	120
Turkmenia	18	27	28	31	32	32	34	34	37
Estonia	25	58	58	56	58	56	59	58	63
FORESTRY									
Total, U.S.S.R.	444	359	402	433	432	443	444	449	453
R.S.F.S.R.	274	211	245	263	263	272	272	276	277
Ukraine	80	70	73	69	69	70	71	72	73
Belorussia	27	21	24	26	27	27	27	27	27
Uzbekistan	6	3	3	3	3	4	4	4	5
Kazakhstan	9	14	16	18	18	17	17	16	16
Georgia	9	8	7	12	12	12	13	13	14
Azerbaydzhan	3	3	3	5	5	4	4	4	4
Lithuania	9	9	7	7	7	7	7	7	7
Moldavia	3	3	4	5	5	5	5	6	6
Latvia	11	4	5	5	5	5	5	5	5
Kirgizia	2	3	3	3	4	4	3	3	3
Tadzhikistan	1	1	1	2	2	2	2	2	2
Armenia	3	3	3	6	5	5	5	5	5
Turkmenia	1	2	1	2	1	1	1	1	1
Estonia	7	6	7	8	8	8	8	8	8
TRANSPORT									
Total, U.S.S.R.	4, 117	6, 279	7, 252	7, 895	8, 203	8, 446	8, 705	8, 922	9, 215
R.S.F.S.R.	2, 691	4, 004	4, 446	4, 725	4, 838	4, 973	5, 139	5, 272	5, 433
Ukraine	710	1, 062	1, 314	1, 502	1, 552	1, 598	1, 633	1, 657	1, 702
Belorussia	122	171	209	249	257	267	276	285	295
Uzbekistan	74	121	164	218	232	238	246	254	271
Kazakhstan	182	387	432	477	490	509	526	542	562
Georgia	55	95	111	135	136	141	142	146	152
Azerbaydzhan	65	84	103	120	124	129	133	136	146
Lithuania	37	59	76	93	95	98	101	103	106
Moldavia	29	43	65	84	87	88	91	94	99
Latvia	51	74	89	93	94	97	99	100	102
Kirgizia	13	35	54	67	69	71	74	76	79
Tadzhikistan	13	28	42	54	58	61	64	68	72
Armenia	15	34	46	56	56	59	59	61	64
Turkmenia	29	38	45	57	60	62	65	67	72
Estonia	31	44	55	55	56	56	58	59	60

TABLE 1.—ANNUAL AVERAGE EMPLOYMENT IN THE U.S.S.R., BY REPUBLIC AND BRANCH OF THE NATIONAL ECONOMY: 1950 to 1975—Continued

[In thousands; components may not add to totals due to rounding]

Republic	1950	1960	1965	1970	1971	1972	1973	1974	1975
COMMUNICATIONS									
Total, U.S.S.R.	542	738	1,007	1,330	1,394	1,435	1,465	1,499	1,528
R.S.F.S.R.	349	471	625	793	827	850	868	888	905
Ukraine	87	113	160	241	256	264	266	270	275
Belorussia	19	27	37	49	50	51	52	54	56
Uzbekistan	10	17	26	34	35	36	38	39	40
Kazakhstan	20	34	58	73	76	79	81	83	84
Georgia	8	11	15	23	24	25	25	26	26
Azerbaydzhan	8	10	15	20	21	22	23	23	24
Lithuania	8	10	12	17	18	19	20	21	21
Moldavia	5	6	8	14	15	16	16	18	18
Latvia	10	11	13	17	17	18	18	19	19
Kirgizia	3	5	8	12	13	13	14	14	15
Tadzhikistan	3	5	6	9	10	10	10	10	11
Armenia	3	5	8	11	12	12	13	14	14
Turkmenia	4	5	6	9	9	10	10	11	11
Estonia	6	8	9	10	10	10	10	10	11
CONSTRUCTION									
Total, U.S.S.R.	3,278	6,319	7,301	9,052	9,549	9,986	10,091	10,339	10,574
R.S.F.S.R.	2,130	3,899	4,271	5,227	5,537	5,833	5,896	6,072	6,251
Ukraine	595	1,087	1,300	1,658	1,744	1,811	1,811	1,836	1,854
Belorussia	67	157	210	306	324	339	347	356	360
Uzbekistan	48	172	230	326	341	357	368	337	386
Kazakhstan	127	386	476	530	555	568	583	601	609
Georgia	74	106	126	156	166	164	162	159	162
Azerbaydzhan	80	96	118	139	142	147	152	154	157
Lithuania	17	70	103	129	134	137	140	142	147
Moldavia	17	50	73	99	104	111	111	116	118
Latvia	27	68	80	88	92	92	94	95	97
Kirgizia	14	46	64	80	83	85	86	86	87
Tadzhikistan	9	45	64	74	78	83	85	87	88
Armenia	25	50	76	101	106	108	101	101	100
Turkmenia	27	50	61	79	82	88	91	93	94
Estonia	22	38	49	60	61	63	63	63	63
TRADE, PUBLIC DINING, MATERIAL—TECHNICAL SUPPLY AND SALES, AND PROCUREMENT									
Total, U.S.S.R.	3,360	4,675	6,009	7,537	7,816	8,100	8,392	8,640	8,857
R.S.F.S.R.	2,132	2,868	3,590	4,407	4,557	4,712	4,868	4,995	5,114
Ukraine	613	854	1,129	1,464	1,526	1,582	1,641	1,684	1,713
Belorussia	90	137	187	250	258	268	279	291	302
Uzbekistan	104	135	188	249	259	272	289	296	311
Kazakhstan	115	243	317	384	398	410	425	441	454
Georgia	56	78	98	121	126	131	134	141	145
Azerbaydzhan	50	62	83	102	106	111	115	122	124
Lithuania	31	49	69	96	101	107	112	117	121
Moldavia	28	40	64	92	95	101	106	112	117
Latvia	36	54	72	92	95	99	102	105	108
Kirgizia	23	37	50	67	71	73	77	81	83
Tadzhikistan	19	28	38	51	54	57	60	64	67
Armenia	18	28	42	60	64	66	70	73	75
Turkmenia	22	29	38	48	50	52	55	58	60
Estonia	23	34	44	54	56	58	59	61	62

TABLE 1.—ANNUAL AVERAGE EMPLOYMENT IN THE U.S.S.R., BY REPUBLIC AND BRANCH OF THE NATIONAL ECONOMY: 1950 to 1975—Continued

[In thousands; components may not add to totals due to rounding]

Republic	1950	1960	1965	1970	1971	1972	1973	1974	1975
HOUSING—COMMUNAL ECONOMY AND PERSONAL SERVICES									
Total, U.S.S.R.	1,371	1,920	2,386	3,052	3,213	3,376	3,527	3,664	3,805
R.S.F.S.R.	950	1,277	1,525	1,905	1,990	2,082	2,157	2,235	2,314
Ukraine	222	315	401	540	575	614	649	674	701
Belorussia	23	38	51	69	75	79	86	92	97
Uzbekistan	21	32	57	82	86	90	95	101	106
Kazakhstan	37	74	107	138	149	157	168	177	183
Georgia	24	38	49	63	68	69	72	75	79
Azerbaydzhan	20	28	36	47	51	52	54	54	57
Lithuania	12	18	26	37	39	41	44	46	48
Moldavia	5	12	17	22	25	27	29	31	33
Latvia	22	30	35	43	44	45	48	49	50
Kirgizia	5	10	14	19	21	22	23	24	25
Tadzhikistan	4	8	13	18	19	19	21	23	23
Armenia	8	14	21	29	31	33	35	36	39
Turkmenia	5	9	13	17	18	19	20	20	21
Estonia	14	18	21	23	25	26	27	28	29
HEALTH SERVICES									
Total, U.S.S.R.	2,051	3,461	4,277	5,080	5,239	5,386	5,522	5,655	5,769
R.S.F.S.R.	1,261	2,026	2,466	2,877	2,960	3,033	3,102	3,169	3,217
Ukraine	385	689	845	1,014	1,044	1,073	1,100	1,125	1,144
Belorussia	63	106	143	172	179	184	189	195	199
Uzbekistan	60	107	137	181	190	203	211	218	232
Kazakhstan	64	148	205	257	268	277	286	293	301
Georgia	51	77	96	113	115	119	122	126	130
Azerbaydzhan	39	59	72	89	91	94	95	98	100
Lithuania	18	41	52	63	65	67	69	72	74
Moldavia	21	39	49	60	62	64	66	69	72
Latvia	23	44	51	56	56	58	60	60	62
Kirgizia	13	27	40	51	53	55	56	59	61
Tadzhikistan	12	22	31	39	42	43	45	48	50
Armenia	14	24	31	40	42	44	45	48	49
Turkmenia	15	26	31	37	39	40	41	41	42
Estonia	13	25	29	32	33	34	35	35	36
EDUCATION AND CULTURE									
Total, U.S.S.R.	3,315	4,803	6,600	8,025	8,262	8,482	8,708	8,924	9,136
R.S.F.S.R.	1,958	2,782	3,759	4,461	4,556	4,654	4,750	4,841	4,929
Ukraine	617	881	1,181	1,422	1,464	1,505	1,547	1,581	1,616
Belorussia	124	183	241	291	301	310	319	330	339
Uzbekistan	109	174	276	371	391	410	431	453	478
Kazakhstan	120	213	358	474	498	516	529	544	561
Georgia	87	116	144	172	182	183	193	196	202
Azerbaydzhan	58	85	114	157	163	170	179	189	198
Lithuania	37	62	81	100	103	105	108	112	115
Moldavia	35	56	89	115	120	125	129	133	138
Latvia	34	50	67	79	81	83	84	88	90
Kirgizia	30	44	68	90	95	100	104	108	111
Tadzhikistan	27	46	66	88	93	97	101	105	110
Armenia	34	48	70	95	100	105	111	115	118
Turkmenia	23	33	49	66	68	71	74	79	81
Estonia	21	31	38	46	47	48	49	50	51
ART									
Total, U.S.S.R.	185	315	370	412	420	428	434	441	446
R.S.F.S.R.	106	180	216	235	239	241	244	246	246
Urkaine	32	52	68	71	72	73	76	77	77
Belorussia	7	11	13	15	15	15	15	15	15
Uzbekistan	6	10	11	13	13	14	13	15	15
Kazahkstan	10	18	18	23	24	26	26	26	27
Georgia	5	8	8	11	12	13	14	14	15
Azerbaydzhan	4	6	6	8	8	8	8	9	9
Lithuania	3	5	5	6	6	6	6	6	6
Moldavia	2	3	5	5	5	6	6	6	6
Latvia	3	5	4	5	5	5	5	5	5
Kirgizia	2	3	3	4	4	4	5	5	5
Tadzhikistan	2	3	3	4	4	4	4	4	4
Armenia	3	5	4	6	7	7	7	7	7
Turkmenia	2	2	3	3	3	3	3	3	4
Estonia	1	3	3	3	3	3	3	3	3

TABLE 1.—ANNUAL AVERAGE EMPLOYMENT IN THE U.S.S.R., BY REPUBLIC AND BRANCH OF THE NATIONAL ECONOMY: 1950 to 1975—Continued

[In thousands; components may not add to totals due to rounding]

Republic	1950	1960	1965	1970	1971	1972	1973	1974	1975
SCIENCE AND SCIENTIFIC SERVICES									
Total, U.S.S.R.	714	1,763	2,625	3,238	3,374	3,544	3,735	3,864	4,046
R.S.F.S.R.	531	1,266	1,875	2,295	2,384	2,502	2,633	2,718	2,839
Ukraine	71	199	332	425	448	475	504	526	550
Belorussia	6	31	42	61	68	75	80	86	101
Uzbekistan	15	37	53	63	64	65	70	74	82
Kazakhstan	35	84	104	123	124	125	129	131	135
Georgia	13	25	35	48	50	52	53	57	61
Azerbaydzhan	10	22	29	37	39	40	41	43	46
Lithuania	3	12	22	29	31	34	37	38	42
Moldavia	2	8	16	21	23	24	29	21	23
Latvia	4	11	22	25	27	29	30	32	33
Kirgizia	10	22	29	29	31	31	33	36	37
Tadzhikistan	5	13	15	18	18	22	23	24	24
Armenia	4	16	24	33	35	38	40	41	42
Turkmenia	3	10	14	15	15	15	15	15	16
Estonia	2	8	13	16	18	18	19	21	15
CREDIT AND INSURANCE									
Total, U.S.S.R.	264	265	300	388	411	439	465	493	519
R.S.F.S.R.	160	162	183	237	249	267	282	299	315
Ukraine	46	46	52	68	73	78	83	88	92
Belorussia	9	8	10	12	13	14	15	16	17
Uzbekistan	7	7	8	11	12	13	14	15	15
Kazakhstan	11	12	15	21	22	24	25	27	29
Georgia	5	5	5	6	7	7	7	8	8
Azerbaydzhan	4	4	4	5	5	5	5	6	6
Lithuania	4	4	4	5	5	5	6	6	6
Moldavia	3	2	3	4	4	4	5	5	6
Latvia	4	3	4	4	5	5	5	5	6
Kirgizia	3	3	3	4	4	4	4	5	5
Tadzhikistan	2	2	2	3	3	3	3	4	4
Armenia	2	2	2	3	3	3	4	4	4
Turkmenia	2	2	2	3	3	3	3	3	3
Estonia	2	2	2	3	3	3	3	3	3
GOVERNMENT ADMINISTRATION									
Total, U.S.S.R.	1,831	1,245	1,460	1,883	1,935	2,008	2,087	2,168	2,243
R.S.F.S.R.	1,108	744	852	1,087	1,114	1,153	1,195	1,236	1,281
Ukraine	333	216	257	337	345	355	369	383	391
Belorussia	67	43	52	73	77	80	84	89	92
Uzbekistan	47	38	49	65	67	71	75	81	84
Kazakhstan	73	61	78	96	100	106	114	119	123
Georgia	29	24	29	34	36	37	37	39	41
Azerbaydzhan	25	21	24	32	33	34	35	36	38
Lithuania	28	17	21	27	27	28	29	30	31
Moldavia	20	12	16	24	26	27	28	29	31
Latvia	24	14	18	24	25	26	26	28	29
Kirgizia	19	12	15	19	20	21	22	23	23
Tadzhikistan	15	11	14	17	17	18	19	20	22
Armenia	13	11	13	18	19	20	21	22	22
Turkmenia	15	11	11	15	16	17	18	19	20
Estonia	15	10	11	14	15	15	15	16	16
OTHER									
Total, U.S.S.R.	194	477	775	998	1,022	1,061	1,131	1,187	1,250
R.S.F.S.R.	133	304	451	577	591	616	662	688	715
Ukraine	32	78	128	169	174	186	196	212	238
Belorussia	2	20	32	33	33	34	36	38	41
Uzbekistan	7	7	26	33	37	34	35	36	38
Kazakhstan	7	20	54	58	57	60	64	69	68
Georgia	0	9	9	17	17	18	20	21	21
Azerbaydzhan	4	8	11	19	20	19	19	20	20
Lithuania	2	8	9	13	13	12	13	13	14
Moldavia	1	4	7	13	13	14	14	14	16
Latvia	2	6	15	14	13	14	15	16	16
Kirgizia	1	5	9	15	16	15	15	16	17
Tadzhikistan	2	3	5	10	10	10	12	12	12
Armenia	0	8	9	12	12	13	14	14	16
Turkmenia	1	3	7	9	8	9	9	10	10
Estonia	2	8	8	8	7	8	7	8	8

TABLE 1.—ANNUAL AVERAGE EMPLOYMENT IN THE U.S.S.R., BY REPUBLIC AND BRANCH OF THE NATIONAL ECONOMY: 1950 to 1975—Continued

[In thousands; components may not add to totals due to rounding]

Republic	1950	1960	1965	1970	1971	1972	1973	1974	1975
COLLECTIVE FARMS									
Total, U.S.S.R.	27,600	22,300	18,900	17,000	16,500	16,200	16,100	15,900	15,400
R.S.F.S.R.	13,883	9,600	7,500	6,500	6,100	5,900	5,900	5,700	5,500
Ukraine	6,624	6,487	6,062	5,447	5,378	5,339	5,240	5,214	4,975
Belorussia	1,441	1,288	1,160	1,041	1,029	1,011	991	985	964
Uzbekistan	1,369	1,015	985	1,042	1,079	1,075	1,085	1,076	1,088
Kazakhstan	877	609	305	291	291	288	290	289	291
Georgia	585	497	435	389	380	369	385	391	358
Azerbaydzhan	483	476	324	277	281	287	287	304	303
Lithuania	295	404	332	311	307	299	291	287	278
Moldavia	557	688	680	641	581	585	576	574	550
Latvia	304	225	185	157	157	151	151	147	142
Kirgizia	275	214	219	218	216	215	210	219	212
Tadzhikistan	328	298	289	266	269	266	262	269	275
Armenia	207	172	123	105	107	88	90	92	93
Turkmenia	226	223	220	247	259	263	276	291	306
Estonia	144	103	81	69	64	64	64	64	63

Source: Data for all republics and branches are from various national and republic statistical handbooks and Divilov, Chislennost', 1976, pp. 92–110, with the following exceptions. Due to changes in the definition of the branch, construction employment for some republics in 1950 and/or 1960 was increased in proportion to the difference between the old and the new definition based on data for 1960 or 1965. Where the sum of the estimated figures differed significantly from the reported totals, the estimates were raked to achieve equivalence. Forestry employment in 1971 was assumed to be the same as in 1970. Employment in the "Other" branch was usually determined as a residual. The appended bibliography contains a list of all sources used.

TABLE 2.—ANNUAL AVERAGE EMPLOYMENT IN THE U.S.S.R., BY REPUBLIC AND SELECTED BRANCHES OF INDUSTRY: 1960 TO 1975

[In thousands; components may not add to totals due to rounding]

Republic	1960	1965	1970	1971	1972	1973	1974	1975
ALL INDUSTRIES								
Total, U.S.S.R.	22,620	27,447	31,593	32,030	32,461	32,875	33,433	34,054
R.S.F.S.R.	15,335	18,082	20,206	20,403	20,630	20,830	21,117	21,433
Ukraine	4,056	5,047	6,036	6,143	6,234	6,336	6,454	6,602
Belorussia	569	781	1,030	1,070	1,106	1,132	1,160	1,194
Uzbekistan	371	492	579	598	613	639	669	697
Kazakhstan	626	849	1,052	1,075	1,095	1,106	1,131	1,161
Georgia	272	330	385	388	385	388	396	402
Azerbaydzhan	219	281	308	309	313	323	334	342
Lithuania	212	313	414	425	434	440	449	458
Moldavia	124	185	260	273	287	294	308	320
Latvia	279	347	397	400	399	400	403	405
Kirgizia	109	150	204	212	218	223	232	240
Tadzhikistan	75	105	131	134	137	141	146	153
Armenia	142	199	273	282	287	295	304	314
Turkmenia	67	80	91	93	94	98	100	102
Estonia	164	207	226	227	229	230	230	232
ELECTRIC POWER								
Total, U.S.S.R.	397	540	633	645	655	659	671	686
R.S.F.S.R.	247	333	362	374	382	392	402	405
Ukraine	59	80	104	103	106	100	103	111
Belorussia	13	15	22	23	23	23	23	23
Uzbekistan	9	16	20	20	19	20	20	20
Kazakhstan	31	44	50	51	50	46	45	48
Georgia	7	8	13	13	13	13	11	11
Azerbaydzhan	6	8	11	11	11	12	13	14
Lithuania	4	6	9	9	9	10	10	11
Moldavia	2	4	6	7	7	7	7	7
Latvia	4	5	5	5	6	5	6	6
Kirgizia	3	4	7	6	6	6	6	6
Tadzhikistan	2	3	4	4	4	4	5	5
Armenia	3	4	7	7	7	7	7	6
Turkmenia	3	5	5	5	5	6	6	6
Estonia	4	6	8	8	8	7	7	8

TABLE 2.—ANNUAL AVERAGE EMPLOYMENT IN THE U.S.S.R., BY REPUBLIC AND SELECTED BRANCHES OF INDUSTRY: 1960 TO 1975—Continued

[In thousands; components may not add to totals due to rounding]

Republic	1960	1965	1970	1971	1972	1973	1974	1975
FUELS								
Total, U.S.S.R.	1,568	1,579	1,542	1,513	1,479	1,447	1,425	1,434
R.S.F.S.R.	781	786	782	769	756	742	728	737
Ukraine	598	600	572	558	538	522	517	520
Belorussia	21	19	20	20	19	20	19	20
Uzbekistan	8	11	11	11	11	12	12	12
Kazakhstan	57	64	68	69	70	68	66	64
Georgia	12	11	9	9	8	8	8	8
Azerbaydzhan	42	42	37	35	34	33	33	31
Lithuania	6	5	4	4	3	3	3	3
Moldavia	0	0	0	0	0	0	0	0
Latvia	7	5	4	4	4	4	3	3
Kirgizia	[1] 12	[1] 10	10	10	9	9	9	9
Tadzhikistan	3	3	3	3	3	3	3	3
Armenia	0	0	0	0	0	0	0	0
Turkmenia	5	6	5	5	6	6	6	5
Estonia	16	18	18	18	18	18	18	18
FERROUS METALLURGY								
Total, U.S.S.R.	1,047	1,236	1,359	1,352	1,354	1,356	1,366	1,369
R.S.F.S.R.	602	702	758	755	761	765	772	772
Ukraine	388	452	508	503	496	494	494	490
Belorussia	2	2	4	4	4	4	4	5
Uzbekistan	3	3	3	3	3	3	3	3
Kazakhstan	18	36	49	51	54	55	55	57
Georgia	21	24	22	22	21	21	21	22
Azerbaydzhan	9	10	10	9	11	10	10	10
Lithuania	1	1	1	1	1	1	1	1
Moldavia	0	0	0	0	0	0	0	0
Latvia	3	3	4	4	4	4	4	4
Kirgizia	0	0	0	0	0	0	0	0
Tadzhikistan	0	0	0	0	0	0	0	0
Armenia	1	1	1	1	1	1	1	1
Turkmenia	0	0	0	0	0	0	0	0
Estonia	0	0	0	0	0	0	0	0
CHEMICAL AND PETROCHEMICAL								
Total, U.S.S.R.	792	1,251	1,568	1,598	1,626	1,667	1,706	1,753
R.S.F.S.R.	601	902	1,062	1,072	1,087	1,105	1,128	1,159
Ukraine	108	189	271	282	286	294	304	311
Belorussia	13	30	54	60	66	74	76	78
Uzbekistan	11	18	23	25	26	27	28	29
Kazakhstan	13	21	37	39	39	41	43	49
Georgia	9	16	22	22	22	21	21	22
Azerbaydzhan	11	18	23	23	24	24	24	25
Lithuania	3	9	18	18	18	19	19	18
Moldavia [2]	1	3	3	2	3	3	4	4
Latvia	6	19	22	21	22	22	22	21
Kirgizia	0	0	0	0	0	0	0	0
Tadzhikistan	0	1	3	3	3	4	4	5
Armenia	9	17	22	22	21	21	22	22
Turkmenia	3	4	5	5	5	6	6	6
Estonia	3	4	4	4	4	5	5	5
MACHINE-BUILDING AND METALWORKING								
Total, U.S.S.R.	7,206	9,905	12,017	12,369	12,718	13,049	13,424	13,816
R.S.F.S.R.	5,324	6,994	8,277	8,475	8,685	8,871	9,093	9,295
Ukraine	1,169	1,725	2,188	2,272	2,343	2,441	2,520	2,616
Belorussia	154	268	382	405	424	439	458	479
Uzbekistan	93	147	169	175	178	189	200	209
Kazakhstan	129	209	262	275	292	288	298	317
Georgia	54	70	82	84	85	86	89	96
Azerbaydzhan	41	66	68	70	69	73	77	82
Lithuania	50	95	141	146	152	156	161	165
Moldavia	15	39	61	66	72	76	82	87
Latvia	74	111	130	132	137	137	140	147
Kirgizia	26	46	70	75	79	83	88	92
Tadzhikistan	8	17	22	23	24	26	27	29
Armenia	33	60	98	103	107	112	117	124
Turkmenia	8	13	15	15	16	17	18	19
Estonia	28	45	52	53	55	55	55	58

See footnotes at end of table.

TABLE 2.—ANNUAL AVERAGE EMPLOYMENT IN THE U.S.S.R., BY REPUBLIC AND SELECTED BRANCHES OF INDUSTRY, 1960 TO 1975—Continued

[In thousands; components may not add to totals due to rounding]

Republic	1960	1965	1970	1971	1972	1973	1974	1975
TIMBER, WOODWORKING, AND PULP AND PAPER								
Total, U.S.S.R.	2,698	2,819	2,848	2,829	2,821	2,807	2,799	2,795
R.S.F.S.R.	2,117	2,176	2,180	2,157	2,145	2,128	2,118	2,108
Ukraine	261	298	307	310	311	312	311	313
Belorussia	97	103	101	101	101	102	103	104
Uzbekistan	16	17	21	21	21	22	23	24
Kazakhstan	44	46	49	50	50	52	52	52
Georgia	21	21	22	24	25	25	26	26
Azerbaydzhan	8	10	11	11	12	13	14	13
Lithuania	27	39	38	38	38	38	39	40
Moldavia	10	14	18	18	19	18	19	19
Latvia	53	49	51	50	48	44	44	43
Kirgizia	5	6	8	9	9	9	9	9
Tadzhikistan	4	5	5	6	6	6	6	6
Armenia	8	7	8	8	8	8	8	8
Turkmenia	4	5	4	4	4	4	4	3
Estonia	23	23	24	24	24	24	24	24
CONSTRUCTION MATERIALS								
Total, U.S.S.R.	1,575	1,716	1,996	2,039	2,070	2,093	2,115	2,151
R.S.F.S.R.	933	1,000	1,111	1,133	1,153	1,165	1,171	1,187
Ukraine	338	356	428	437	442	447	451	458
Belorussia	48	53	72	76	77	77	80	80
Uzbekistan	37	46	64	67	68	71	73	76
Kazakhstan	78	93	114	114	115	116	119	123
Georgia	23	28	33	34	34	35	36	37
Azerbaydzhan	16	17	19	19	19	19	20	21
Lithuania	18	24	32	33	33	33	34	35
Moldavia	18	21	25	26	27	26	27	28
Latvia	16	17	18	20	20	20	20	20
Kirgizia	9	12	16	17	17	17	18	18
Tadzhikistan	7	10	13	13	13	14	14	14
Armenia	15	19	24	25	25	25	25	24
Turkmenia	9	9	12	13	13	13	13	14
Estonia	10	13	15	15	15	16	16	16
LIGHT INDUSTRY								
Total, U.S.S.R.	3,860	4,308	5,019	5,036	5,034	5,045	5,074	5,109
R.S.F.S.R.	2,543	2,704	2,942	2,926	2,893	2,878	2,874	2,871
Ukraine	514	607	805	821	828	831	836	843
Belorussia	126	168	225	228	235	237	240	244
Uzbekistan	126	145	167	172	179	183	191	199
Kazakhstan	96	124	179	187	189	195	200	201
Georgia	65	80	96	93	93	96	98	104
Azerbaydzhan	53	67	78	78	80	83	85	88
Lithuania	60	76	98	97	98	98	98	100
Moldavia	36	49	76	78	81	83	86	90
Latvia	64	71	88	88	87	87	88	85
Kirgizia	29	39	56	56	56	57	59	61
Tadzhikistan	32	44	55	56	57	58	59	61
Armenia	47	54	70	72	72	74	76	79
Turkmenia	23	25	29	30	30	31	32	32
Estonia	45	55	55	54	54	54	53	52

TABLE 2.—ANNUAL AVERAGE EMPLOYMENT IN THE U.S.S.R., BY REPUBLIC AND SELECTED BRANCHES OF INDUSTRY: 1960 TO 1975—Continued

[In thousands; components may not add to totals due to rounding]

Republic	1960	1965	1970	1971	1972	1973	1974	1975
FOOD INDUSTRY								
Total, U.S.S.R.	2,164	2,595	2,901	2,903	2,920	2,936	2,986	3,015
R.S.F.S.R.	1,270	1,484	1,619	1,609	1,606	1,610	1,635	1,641
Ukraine	451	546	625	627	638	643	653	654
Belorussia	72	92	108	109	112	112	112	113
Uzbekistan	45	54	57	58	58	62	65	69
Kazakhstan	74	102	121	121	123	123	125	129
Georgia	43	52	61	63	63	62	64	69
Azerbaydzhan	23	28	33	34	35	37	38	40
Lithuania	37	46	55	56	58	57	58	57
Moldavia	35	48	59	62	65	65	67	69
Lativa	42	49	52	52	51	51	51	52
Kirgizia	15	20	24	24	24	25	26	27
Tadzhikistan	11	14	18	18	18	19	19	20
Armenia	15	20	25	25	25	25	27	28
Turkmenia	8	10	11	12	11	12	12	12
Estonia	23	30	33	33	33	33	34	36

[1] Sum of employment in oil extraction and coal.
[2] Includes pharmaceutical industry.
0=No employment, or the figure rounds to less than 1,000.

Source: Most data presented in the table are reported in sources listed in the appended bibliography. In cases for which data were not available or the definition of a branch of industry changed, estimates were usually derived by one of the following four methods. (1) Wageworker figures were adjusted to include all industrial-production personnel by using proportions between wageworkers and industrial-production personnel available for the earlier definition or by using proportions based on national data. (2) Some figures were estimated by multiplying the employment figure for an earlier year by an index derived from the ratio of changes in output and productivity. (3) For branches in which employment was extremely low, the figures were based on information or fragmentary data in secondary sources. (4) Percent distributions of employment by branch of industry, presented in secondary sources, were used to estimate employment figures.
Where the sum of the estimated figures differed significantly from the reported totals, the estimates were raked to achieve equivalence.

TABLE 3.—SHARE OF ANNUAL AVERAGE FEMALE EMPLOYMENT, BY REPUBLIC AND BRANCH OF THE NATIONAL ECONOMY IN THE U.S.S.R.: 1950 to 1975

[In percentages]

Republic	1950	1960	1970	1975
STATE SECTOR				
U.S.S.R.	47	47	51	51
R.S.F.S.R.	50	50	53	53
Ukraine	43	45	50	52
Belorussia	45	49	52	53
Uzbekistan	40	39	41	42
Kazakhstan	40	38	47	48
Georgia	40	40	43	45
Azerbaydzhan	40	38	41	43
Lithuania	38	43	49	51
Moldavia	38	43	51	51
Latvia	45	49	53	54
Kirgizia	41	41	47	48
Tadzhikistan	39	37	38	38
Armenia	40	38	41	45
Turkmenia	41	36	39	40
Estonia	48	50	53	54
INDUSTRY				
U.S.S.R.	46	45	48	49
R.S.F.S.R.	49	47	49	49
Ukraine	38	39	45	[1] 47
Belorussia	44	49	52	53
Uzbekistan	44	43	45	47
Kazakhstan	37	39	47	47
Georgia	36	40	42	[1] 45
Azerbaydzhan	43	40	41	44
Lithuania	34	43	49	51
Moldavia	34	43	52	54
Latvia	42	46	51	53
Kirgizia	41	44	50	51
Tadzhikistan	45	46	48	[1] 49
Armenia	37	40	44	47
Turkmenia	46	42	45	[1] 45
Estonia	44	49	52	51
AGRICULTURE				
U.S.S.R.	42	41	44	44
R.S.F.S.R.	43	43	45	44
Ukraine	53	47	50	[1] 50
Belorussia	35	46	52	51
Uzbekistan	34	[2] 40	40	41
Kazakhstan	35	27	36	36
Georgia	[2] 49	[2] 44	48	[1] 48
Azerbaydzhan	32	25	45	50
Lithuania	30	37	39	39
Moldavia	36	38	53	49
Latvia	38	45	48	46
Kirgizia	35	30	39	41
Tadzhikistan	30	22	30	[1] 35
Armenia	36	39	45	51
Turkmenia	24	30	24	[1] 24
Estonia	44	44	47	45
FORESTRY				
U.S.S.R.	32	21	22	23
R.S.F.S.R.	33	21	21	NA
Ukraine	39	27	26	NA
Belorussia	31	14	12	NA
Uzbekistan	17	0	33	NA
Kazakhstan	26	17	21	21
Georgia	11	13	14	[1] 24
Azerbaydzhan	33	0	20	NA
Lithuania	11	11	7	NA
Moldavia	33	0	20	NA
Latvia	22	28	37	21
Kirgizia	29	21	19	15
Tadzhikistan	0	0	0	NA
Armenia	33	33	33	NA
Turkmenia	25	15	17	[1] 19
Estonia	29	16	20	22

See footnotes at end of table.

TABLE 3.—SHARE OF ANNUAL AVERAGE FEMALE EMPLOYMENT, BY REPUBLIC AND BRANCH OF THE NATIONAL ECONOMY IN THE U.S.S.R.: 1950 to 1975—Continued

[In percentages]

Republic	1950	1960	1970	1975
TRANSPORT				
U.S.S.R.	28	24	24	24
R.S.F.S.R.	32	26	26	26
Ukraine	23	21	23	[1] 24
Belorussia	24	22	22	22
Uzbekistan	22	18	16	15
Kazakhstan	25	19	23	23
Georgia	20	14	13	[1] 12
Azerbaydzhan	23	18	15	13
Lithuania	18	20	22	23
Moldavia	15	13	14	16
Latvia	23	24	25	26
Kirgizia	17	16	17	16
Tadzhikistan	23	14	12	[1] 12
Armenia	19	12	11	11
Turkmenia	24	19	19	[1] 19
Estonia	26	24	23	24
COMMUNICATIONS				
U.S.S.R.	59	64	68	68
R.S.F.S.R.	62	67	71	71
Ukraine	52	62	67	[1] 68
Belorussia	55	63	65	66
Uzbekistan	60	53	48	48
Kazakhstan	52	60	67	69
Georgia	48	54	50	[1] 55
Azerbaydzhan	52	47	40	40
Lithuania	44	46	63	68
Moldavia	37	52	60	61
Latvia	60	68	69	70
Kirgizia	55	59	63	61
Tadzhikistan	33	54	47	[1] 45
Armenia	41	43	45	47
Turkmenia	56	55	44	[1] 49
Estonia	67	66	74	73
CONSTRUCTION				
U.S.S.R.	32	30	29	28
R.S.F.S.R.	36	32	31	31
Ukraine	30	30	30	[1] 30
Belorussia	[3] 31	[3] 30	[3] 26	[3] 26
Uzbekistan	18	[3] 16	20	20
Kazakhstan	25	26	29	29
Georgia	[3] 22	[3] 12	12	[1] 12
Azerbaydzhan	21	15	15	14
Lithuania	[3] 18	17	19	19
Moldavia	18	21	26	25
Latvia	24	17	19	19
Kirgizia	[3] 23	[3] 21	22	21
Tadzhikistan	25	14	16	[1] 14
Armenia	[3] 18	[3] 10	13	13
Turkmenia	26	13	16	[1] 17
Estonia	28	24	21	21
TRADE, PUBLIC DINING, MATERIAL-TECHNICAL SUPPLY AND SALES, AND PROCUREMENT				
U.S.S.R.	57	66	75	76
R.S.F.S.R.	62	69	80	81
Ukraine	52	64	76	[1] 77
Belorussia	53	67	78	79
Uzbekistan	35	35	43	47
Kazakhstan	49	55	73	75
Georgia	36	42	50	[1] 52
Azerbaydzhan	41	40	44	46
Lithuania	51	63	75	77
Moldavia	38	50	65	69
Latvia	60	71	81	81
Kirgizia	41	49	62	67
Tadzhikistan	37	36	38	[1] 40
Armenia	39	43	50	50
Turkmenia	43	43	49	[1] 56
Estonia	65	[4] 81	[4] 88	[4] 89
HOUSING—COMMUNAL ECONOMY AND PERSONAL SERVICES				
U.S.S.R.	54	53	51	53
R.S.F.S.R.	57	57	54	56
Ukraine	46	48	50	[1] 52
Belorussia	35	42	43	NA
Uzbekistan	38	39	39	37
Kazakhstan	48	43	44	48
Georgia	42	32	38	[1] 36
Azerbaydzhan	50	50	51	45
Lithuania	45	48	49	50
Moldavia	39	35	39	43
Latvia	57	59	54	54
Kirgizia	40	45	41	45
Tadzhikistan	50	43	36	[1] 39
Armenia	38	36	36	40
Turkmenia	52	47	45	[1] 43
Estonia	57	62	55	59
HEALTH SERVICES				
U.S.S.R.	84	85	85	84
R.S.F.S.R.	87	88	87	87
Ukraine	82	84	84	[1] 83
Belorussia	81	83	82	82
Uzbekistan	80	74	74	73
Kazakhstan	81	86	85	85
Georgia	75	75	74	[1] 80
Azerbaydzhan	76	76	77	75
Lithuania	77	82	83	83
Moldavia	76	78	78	78
Latvia	80	84	85	84
Kirgizia	82	83	84	83
Tadzhikistan	83	76	74	[1] 73
Armenia	77	79	78	81
Turkmenia	83	76	73	[1] 72
Estonia	85	86	87	86
EDUCATION AND CULTURE				
U.S.S.R.	69	70	72	73
R.S.F.S.R.	73	74	77	77
Ukraine	67	69	71	[1] 72
Belorussia	66	67	71	72
Uzbekistan	46	48	53	55
Kazakhstan	61	64	70	73
Georgia	62	62	68	[1] 67
Azerbaydzhan	53	52	53	55
Lithuania	62	69	75	77
Moldavia	59	64	70	71
Latvia	69	73	76	76
Kirgizia	57	59	64	64
Tadzhikistan	37	44	46	[1] 47
Armenia	62	56	60	64
Turkmenia	49	49	56	[1] 57
Estonia	71	[5] 76	[5] 80	[5] 79
ART				
U.S.S.R.	37	36	44	47
R.S.F.S.R.	38	36	48	51
Ukraine	38	37	37	[1] 41
Belorussia	43	45	40	NA
Uzbekistan	33	31	32	33
Kazakhstan	32	33	41	45
Georgia	40	38	33	[1] 34
Azerbaydzhan	37	30	29	30
Lithuania	35	32	45	49
Moldavia	26	28	35	41
Latvia	41	42	52	52
Kirgizia	50	33	50	NA
Tadzhikistan	50	33	50	NA
Armenia	33	40	35	35
Turkmenia	40	32	31	[1] 30
Estonia	0	33	33	NA

See footnotes at end of table.

TABLE 3.—SHARE OF ANNUAL AVERAGE FEMALE EMPLOYMENT, BY REPUBLIC AND BRANCH OF THE NATIONA ECONOMY IN THE U.S.S.R.: 1950 to 1975—Continued

[In percentages]

Republic	1950	1960	1970	1975
SCIENCE AND SCIENTIFIC SERVICES				
U.S.S.R.	43	42	47	50
R.S.F.S.R.	44	42	48	51
Ukraine	42	43	46	[1] 49
Belorussia	47	49	50	51
Uzbekistan	40	34	42	44
Kazakhstan	33	33	39	43
Georgia	37	40	41	[1] 44
Azerbaydzhan	48	39	42	46
Lithuania	46	40	48	49
Moldavia	34	44	49	55
Latvia	54	49	52	55
Kirgizia	34	34	43	46
Tadzhikistan	20	37	38	[1] 38
Armenia	38	34	41	45
Turkmenia	40	30	37	[1] 43
Estonia	50	50	54	59
CREDIT AND INSURANCE				
U.S.S.R.	58	68	78	82
R.S.F.S.R.	61	72	81	85
Ukraine	55	65	76	[1] 80
Belorussia	56	64	73	78
Uzbekistan	57	52	59	62
Kazakhstan	50	61	74	79
Georgia	55	61	64	[1] 67
Azerbaydzhan	46	49	55	59
Lithuania	46	69	76	81
Moldavia	49	62	71	75
Latvia	57	73	82	86
Kirgizia	46	57	69	72
Tadzhikistan	50	53	60	[1] 62
Armenia	58	58	68	69
Turkmenia	48	52	60	[1] 63
Estonia	50	74	83	86
GOVERNMENT ADMINISTRATION				
U.S.S.R.	43	51	61	65
R.S.F.S.R.	47	54	64	68
Ukraine	39	47	59	[1] 63
Belorussia	40	47	58	63
Uzbekistan	34	38	46	48
Kazakhstan	35	44	55	62
Georgia	36	41	45	[1] 50
Azerbaydzhan	34	35	42	46
Lithuania	34	47	60	65
Moldavia	34	41	54	57
Latvia	50	60	70	74
Kirgizia	36	42	52	56
Tadzhikistan	33	42	47	[1] 50
Armenia	33	38	43	47
Turkmenia	40	45	50	[1] 54
Estonia	53	59	67	72
OTHER				
U.S.S.R.	49	43	51	50
R.S.F.S.R.	33	56	43	NA
Ukraine	19	47	36	NA
Belorussia	13	31	45	NA
Uzbekistan	19	22	25	NA
Kazakhstan	17	28	39	NA
Georgia	18	21	18	[1] 20
Azerbaydzhan	11	15	24	NA
Lithuania	29	17	40	NA
Moldavia	0	22	21	NA
Latvia	43	22	47	NA
Kirgizia	0	8	55	53
Tadzhikistan	0	11	36	NA
Armenia	0	25	12	NA
Turkmenia	35	37	44	[1] 46
Estonia	33	56	61	64
COLLECTIVE FARMS				
U.S.S.R.	59	52	50	48
R.S.F.S.R.	NA	53	49	46
Ukraine	NA	54	52	50
Belorussia	NA	55	52	50
Uzbekistan	NA	45	48	49
Kazakhstan	NA	43	40	40
Georgia	NA	47	48	50
Azerbaydzhan	NA	47	46	48
Lithuania	NA	47	46	45
Moldavia	NA	50	51	50
Latvia	NA	52	47	45
Kirgizia	NA	44	43	43
Tadzhikistan	NA	42	43	44
Armenia	NA	43	44	46
Turkmenia	NA	50	48	48
stonia E	NA	56	47	44

[1] Figures are for 1974.
[2] Limited to agricultural activity.
[3] Limited to construction-installation work.
[4] Limited to retail trade and public dining.
[5] Limited to employment in education.
NA—Not available.

Source: Figures were obtained or derived from the sources listed in the appended bibliography.

TABLE 4.—NUMBERS OF SPECIALISTS WITH HIGHER AND SPECIALIZED SECONDARY EDUCATION EMPLOYED IN THE U.S.S.R., BY REPUBLIC AND SELECTED BRANCHES OF THE NATIONAL ECONOMY: 1960 TO 1975

[In thousands]

Branch of economy	Republic											
	U.S.S.R.			R.S.F.S.R.			Ukraine			Belorussia		
	1960	1970	1975	1960	1970	1975	1960	1970	1975	1960	1970	1975
Total	8,784	16,841	22,796	5,331	9,905	13,275	1,661	3,269	4,397	276	577	81[4]
Industry	1,667	3,846	5,460	1,159	2,512	3,519	303	785	1,123	35	116	180
Agriculture	493	962	1,383	181	450	653	106	222	306	20	45	70
Collective farms	222	380	548	78	149	212	NA	NA	NA	7	20	33
State farms and agricultural organizations	184	431	659	91	240	366	NA	NA	NA	8	18	27
Transport	272	609	907	171	369	544	47	123	182	8	17	26
Communications	46	121	190	29	71	112	7	24	35	2	6	9
Construction	540	1,312	2,060	328	767	1,211	53	171	256	10	43	76
Trade, public dining, material—technical supply and sales, and procurement	316	821	1,278	164	433	673	57	194	315	9	34	49
Health services	1,525	2,339	2,870	892	1,321	1,608	315	466	558	49	82	98
Education and culture	2,446	3,847	4,513	1,362	2,055	2,315	488	726	839	102	148	176
Science and scientific services	636	1,388	1,975	291	1,005	1,405	77	187	278	7	24	42
Credit and insurance	75	130	193	NA	73	110	NA	NA	NA	4	5	7
Government administration	571	1,057	1,372	383	612	779	108	199	246	19	40	58

Branch of economy	Uzbekistan			Kazakhstan			Georgia			Azerbaydzhan		
	1960	1970	1975	1960	1970	1975	1960	1970	1975	1960	1970	1975
Total	242	531	788	340	744	1,039	191	325	NA	152	274	377
Industry	24	60	95	35	107	163	26	43	NA	17	34	48
Agriculture	14	38	62	32	62	88	14	22	NA	11	22	29
Collective farms	7	16	24	8	8	11	8	10	NA	NA	9	10
State farms and agricultural organizations	6	15	28	17	45	66	4	10	NA	NA	9	15
Transport	6	13	21	14	31	49	6	9	NA	5	10	15
Communications		3	5	2	5	9		2	NA	1	2	3
Construction	13	44	76	22	66	108	5	17	NA	7	17	24
Trade, public dining, material—technical supply and sales, and procurement	9	26	43	16	42	61	9	18	NA	4	11	16
Health services	41	88	123	60	114	151	38	57	NA	29	43	53
Education and culture	90	188	258	104	208	255	59	98	NA	52	93	126
Science and scientific services	12	24	36	20	39	51	15	23	NA	8	15	23
Credit and insurance	NA	3	5	4	7	11	1	3	NA	1	2	3
Government administration	[1] 20	34	48	27	52	73	14	21	NA	11	17	23

Branch of economy	Lithuania			Moldavia			Latvia			Kirgizia		
	1960	1970	1975	1960	1970	1975	1960	1970	1975	1960	1970	1975
Total	92	206	291	82	184	272	110	184	237	72	156	213
Industry	11	43	64	7	25	42	19	43	54	7	22	32
Agriculture	9	22	31	[2] 8	[2] 17	[2] 32	9	17	22	7	13	18
Collective farms	4	13	19	5	10	15	5	9	12	3	5	7
State farms and agricultural organizations	3	7	9	1	3	9	3	6	8	2	4	7
Transport	2	5	8	2	6	10	4	10	15	2	4	6
Communications	(4)	2	3							(4)	1	2
Construction	6	17	25	3	12	22	6	12	18	3	11	17
Trade, public dining, material—technical supply and sales, and procurement	4	12	19	3	10	16	5	11	15	3	8	13
Health services	17	29	37	18	29	37	18	26	30	12	25	30
Education and culture	28	45	56	[3] 30	[3] 58	[3] 75	26	37	44	26	50	63
Science and scientific services	4	12	20	3	8	13	5	12	18	4	8	11
Credit and insurance	1	2	2	1	1	2	1	2	2	1	1	2
Government administration	7	14	18	5	13	19	6	11	15	6	11	14

See footnotes at end of table.

TABLE 4.—NUMBERS OF SPECIALISTS WITH HIGHER AND SPECIALIZED SECONARY EDUCATION EMPLOYED IN THE U.S.S.R., BY REPUBLIC AND SELECTED BRANCHES OF THE NATIONAL ECONOMY: 1960 TO 1975
(Continued)

[In thousands]

	Republic											
	Tadzhikistan			Armenia			Turkmenia			Estonia		
	1960	1970	1975	1960	1970	1975	1960	1970	1975	1960	1970	1975
Total	57	120	NA	75	NA	NA	53	102	NA	60	114	149
Industry	4	11	NA	10	NA	NA	4	9	NA	11	29	37
Agriculture	[5]3	[5]8	NA	5	NA	NA	4	7	NA	6	10	16
Collective farms	1	4	NA	2	NA	NA	2	4	NA	3	5	8
State farms and agricultural organizations	1	2	NA	1	NA	NA	1	1	NA	2	5	8
Transport	1	3	NA	2	NA	NA	2	4	NA	2	5	7
Communications	(4)	1	NA		NA	NA	(4)	1	NA	1	1	1
Construction	3	9	NA	5	NA	NA	3	9	NA	1	6	9
Trade, public dining, material—technical supply and sales, and procurement	2	6	NA	3	NA	NA	2	5	NA	3	6	8
Health services	8	17	NA	14	NA	NA	11	18	NA	10	15	17
Education and culture	25	45	NA	22	NA	NA	18	32	HA	15	21	25
Science and scientific services	3	6	NA	8	NA	NA	4	5	NA	3	7	9
Credit and insurance	1	1	NA	NA	NA	NA	1	1	NA	1	1	1
Government administration	5	11	NA	5	NA	NA	5	9	NA	5	8	10

[1] Includes employment in credit and insurance.
[2] Includes employment in forestry.
[3] Includes employment in art.
[4] Rounds to less than 1,000.
[5] Sum of employment on collective farms, state farms, and in organizations servicing agricultural and veterinary establishments.

NA—Not available.

Source: National and republic statistical handbooks listed in the appended bibliography.

TABLE 5.—NUMBERS OF FEMALE SPECIALISTS WITH HIGHER AND SPECIALIZED SECONDARY EDUCATION EMPLOYED IN THE U.S.S.R., BY REPUBLIC: 1960 TO 1975

[In thousands; components may not add to total due to rounding]

Republic	1960	1965	1970	1975
Total, U.S.S.R	5,189	6,941	9,900	13,411
R.S.F.S.R	3,279	4,302	6,037	8,098
Ukraine	965	1,309	1,874	2,532
Belorussia	171	236	346	486
Uzbekistan	107	159	254	374
Kazakhstan	184	273	427	618
Georgia	94	125	170	208
Azerbaydzhan	67	86	122	158
Lithuania	54	81	126	178
Moldavia	48	69	107	159
Latvia	59	82	112	143
Kirgizia	37	55	86	119
Tadzhikistan	25	34	52	78
Armenia	37	49	73	108
Turkmenia	25	32	45	64
Estonia	37	49	69	89

Source: 1960, 1965, 1970: TsSU, Zhenshchiny, 1975, p. 74. 1975: TsSU, Nar. obraz., 1977, p. 292.

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THE ECONOMIC INTERDEPENDENCE OF SOVIET REPUBLICS

(By James W. Gillula*)

CONTENTS

FIGURES

TABLES

*Foreign Demographic Analysis Division, U.S. Bureau of the Census.

APPENDIXES

I. SUMMARY

This paper analyzes some aspects of the economic interrelations of union republics in the U.S.S.R. using new sources of data including regional input-output tables. An analysis of the interrepublic redistribution of national income accomplished through the state budget shows that since the mid-1960's it has primarily benefited the less developed republics of Central Asia and (to a lesser extent) the Transcaucasus, while the Ukraine has consistently had an excess of produced over utilized national income throughout this period. Calculations based on interregional input-output models constructed for 11 republics reveal a number of relations between the level of development of republics and their dependence on interregional trade. One of the major features of the economic interdependence of republics is the importance of interrepublic ties in the capital formation process. The redistribution of national income has had a greater effect on levels of investment than on levels of consumption in less developed republics, and these republics have been highly dependent on interregional trade in satisfying their needs for capital accumulation.

II. INTRODUCTION

A number of studies have shown that the Soviet Union has made little progress during the last two decades toward the frequently stated goal of reducing the development gap between republics.[1] According to official Soviet data, industrial output and national income in the smaller republics in the European part of the country have grown faster than the national average, with especially significant gains in Belorussia, Lithuania, and Moldavia. However, economic growth has lagged in some of the historically less developed republics across the southern belt of the country—including the Transcaucasus, Central Asia, and Kazakhstan. And the growth in absolute terms achieved in some of these southern-belt republics—Kazakhstan, Armenia, and Kirgizstan—has been offset by much higher than average rates of population growth. Thus, by most per capita measures the overall variation in levels of development of republics has increased slightly since 1960.

This widening of the development gap has led most Western specialists to conclude that the reduction of interrepublic differences in levels of development has not been a major goal of Soviet regional development policy. These results, in fact, seem to contradict the statements often made by Soviet economists that the growth of less developed regions is aided by an official policy of transferring investment funds to these regions from the more developed areas of the country. It is clear that strong institutional mechanisms for accomplishing this exist within the framework of the Soviet command economy. More than

[1] See, in particular, Schroeder, "Soviet," 1978; Schroeder, "Regional," 1973; and Koropeckyj, "Industrial," 1970.

one-half of Soviet national income passes through the state budget; approximately one-half of all capital formation is financed directly from the budget; and a large share of annual investment is centrally controlled by industrial ministries in Moscow. However, it has been impossible to determine how these instruments of central control have been used to redistribute national income among republics because published data on the all-union part of the state budget do not include a breakdown of revenues and expenditures by republic.

In part III of this paper, the interrepublic redistribution of national income accomplished through the state budget is analyzed first for a single year using a complete account of national income produced and utilized (for both consumption and capital accumulation) for all republics derived from reconstructed input-output tables for 1966. Data published annually on total capital formation, retail trade sales, and the growth of national income are then combined to form an indicator which can be used to trace trends in the redistribution of national income as it has affected individual republics from 1960 through 1977. This analysis is complicated by the fact that official Soviet data on produced national income do not provide a reliable measure of the relative levels of outputs of republics. However, even when the adjustments to official data implied by alternative estimates of national income for republics are taken into account, the available evidence indicates that it is the less developed republics that have benefited most from the redistribution of national income. Thus, the failure to reduce the development gap between republics must be explained in terms of factors which offset this policy.

Clearly a major factor underlying the increasing coefficients of variation for measures of the level of development of republics in per capita terms is the much higher than average rates of population growth in most of the less developed republics. The most obvious conclusion is that the increased levels of investment made possible by the redistribution of national income to these republics were just not sufficient to spur rates of economic growth that could keep pace with the growth of population. A second factor which apparently contributed to this failure to reduce the development gap was the sluggish growth of productivity in most of the less developed republics. An index of combined factor productivity growth in industry for republics during the period 1960–70 calculated by Whitehouse showed that all southern-belt republics except Kirgizstan and Georgia were below the national average.[2]

In part IV of this paper, a third possible explanation for the lack of progress in reducing interrepublic differences in levels of development is examined. In a pioneering study of the regional dimension of economic development (for Italy), Chenery showed that structural differences in the economies of more and less developed regions give rise to patterns of regional economic interdependence which must be considered in evaluating the indirect effects of an investment policy aimed at reducing a regional development gap.[3] A regional investment policy that favors less developed regions may not be successful unless it leads to structural changes that alter existing patterns of regional

[2] Whitehouse, "Demographic," 1973, pp. 156–158.
[3] Chenery, "Regional," 1953.

interdependence. Chenery demonstrated this with the first empirical application of an interregional input-output model. In part IV of this paper, the 1966 input-output tables for 11 Soviet republics are used to construct interregional input-output models for a similar analysis of the Soviet economy. Eleven two-region input-output models are constructed, each with a single republic as one region and the rest of the U.S.S.R. as the second.

Before turning to the questions outlined above, one important point must be made. The regional units throughout this paper are the 15 union republics. Because of the great disparity in the size of republics, a division of the country into more equal units would be preferable for the analysis of many regional economic questions. In fact, regional comparisons made with the large Russian and Ukrainian republics broken down into their component economic regions lead to different conclusions about the results of Soviet regional development policy. Indexes of per capita industrial output in 1960, 1970, and 1975 for all republics and for the 13 economic regions within the R.S.F.S.R. and the Ukraine are estimated in appendix A. Although the coefficient of variation calculated for per capita industrial output in the 15 republics increases between 1960 and 1975 (consistent with the results of other studies summarized above), the coefficient of variation obtained with a division of the U.S.S.R. into 26 regions—the 13 regions within the R.S.F.S.R. and the Ukraine plus the remaining 13 republics—declines from 1960 to 1970 and then remains at about the same level in 1975. However, comparisons of union republics have important political as well as economic implications, and in this context the observed trend toward equalization in levels of development for regions within the R.S.F.S.R. presents an even greater contrast to the lagging development of most southern-belt republics.

III. The Interrepublic Redistribution of National Income

In the first major study of the economic relations between union republics, Holubnychy concluded that from 1913 through the mid-1960's Soviet development policy could be explained largely as an attempt to develop the R.S.F.S.R. at the expense of non-Russian republics—a form of economic colonialism.[4] The characterization of Soviet policy as economic exploitation was also a recurring theme in a recent conference on the role of the Ukraine in the economy of the U.S.S.R. The connotation of exploitation has been attached to interrepublic economic relations because neither the value of national income redistributed through the state budget or any interest payments on it are returned to the producing republic, and republic leaders have little influence on this process. Interrepublic transfers of income by this means are in effect unreimbursed grants to the receiving republics.[5] Although the state budget is the primary instrument for carrying out this redistribution, published budget data are not sufficient for measuring the extent of this economic "exploitation" or determining which republics have been net gainers and which net losers in this process.

[4] Holubnychy, "Some Economic," 1968, pp. 76–86.
[5] Koropeckyj (Ed.), The Ukraine, 1977. See especially Hunter, "Overview," 1977, p. 10.

A. The State Budget as a Regional Policy Instrument

The state budget for the U.S.S.R. as a whole is composed of the all-union budget, the budgets of each union republic, and the budgets of lower administrative territorial units.[6] The budget of each union republic includes only the financial relations of enterprises and organizations subordinated to the republic's Council of Ministers. Revenue from and expenditures on enterprises and organizations of all-union subordination are included in the all-union budget. Although there are important differences in the composition of the all-union budget and the budgets of republics, both have the same major sources of revenue (turnover taxes and payments out of profits of enterprises) and both include expenditures on capital formation as well as on social-cultural measures.[7]

While the centralized control of the all-union portion of the state budget is obvious, the U.S.S.R. Ministry of Finance also has substantial control over the budget of each republic. The primary instrument of this control is the Ministry's power to determine the percentage of total turnover tax collected within each republic that is retained in the budget of the republic and the percentage that is allocated to the all-union budget. Different percentages are set for each republic, and these percentages may change each year. A similar policy is followed for income taxes and other sources of budget revenue, but these sources account for a much smaller share of total revenue in the state budget. The Supreme Soviet of each republic, which must approve its budget annually, may alter the targets set for total revenue or expenditure but cannot change the percentages of these revenue sources to be allocated to the republic's budget.[8] The budget revenue of a republic that has already been allocated 100 percent of its turnover tax collections in a given year may also be supplemented by direct subsidies (*dotatsii*) from the all-union budget.

Since both the values of total turnover tax collections by republic and the values of turnover tax retained in republic budgets have been published for a number of years, it is possible to compare the levels at which these percentages of retained turnover tax have been set for each republic. Average shares of turnover tax retained by republics for 5-year periods, 1961–1975, and for the last 4 years are given in table 1.[9] The most striking pattern in these percentages is that all of the southern-belt republics have consistently been assigned shares of their total turnover tax collections which are well above average and in some cases at or near 100 percent. However, this result cannot be attributed solely to an attempt to aid less developed republics since other factors, including differences among republics in the relative

[6] The income and expenditures of the budgets of lower administrative territorial units are included in the corresponding republic budget totals and will not be discussed separately here.

[7] In recent years the all-union portion of the state budget has accounted for about 52 percent of total incomes and expenditures and the sum of all republic budgets about 48 percent. The structure and composition of the state budget is described in detail in Gallik et al., The Soviet, 1968.

[8] Tulebayev, Problemy, 1973, pp. 92–93.

[9] Although complete budget data for republics are not yet available for this most recent period, the percentages of turnover tax collections to be retained are published annually in various Soviet newspapers in articles on the state budget plan for the following year. A simple average of these percentages was calculated for each republic for the 1976–1979 period. A comparison of percentages published in such articles for several years prior to 1976 with turnover tax data published subsequently in statistical handbooks on the state budget showed that these "planned" percentages are in fact consistently adhered to.

value of total turnover tax collections (e.g., on a per capita basis), apparently influence the setting of these percentages.

TABLE 1.—AVERAGE SHARES OF TURNOVER TAX COLLECTIONS RETAINED IN THE BUDGETS OF REPUBLICS, 1961–79

[In percent]

Republic	1961–65 (1)	1966–70 (2)	1971–75 (3)	1967–79 (4)
All republics	39	41	47	53
R.S.F.S.R.	30	30	39	45
Ukrainian S.S.R.	31	32	36	51
Moldavian S.S.R.	31	37	47	61
Belorussian S.S.R.	54	68	68	64
Latvian S.S.R.	17	22	41	43
Lithuanian S.S.R.	77	82	93	93
Estonian S.S.R.	52	48	51	59
Georgian S.S.R.	84	83	86	79
Armenian S.S.R.	94	98	92	75
Azerbaydzhan S.S.R.	78	85	77	61
Kazakh S.S.R.	100	100	98	100
Uzbek S.S.R.	79	99	98	92
Kirgiz S.S.R.	93	87	90	96
Tadzhik S.S.R.	98	99	98	90
Turkmen S.S.R.	100	100	99	99

Source: Col. 1: Ministerstvo Finansov SSSR, Gosudarstvennyy, 1966, pp. 14–15. Col. 2: Ministerstvo Finansov SSSR, Gosudarstvennyy, 1972, pp. 16–17. Col. 3: Ministerstvo Finansov SSSR, Gosudarstvennyy, 1976, pp. 13–14. Col. 4: 1976: Pravda, Dec. 5, 1975, p. 1; 1977: Izvestiya, Oct. 30, 1976, p. 2; 1978: Ekonomicheskaya Gazeta, No. 52, 1977, p. 3; 1979: Pravda, Dec. 1, 1978, p. 1.

Because turnover tax is collected primarily on various processed food products and consumer goods, the relative levels of turnover tax collections in republics are greatly affected by differences in the branch structure of their economies. We will return to this problem later in discussing the calculation of national income for republics. Here, in order to investigate the relation between the relative amounts of turnover tax collected in republics and the shares of this revenue assigned to republic budgets, both total turnover tax collections and the values of turnover tax retained in republic budgets are put in per capita terms for all republics using data for the 1971–75 period. Indexes of these per capital values are given in table 2. All eight southern-belt republics, which were assigned above average shares of their turnover tax collections as shown in table 1 (column 3), did in fact have below average amounts of turnover tax collections on a per capita basis (table 2, column 1). Just the opposite was true for the R.S.F.S.R. and Latvia. However, this effect of offsetting levels of turnover tax collections which were below or above average did not hold for the other five republics.

TABLE 2.—PER CAPITA INDEXES OF TURNOVER TAX COLLECTED AND RETAINED BY REPUBLICS, 1971–75

Republic	Turnover tax	
	Total collections	Retained in republic budget
U.S.S.R.	100	100
R.S.F.S.R.	116	95
Ukrainian S.S.R.	86	66
Moldavian S.S.R.	86	86
Belorussian S.S.R.	102	146
Latvian S.S.R.	167	146
Lithuanian S.S.R.	116	227
Estonian S.S.R.	126	136
Georgian S.S.R.	66	121
Armenian S.S.R.	97	188
Azerbaydzhan S.S.R.	64	105
Kazakh S.S.R.	70	146
Uzbek S.S.R.	53	110
Kirgiz S.S.R.	76	144
Tadzhik S.S.R.	58	121
Turkmen S.S.R.	59	123

Source: Ministerstvo Finansov SSSR, Gosudarstvennyy, 1976, pp. 13–14. Values converted to a per capita basis using mid-year population for 1973 from Baldwin, Projections (forthcoming).

The indexes given in the second column of table 2 suggest that the levels at which these percentages of retained turnover tax were set did more than just offset the shortfall in per capita turnover tax collections in all southern-belt republics—the level of turnover tax retained was above average in each of these republics. This result may also have explanations other than an attempt to provide above average levels of income for the budgets of these republics, however, since turnover tax accounts for only about one-third of all budget incomes and there are substantial differences among republics in the relative importance of all-union enterprises in their economies.[10]

While this limited evidence on the use of centralized instruments of control over the budgets of republics is at best inconclusive, virtually nothing can be said about the balance of income from and expenditures on enterprises and organizations of all-union subordination located within each republic. As noted above, the financial relations of these enterprises are included in the all-union budget, and published data on the all-union budget do not include a breakdown of incomes and expenditures by republic. Thus, budget data can be used to analyze the overall balance of financial relations for republics only if certain assumptions about the shares of each republic in all-union incomes and expenditures are made.[11]

B. The Balance of Produced and Used National Income in 1966

An alternative to the use of budget data in analyzing the redistributive effects on republics of central government policies is to compare the value of national income used (for consumption and capital accumulation) with national income produced in each republic. These two

[10] Before leaving this discussion of republic budgets, one other factor which may have influenced the allocation of turnover tax to republic budgets is worth noting. As table 1 shows, the share of turnover tax assigned to republic budgets has been growing steadily over the past 10 years with some of the greatest gains occurring in the R.S.F.S.R. and the Ukraine. This may reflect a need to finance the rapidly growing agricultural subsidies in the Soviet Union, which are covered primarily by republic budgets as shown by Treml, Agricultural, 1978, pp. 16–18.

[11] Melnyk, "Capital," 1977, pp. 268–299, has done this for the Ukraine. However, using a similar approach of allocating all-union budget totals according to republic shares of various known aggregate economic indicators would very likely defeat the purpose of identifying particular differences in the treatment of the republics which are of most interest.

values need not be equal, and except in rare cases they are not. The difference between produced and used national income is equal to the export-import balance of the republic, where exports and imports include both interregional (domestic) and foreign flows. Such national income balances have been compiled for all republics since about 1960. However, information on both produced and used national income is published in the annual statistical handbooks of less than half of all republics. This section presents data on the balances of produced and used national income for all republics in 1966, which were estimated from input-output tables. Although these data are somewhat out-of-date, they provide some useful insights into the interrepublic redistribution of national income, and the limited information available from republic statistical handbooks suggests that there is considerable stability over time in the relationship of used to produced national income for individual republics.

Using a variety of sources on the 1966 input-output tables of Soviet republics, estimates were made for produced national income, two components of used national income, and the export-import balance for each republic (see table 3).[12] Since these values are based on data from input-output tables, estimates of produced national income differ slightly from the corresponding values calculated (but not published for all republics) in standard national income and product accounts. Values of national income in Soviet input-output tables exclude the so-called "special earnings of foreign trade."[13] These values are preferable since the export-import balance shown in input-output tables reflects only the difference between exports and imports valued in domestic prices. Values of consumption include both personal and communal consumption. They also include the value of depreciation payments on housing and other nonproductive capital stock and are thus completely consistent with the values of consumption as recorded in standard national income accounts. The values in the column labeled "Capital accumulation" include fixed capital accumulation, changes in working capital and reserves, losses out of national income, and unspecified other expenditures. The "Export-import balance" reflects the balance of all interregional and foreign shipments into and out of each republic.

[12] The estimation of these values is described in Gillula, Regional, 1978, pp. 84–86.
[13] See Treml et al., The Structure, 1972, pp. 149–159, for a discussion of this difference in methodology.

TABLE 3.—PRODUCED AND USED NATIONAL INCOME FOR REPUBLICS, 1966

[In millions of rubles]

Republic	Produced national income	Used national income			
		Total	Consumption	Capital accumulation	Export-import balance [1]
Total U.S.S.R.	202,486	206,547	150,473	56,074	−4,061
R.S.F.S.R.	120,800	123,200	90,100	33,100	−2,400
Ukrainian S.S.R.	38,910	37,440	27,650	9,790	1,470
Moldavian S.S.R.	2,537	2,339	1,720	619	198
Belorussian S.S.R.	6,466	6,523	5,020	1,503	−57
Latvian S.S.R.	2,749	2,569	2,002	568	179
Lithuanian S.S.R.	2,907	2,862	2,147	714	45
Estonian S.S.R.	1,514	1,529	1,152	377	−15
Georgian S.S.R.	2,937	3,260	2,503	757	−323
Armenian S.S.R.	1,607	1,705	1,161	544	−98
Azerbaydzhan S.S.R.	2,755	2,743	2,061	687	7
Kazakh S.S.R.	9,231	10,849	7,009	3,840	−1,618
Uzbek S.S.R.	5,846	6,665	4,632	2,033	−819
Kirgiz S.S.R.	1,615	1,886	1,317	569	−271
Tadzhik S.S.R.	1,367	1,498	1,074	424	−131
Turkmen S.S.R.	1,246	1,474	925	549	−228

[1] Minus sign indicates a net import balance.

Source: Gillula, Regional, 1978, p. 85.

In 1966 the total value of used national income exceeded produced national income in seven of the eight southern-belt republics. The ratio of used to produced national income for these republics ranged from 106 percent in Armenia to 118 percent in Kazakhstan and Turkmenistan. National income used was less than produced national income by 4 percent in the Ukraine, 7 percent in Latvia, and 8 percent in Moldavia. In all other republics these two totals were within 2 percent of each other.

In order to compare the relative size of the components of national income for each republic, the values in table 3 were converted to per capita indexes with the U.S.S.R. equal to 100 (see table 4). From coefficients of variation calculated for these indexes, it is apparent that the effect of the interrepublic redistribution of national income was to reduce the overall variation among republics in used national income as compared to produced national income. (Values of the coefficient of variation were 0.134 for the former and 0.148 for the latter.) Furthermore, there was a significant inverse relation between the rankings of republics by per capita produced national income and by the ratio of used to produced national income ($r_{sp}=-0.532$),[14] i.e., the higher a republic's per capita produced national income, the lower the share of this total used within the republic.

[14] The symbol "r_{sp}" is the Spearman rank correlation coefficient.

TABLE 4.—INDEXES OF PRODUCED AND USED NATIONAL INCOME PER CAPITA FOR REPUBLICS, 1966

Republic	Produced national income	Used national income			
		Total	Consumption	Capital accumulation	Export-import balance
Total U.S.S.R.	100.0	100.0	100.0	100.0	100.0
R.S.F.S.R.	109.2	109.2	109.6	108.0	−108.2
Ukrainian S.S.R.	98.0	92.5	93.8	89.1	184.7
Moldavian S.S.R.	86.2	77.9	78.6	75.9	335.4
Belorussian S.S.R.	85.6	84.7	89.5	71.9	−37.6
Latvian S.S.R.	138.3	126.7	135.6	103.2	449.1
Lithuanian S.S.R.	111.5	107.6	110.8	98.9	86.0
Estonian S.S.R.	134.0	132.7	137.2	120.5	−66.2
Georgian S.S.R.	74.8	81.4	85.8	69.6	−410.0
Armenian S.S.R.	81.6	84.8	79.3	99.7	−248.0
Azerbaydzhan S.S.R.	67.5	66.0	67.9	60.8	8.6
Kazakh S.S.R.	88.5	102.0	90.4	132.9	−773.4
Uzbek S.S.R.	62.9	70.4	67.1	79.0	−439.7
Kirgiz S.S.R.	70.2	80.3	77.0	89.3	−587.0
Tadzhik S.S.R.	60.8	65.3	64.2	68.0	−290.3
Turkmen S.S.R.	73.9	85.7	73.8	117.6	−674.5

Source: Calculated from values in table 3 using mid-year population figures for 1966 from Vesthik statistiki, 1971, pp. 85–86.

Another aspect of the interregional redistribution of national income that was investigated using these data is its relative effect on levels of consumption and capital accumulation. Comparison of the ranking of republics by per capita produced national income with ranking by each component of used national income reveals an almost perfect correlation with consumption (r_{sp}=0.968) and also a positive correlation with capital accumulation (r_{sp}=0.600). The latter result shows that in spite of the redistribution of national income, differences in levels of capital formation for republics are still to a large extent determined by differences in income levels, i.e., by differences in their ability to generate investment funds internally. A second test of this relationship also showed a significant correlation between levels of capital formation and levels of produced national income.[15] However, this does not contradict the conclusions about the redistribution of national income stated above. In making interrepublic comparisons of capital investment, it is important to consider that, for example, a level of per capita capital formation in a given republic which is only 80 percent of the national average may still imply a net inflow of investment funds if the per capita national income of the republic is only 60 percent of the national average.

The index of the export-import balance for republics in per capita terms indicates the relative size of the gains and losses of national income for each republic. All values are shown in relation to the net import balance of the U.S.S.R. as a whole. In each of the southern-belt republics except Azerbaydzhan, the import surplus was from two to seven times greater than the U.S.S.R. average. Other Western specialists have shown that much of the national income redistributed to other republics comes from the Ukraine. This was indeed the case in 1966. However, on a per capita basis the amounts of current income extracted in that year from both Moldavia and Latvia were larger than from the Ukraine, according to these official data on national income produced and used.

[15] See Gillula, Regional, 1978, p. 82. The ranking of republics according to indexes of total capital formation for three different 5-year periods (1961–1965, 1966–1970, and 1971–1975) was compared with the ranking for indexes of produced national income per capita for a year at the beginning of each of these periods.

C. Shortcomings of Official National Income Data for Republics

Before drawing conclusions about the redistribution of national income on the basis of national income data, one important factor which must be considered is the meaningfulness of produced national income figures for republics as calculated by the U.S.S.R. Central Statistical Administration (*Tsentral'noye statisticheskoye upravleniye*—TsSU). One major objection made by many Soviet economists to the methodology of calculating national income for republics—the treatment of turnover tax—was noted above. The values of turnover tax to be included in the national income of republics are determined centrally on the basis of their shares in the output of products on which this tax is collected. Because most of this tax is collected on products of the light and food industries and none on the output of agriculture, the contribution of agriculture to national income is understated, and the total value of national income for individual republics may be understated or overstated depending on the relative shares of primary production and processing industries in their economies. One Soviet attempt to reestimate national income for republics by distributing turnover tax according to total days worked in industry and agriculture (with a correction for differences in productivity) concluded that national income in 1970 was understated by as much as 20 percent in some republics and overstated by as much as 11 percent in others.[16]

Furthermore, the distortive effect of the treatment of turnover tax is only part of a more general problem of how to measure the true contribution of individual republics to the country's national income in the context of the Soviet price system. Aspects of pricing policy other than just the collection of turnover tax serve to redistribute income among sectors of the economy. The setting of relative prices produces dramatic intersectoral differences in profits realized; in some instances enterprises are even planned to operate at a loss. Because there are substantial differences in the branch structures of the economies of republics, the calculation of national income can be significantly affected by these intersectoral differences in levels of profits.[17] This has led some Soviet economists to question whether national income for republics can even be calculated:

> In spite of the almost complete agreement on the shortcomings of this [TsSU] method of calculating national income for republics, there is currently no consensus of opinion on how to improve it. Moreover, essentially opposing points of view have developed on whether it is even possible to calculate national income for republics and regions of the U.S.S.R. within the framework of the existing system of price formation.[18]

Because of these shortcomings of official national income data for republics (and in part because national income is not calculated for any administrative-territorial divisions other than union republics), several attempts have been made by Soviet economists to estimate national income by other methods. In the study from which the above

[16] Mazanova, "Territorialnyye," 1976, p. 95. Results for individual republics were not reported.
[17] The biases in official national income data which result were summarized by Koropeckyj, "Methodological," 1972, pp. 390–391.
[18] Telepko, Urovni, 1971, p. 59.

quote was taken, values of national income in 1968 were estimated for the 18 large economic regions into which the U.S.S.R. is divided by: (1) using official data on wages and employment to calculate the labor component of national income; and (2) distributing the total value of nonlabor income in major sectors of the economy according to shares of employment adjusted for differences in productivity. Another Soviet economist used the approach of estimating national income as the returns to capital and labor in each republic. He estimated a Cobb-Douglas production function (with constant returns to scale) for the U.S.S.R. as a whole using time series data and then substituted the values of labor and capital for each republic in 1970 into this estimated equation to calculate national income in that year.[19]

Although these and other Soviet attempts to estimate national income for republics (regions) have overcome the distortive effects of the Soviet price system, they have not taken into account two important factors—the contribution of the services sector to national income and the value of differential rent (primarily in agriculture). Allowances for both of these factors were incorporated in estimates of gross national product (GNP) for Soviet republics in 1970 made by Koropeckyj.[20]

The biases in official data on national income can be examined by comparing two of the alternative sets of estimates for 1970 mentioned above with published TsSU values for that year (see table 5). To ensure the comparability of all three indexes, the values taken from Koropeckyj were his estimates of net material product (rather than GNP). These values are preferred here since the use of estimates that include the services sector would require the recalculation of values of used national income for all republics as well in order to draw valid conclusions about the redistribution of national income.[21]

TABLE 5.—ALTERNATIVE INDEXES OF PER CAPITA NATIONAL INCOME FOR REPUBLICS, 1970

Republic	National income per capita as calculated by:		
	TsSU	Koropeckyj	Zakumbayev
	(1)	(2)	(3)
U.S.S.R.	100	100	100
R.S.F.S.R.	112	109	113
Ukrainian S.S.R.	97	105	95
Moldavian S.S.R.	81	84	56
Belorussian S.S.R.	91	101	82
Latvian S.S.R.	132	121	113
Lithuanian S.S.R.	112	113	94
Estonian S.S.R.	133	138	133
Georgian S.S.R.	73	62	77
Armenian S.S.R.	77	71	77
Azerbaydzhan S.S.R.	62	50	67
Kazakh S.S.R.	82	94	99
Uzbek S.S.R.	61	54	58
Kirgiz S.S.R.	67	66	60
Tadzhik S.S.R.	56	50	51
Turkmen S.S.R.	74	65	72

Source: Col. 1: Nar. khoz. Lat. SSR 1971, p. 56. Col. 2: Koropeckyj, "National," 1975. Values of net material product calculated as the sum of gross national product in the "M+" and "A" sectors (ibid., p. 313) less the values of depreciation in these 2 sectors (ibid., p. 311). Col. 3: Zakumbayev, Metody, 1975, p. 61.

[19] Zakumbayev, Metody, 1975, pp. 56–63.
[20] Koropeckyj, "National," 1975.
[21] Indexes of GNP per capita calculated by Koropeckyj do not differ from those given in table 5 (column 2) by more than 5 percentage points for any single republic.

A comparison of the three indexes in table 5 shows that the reestimation of national income does not significantly alter the overall picture of the ranking of republics in per capita terms given by the official data, but the positions of individual republics relative to the national average change by as much as 12 percentage points according to Koropeckyj's estimates and as much as 25 percentage points according to Zakumbayev's. The major differences between the Koropeckyj and the Zakumbayev estimates for certain republics can probably be attributed to the explicit treatment of differential rent in agriculture by Koropeckyj. This applies especially to their conflicting results for the Ukraine, Moldavia, Belorussia, and Lithuania, all of which have above average share of agricultural output. Since, as Koropeckyj noted, the values of differential rent he calculated may include some elements of returns to capital, more realistic values of national income may lie somewhere in between these conflicting estimates. Koropeckyj and Zakumbayev do agree on two points of interest for this study, however. The official national income for Kazakhstan is understated and the values for all Central Asian republics are overstated.

D. Patterns of Income Redistribution, 1960–77

Having examined the apparent biases in official Soviet data on national income for republics, we can now return to the question of interrepublic income redistribution. Data on the relation of used to produced national income like those presented above for 1966 cannot yet be assembled for all republics for any other year. However, from data published in the statistical handbooks for seven republics, it was possible to calculate the ratio of these two values for a number of years during the period 1961–75. Although the Ukraine is among the republics for which no data on used national income are published, it was possible to derive values of consumption and capital accumulation for 1961–72 from information in a recent book on the Ukrainian economy. All ratios of used to produced national income that could be calculated for eight republics are given in table 6. For these republics, it is apparent that with few exceptions the ratio of used to produced national income changed only slowly over time. Although this relative stability lends some support to the generalizations made above on the basis of complete data for 1966, there are some important omissions in this sample of republics. Therefore, in an attempt to identify trends over time in the policy of redistributing national income as it has affected all republics (using readily available data), the following indicator was derived:

$$S_r^t = \frac{\frac{(C_r^t + I_r^t)}{(C_u^t + I_u^t)}}{\frac{Y_r^t}{Y_u^t}} \qquad (1)$$

where

Superscripts, t, indicate the year;
Subscripts, r, refer to a single union republic; and u, to the U.S.S.R. as a whole;
C is the total value of retail trade sales (including public dining);

I is the total value of capital formation (including *Kolkhozes* and the population); and
Y is the value of produced national income.

TABLE 6.—RATIOS OF USED NATIONAL INCOME TO PRODUCED NATIONAL INCOME FOR 8 REPUBLICS, 1961–75

Year	Ukrainian S.S.R.	Latvian S.S.R.	Lithuanian S.S.R.	Estonian S.S.R.	Armenian S.S.R.	Azerbaydzhan S.S.R.	Uzbek S.S.R.	Kirgiz S.S.R.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1961	0.93	0.93	0.96	NA	NA	0.93	NA	1.10
1962	.93	.95	.96	NA	NA	.96	.98	NA
1963	.93	.94	.96	NA	NA	.96	1.04	NA
1964	.93	.93	.95	NA	NA	.94	1.09	NA
1965	.93	.88	.94	0.93	NA	.98	1.10	1.07
1966	.93	.90	.95	.96	1.05	.94	1.10	1.12
1967	.94	.94	1.03	1.00	NA	.98	1.12	1.10
1968	.94	.95	1.05	1.00	NA	.96	1.16	1.10
1969	.95	.95	1.03	.98	NA	1.04	1.18	1.18
1970	.94	.98	.99	1.01	1.05	.99	1.08	1.10
1971	.94	.96	.98	1.00	1.09	.95	1.04	1.07
1972	.92	.94	.97	1.03	1.01	.93	1.07	1.09
1973	NA	.98	1.02	1.06	1.05	.92	1.05	1.12
1974	NA	.94	1.03	1.02	.98	.93	1.04	1.14
1975	NA	.94	NA	.98	.98	.92	1.02	NA

NA—Not available.

Source: Col. 1: Values of consumption and capital accumulation were estimated from growth indexes (base-year 1959) for these 2 components of used national income for each year through 1972 given by Gayats, Prognozirovaniya, 1975, p. 33. These growth indexes were applied to values of consumption and capital accumulation (in per capita terms) for 1959 from the input-output table of the republic (Gillula, "Input-Output," 1977). Total ruble values were calculated using population data from Nar. hosp. Uk. RSR 72, p. 7. Values of produced national income were taken from various statistical handbooks for the Ukraine. Cols. 2–8: Compiled from various republic statistical handbooks.

Values of retail trade sales and capital formation in this expression are used as proxies for the consumption and capital formation components of used national income. Thus a value of $S_r^t = 1.0$ indicates that a republic's share of the national total for these two major categories of final demand was equal to its share of national income. A value greater than one indicates that a republic's share of this total exceeded its share of national income. Values other than 1.0 are interpreted as an indication of income redistribution.

This ratio was calculated for all republics in each year, 1960 to 1977, using official statistical series for each component—C, I, and Y—in constant prices. Values of retail trade sales were estimated by applying constant price growth rates published for all republics to the ruble values of total retail sales in 1970 in existing prices. Values of capital formation for all years except 1976 and 1977 were in 1969 prices.[22] (Published values for the last 2 years reflect the new prices for equipment introduced in 1973 and lower construction-assembly prices introduced in 1976.) Values of national income were estimated by applying published growth rates to ruble values for 1970 in 1970 prices.[23] In using this S_r^t ratio as a measure of income redistribution, the following biases must be considered:

(1) Values of retail trade sales are an imperfect measure of levels of consumption for republics.[24] Perhaps the most important shortcoming of these data is that they omit sales in collective farm

[22] For several republics values of capital formation for the years 1961 through 1964 were available only in 1955 prices. For each of these republics, a single price ratio (calculated as the sum of capital formation during these 4 years in 1969 prices divided by the same sum in 1955 prices) was used to adjust the values of these years.
[23] The values for 1970 were estimated from the per capita values published in Nar. khoz. Lat. SSR 1971, p. 56.
[24] See Schroeder, "Regional," 1973, pp. 180–181, for a discussion of the shortcomings of retail trade data as a measure of consumption.

markets. Largely as a result of this omission, the total value of retail trade sales as a percentage of consumption as shown in the national income accounts in 1966 varied from 66 percent to 78 percent for individual republics. Furthermore, although the share of retail trade sales in total consumption has been increasing over time for most republics, this ratio has apparently grown faster in the more developed republics than in less developed republics.[25]

(2) The values of capital formation reflect gross investment rather than net investment as shown in national income accounts. This factor (together with the fact that retail trade data understate the value of total consumption) results in capital formation having a greater weight in the ratio derived here than it would have in a similar ratio based only on data from standard national income accounts.

(3) Values of all components of this ratio in current prices would give a more appropriate measure of income redistribution, especially considering the questionable reliability of the Soviet statistical series reported to be in constant prices. In particular, implicit price deflators for national income calculated for the period 1958–1970 (using estimated values of national income in these 2 years in current prices and published growth rates in constant prices) showed marked and, in some cases, unexplainable differences among republics.[26]

(4) The most important methodological factor to be considered in interpreting these ratios is that they are based on official Soviet national income data for republics. The possible biases in these data were investigated above for only a single year. Although the percentage adjustments necessary to correct official values of national income for republics may vary from year to year, the estimates for 1970 presented in table 5 should give an indication of the direction in which these adjustments must be made for individual republics for the period considered here.

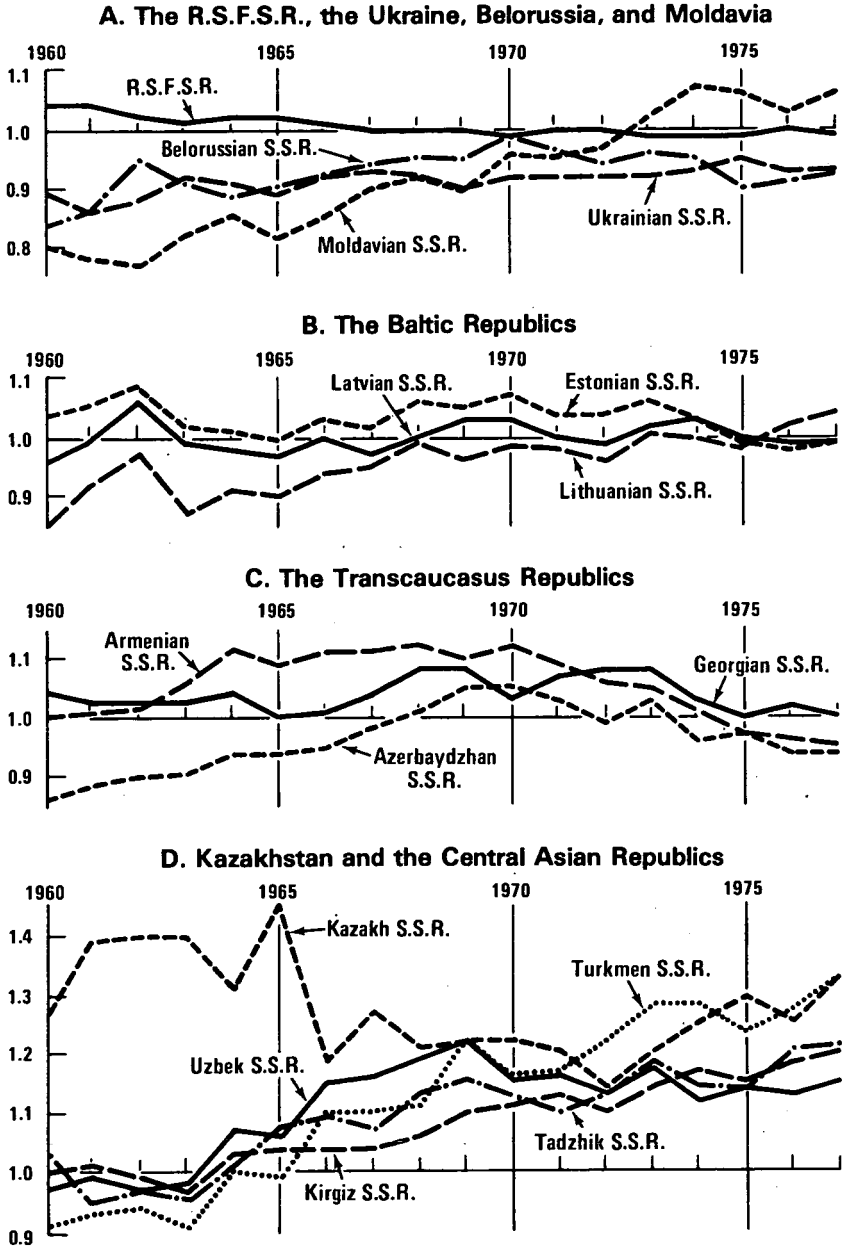
The values of the S_r^t ratio for all republics during the 1960–1977 period are presented in the form of line graphs in figure 1. The movements in these S_r^t ratios follow the general trends in the actual ratios of used to produced national income for the eight republics in table 6. However, the values of S_r^t for each of these republics are either consistently just above or consistently just below the actual ratios of used to produced national income. Thus, the trends in these S_r^t ratios over time should give a reliable indication of changes in income redistribution policies, but care must be taken in drawing conclusions from the precise level of each trend line in figure 1.

Combining the results derived from the national income data for 1966, the ratios of used to produced national income for the eight republics in table 6, and the S_r^t ratios in figure 1, and taking into consideration the biases in official national income data for republics summarized above, the following conclusions about the interrepublic redistribution of national income can be drawn.

[25] See Gillula, Regional, 1978, pp. 67–71.
[26] Ibid., pp. 59–64.

Figure 1.

INCOME REDISTRIBUTION INDICATORS FOR REPUBLICS: 1960 to 1977



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The Ukraine has for the entire period considered here contributed to the economic development of other regions of the U.S.S.R. by maintaining a positive balance of trade amounting to from 5 to 8 percent of its national income as officially calculated. Although ratios of used to produced national income for the republic are available only through 1972, the trend in the S_r^t ratios for the Ukraine suggest that this pattern has changed little in more recent years. Furthermore, if (as Koropeckyj has estimated) the national income of the Ukraine is understated by as much as 6 to 8 percent, then the amount of this annual transfer of national income out of the republic may be more accurately placed at 11 to 14 percent of the actual value of national income produced in the republic.

Since the early to mid-1960's, all four Central Asian republics have benefitted from the interrepublic redistribution of national income. Although the ratio of used to produced national income has declined somewhat for Uzbekistan from levels reached in the late 1960's, for Kirgizstan and Tadzhikistan it has apparently been maintained at a level of about 1.1 to 1.2 according to official national income data, and for Turkmenistan it has continued to rise to still higher levels. Since the values of national income as calculated by TsSU are apparently overstated for each of these republics, the true extent of this redistribution has probably been even greater.

Although official Soviet data indicate that the development of Kazakhstan has been heavily subsidized by other regions, except for the early 1960's this apparent redistribution of national income may be due largely to the fact that the produced national income of the republic is substantially understated. If the actual national income for Kazakhstan is 14 to 20 percent higher than that calculated by TsSU (as suggested by the estimates of Koropeckyj and Zakumbayev), then the ratios of used national income to produced national income observed since 1966 would in fact reflect balances near zero.

Conclusions for the Transcaucasus republics are less clear, in part because of the conflicting estimates in table 5 about the biases in official national income estimates for these republics. However, Armenia and (to a lesser extent) Georgia apparently benefitted from the redistribution of national income for much of the period considered here, while Azerbaydzhan was the only southern-belt republic with values of used national income consistently less than produced national income (with the exception of 1969). The ratios of used to produced national income have apparently been declining steadily for all three of the Transcaucasus republics in recent years.

Among the remaining republics in the European part of the country, only Moldavia shows a trend of significant change over time in the S_r^t ratio, increasing from a level well below average in the early 1960's to above average values during the last 5 years. Thus, the low ratio of used to produced national income for the republic in 1966 reported above was probably not characteristic of the entire period considered here. The S_r^t ratios for R.S.F.S.R. varied little, remaining around 1.0 for the entire period.

In comparing adjusted estimates of produced national income with official values of used national income, it has been assumed that any factors which might distort the relative values of used national income are not significant enough to alter these conclusions. The most serious

weakness of this assumption is that adjustments to national income like those discussed above probably imply an increase in the prices of capital goods relative to consumer goods. However, correcting for this effect would probably mean that the actual redistribution of national income was even greater than the data given above show, since the Central Asian republics have had higher than average shares of capital accumulation in total used national income, while the share for the Ukraine has been below average.

When the trends in ratios of used national income to produced national income for individual republics are viewed together, it is apparent that some fundamental changes in patterns of income redistribution to less developed republics that prevailed through most of the 1960's have been taking place in recent years. Although the ratio of used to produced national income has remained at about the same level for Kirgizstan and Tadzhikistan, since about 1970 it has increased for Kazakhstan and Turkmenistan and fallen for all three Transcaucasus republics and Uzbekistan. In order to get a better understanding of the factors underlying these shifts, it is necessary to focus on trends in the two major components of used national income separately. For this purpose, two additional sets of "share ratios" analogous to S_r^t were calculated for all republics for the same 1960 to 1977 period, first relating only shares of capital formation to shares of national income for republics and, secondly, relating only shares of total retail trade sales to national income shares.[27] The analytical usefulness of these additional "share ratios" is limited by the several factors summarized above in defining the S_r^t ratio, and only general trends observed for the eight southern-belt republics will be summarized here:

(1) For the two republics with increasing S_r^t ratios in recent years (Kazakhstan and Turkmenistan), the retail trade "share ratios" has steadily increased, and the capital formation "share ratio" in 1977 was at or slightly above the level of 1970.

(2) For the two republics with stable S_r^t ratios (Kirgizstan and Tadzhikistan), a steady increase in retail trade "share ratios" has been accompanied by a slight decline in capital formation "share ratios."

(3) For the four republics with declining S_r^t ratios (Uzbekistan and Transcaucasus republics), retail trade "share ratios" have remained at a constant level while capital formation "share ratios" have steadily declined.

These trends indicate that the decline in the ratio of used national income to produced national income (or its proxy S_r^t) observed for several republics during the 1970's can be explained largely by a curtailment in the policy of redistributing national income between republics to provide for higher levels of capital formation in less developed republics. This is true for all southern-belt republics except Kazakhstan and Turkmenistan—republics where the existence of fuel resources and other industrial raw materials is of relatively greater importance. This conclusion is consistent with the results of recent comparisons of the regional distribution of total capital formation in the U.S.S.R.[28] The level of per capita capital formation in each southern-

[27] These two sets of "share ratios" were of the form $(I_r^t/I_u^t)/(Y_r^t/Y_u^t)$ and $(C_r^t/C_u^t)/(Y_r^t/Y_u^t)$, respectively, where all variables are the same as defined in equation (1).

[28] See Gillula, "Regional," 1978, pp. 81–84, and Schroeder, "Soviet," 1978, p. 128.

belt republic relative to the national average was lower in 1971–75 than in the previous 5-year period, while per capita capital formation in the R.S.F.S.R. increased to a relative level that had not been attained since the late 1950's. This shift in the regional distribution of total capital formation, which has been continued in the first 2 years of the current 5-year plan for which data are available, reflects the massive effort underway to develop the eastern regions of the R.S.F.S.R. Thus, the curtailment of the policy of redistributing national income to less developed republics must be explained to a large extent by a shift in priorities in the face of the increasing urgency of developing the natural resources of Siberia.

A second general conclusion which follows from the analysis of the "share ratios" based on retail trade data alone is that the growing consumption needs of the Central Asian republics and Kazakhstan, brought about by their rapid population growth, have increased at rates which have outpaced the growth of national income in these republics. The need to divert a larger share of used national income to consumption in order to keep existing gaps between republics in the standard of living from growing may also have contributed to the cutback in relative levels of capital formation in some republics.

In the following section of this paper, the patterns of interregional trade underlying the redistribution of national income are analyzed with interregional input-output models constructed for 11 republics.

IV. Interregional Input-Output Analysis of the Economies of Republics

In an interregional input-output model, matrixes of technical coefficients describing the input structuure of individual regions are linked together on the basis of information about interregional commodity flows. The result is a system of equations which defines the relationship between the final demand for goods in any region and the total output required for the production of those goods for final use in that region and all other regions.[29] Thus, the indirect as well as the direct effect on levels of output in all regions can be determined. This part of the paper presents the results of calculations made with interregional input-output models constructed from the 1966 input-output tables for 11 Soviet republics and the U.S.S.R. as a whole. In each model one of the two regions is a single union republic, and the other is the rest of the U.S.S.R.

A. Formulation of the Interregional Input-Output Models

Work on the construction of ex post regional input-output tables in the Soviet Union is probably the most advanced of its type in the world. During the last 20 years, more than 100 ex post input-output tables have been constructed for regions including each of the 15 union republics, 9 of the 10 large economic regions into which the R.S.F.S.R. is divided, and a large number of smaller administrative subdivisions such as oblasts and autonomous republics.[30] Although these tables are

[29] For a general discussion of regional input-output tables and interregional input-output models, see Richardson, Input-Output, 1972, pp. 7–30 and 53–84.

[30] See Gillula and Bond, "Development," 1977, for a summary of work on the construction and use of regional input-output tables in the U.S.S.R. through the early 1970's.

a potentially valuable source for analysis of the economies of Soviet republics, the publication of data from these tables in statistical handbooks is never complete. As with the publication of input-output tables for the U.S.S.R. as a whole, values of gross output, nonmaterial inputs, and deliveries for final uses are usually omitted entirely or given only as percentage shares. The input-output tables used in this study were reconstructed from published data on interindustry (first quadrant) flows in these tables and information given in a number of studies by Soviet economists based on the original tables.[31] The original republic tables were constructed on the basis of a common methodology and commodity classification developed by TsSU in Moscow for the construction of the national table. The basic elements of this methodology—e.g., valuation in purchasers' prices and the use of sectors defined on a "commodity" rather than an "establishment" basis—have been described in detail elsewhere and will not be discussed here.[32] Comparable 15-sector tables were used in constructing the interregional models.

The first step in the construction of each two-region model was the calculation of a "rest-of-the-U.S.S.R." input-output table by subtracting individual entries in the input-output table for a republic from the corresponding entry in the table for the U.S.S.R. The matrix of direct input coefficients for the "rest-of-the-U.S.S.R." was then calculated from this table in value terms. The treatment of the foreign (as opposed to domestic interregional) exports and imports raised a special problem for the calculation of trade coefficients. The value of shipments into and out of a republic in Soviet regional input-output tables includes both types of flows. While separate values of foreign exports and imports by branch were apparently included in most of these tables, it was impossible to estimate these components of total shipments into and out of the republic in the process of reconstructing all tables. Therefore, for all republics except the R.S.F.S.R. foreign exports and imports were treated as shipments to and from the "rest-of-the-U.S.S.R." For most republics this foreign component probably accounts for only a small share of the total value of external flows. In the reconstructed input-output table for the R.S.F.S.R. both the domestic and foreign components of shipments in and out of the republic were identified. Since the R.S.F.S.R. plays a dominant role in Soviet foreign trade, calculation of its trade coefficients was based on the value of domestic interregional flows rather than total shipments in and out. Throughout the rest of this study, the terms "export" and "import" will be used to refer to the external relations of republics as they are measured by the available data described above, i.e., domestic interregional shipments for the R.S.F.S.R. and total shipments for all other republics.

With each "single republic"/"rest-of-the-U.S.S.R." pair of input-output tables thus formed, an interregional input-output model of the

[31] The reconstruction of the tables for republics is described in Gillula, "Input-Output," 1977; Bond, Armenian, 1976; Gillula, Central Asian, 1976; Gillula, Kazakh, 1976; Gillula, R.S.F.S.R., 1976; and Bond, Latvian, 1975. The table for the U.S.S.R. was taken from Treml, Gallik, and Kostinsky, "1966," 1977, pp. 10–29.

[32] See Treml et al., The Structure, 1972, chapters 3–6, for a general description of this methodology and the papers cited in the previous footnote for some particular features of republic tables.

type originally developed by Chenery and Moses was constructed.[33] The Chenery-Moses model is based on the assumption that the total requirements for the output of each branch in each region are purchased according to a fixed regional supply pattern. This assumption is expressed by defining trade coefficients t_i^{rs} of the form:

$$t_i^{rs}=\frac{X_i^{rs}}{U_i^s}$$

$$0\leq t_i^{rs}\leq 1 \qquad (2)$$

$$\sum_{r=1}^{m} t_i^{rs}=1$$

$$i=1, \ldots, n$$

$$r, s=1, \ldots, m$$

where

Superscripts denote regions, subscripts denote branches of the economy:

X_i^{rs} is the value of interregional shipments of the output of the i^{th} branch from region r to region s; and

U_i^s is the total value of the output of the i^{th} branch required for all uses (the sum of intermediate and final uses plus shipments out) in region s.

The assumption of fixed import coefficients is integrated into a set of balance equations describing the distribution of the total output of the i^{th} branch of the economy in one region for all intermediate and final uses in all regions:

$$X_i^r=\sum_{s=1}^{m}\left[\left(\sum_{j=1}^{n} t_i^{rs}a_{ij}^s X_j^s\right)+t_i^{rs}Y_i^s\right] \qquad (3)$$

$$i, j=1, \ldots, n$$

$$r, s=1, \ldots, m$$

where

X_i^r is the total output of the i^{th} branch in region r (X_j^s is defined similarly);

Y_i^s is the total value of all final uses of the output of the i^{th} branch within region s;

a_{ij}^s is the value of the output of the i^{th} branch required for the production of a unit of the output of the j^{th} branch in region s.

Thus, in addition to the standard input-output assumption of fixed proportions in production and the assumption of fixed regional shares of imports stated above, this model includes an assumption that the total pool of imported goods of a given branch in any region is distributed among all branches and components of final demand propor-

[33] Moses, "The Stability," 1955 and Chenery, "Regional," 1953. A more detailed mathematical formulation of the model than that presented here is given in Moses, "The Stability," 1955, pp. 827–831.

tionately to the total purchases from that branch by each. Equivalently, imports are assumed to comprise an equal share of each purchase of the output of a given branch within a region.

The data needed to implement the Chenery-Moses model include n x n matrixes of direct input coefficients for each of m regions and a total of mn trade coefficients. The system of equations (3) may be expressed in matrix form as:

$$X = TAX + TY \tag{3a}$$

where

X and Y (without subscripts or superscripts) refer to mn x 1 vectors of total output and total final demand, respectively; and

A and T are mn x mn matrixes.

For purposes of computation, A was a block-diagonal matrix consisting of m (i.e., 2) n x n (15 x 15) submatrixes. T was composed of four diagonal matrixes, each of order n x n.

The primary application of an interregional input-output model is the calculation of the total output required in all branches of the economy in all regions for the production of a given vector of final demand. The matrix equation (3a) can be rewritten as:

$$X = (I - TA)^{-1}TY \tag{4}$$

Elements of the Y vector have been interpreted above as the total value of all components of final demand, but any actual or hypothetical vector of goods for final use may be substituted for Y in equation (4). For the two-region models implemented here, this system of equations is structured so that the vectors of total output and final demand can be partitioned in the following way:

$$\begin{bmatrix} X^r \\ \hline X^u \end{bmatrix} \cdot \begin{bmatrix} Y^r \\ \hline Y^u \end{bmatrix}$$

where

X^r and Y^r are 15 x 1 vectors of total output and final demand for a single republic, and

X^u and Y^u are the corresponding vectors for the "rest-of-the-U.S.S.R."

Since most of the republics for which interregional models were constructed are small in comparison to the counterpart "rest-of-the-U.S.S.R." regions, their direct and indirect contributions to the "rest-of-the-U.S.S.R." are small in relation to the values of total demand and production in that larger region. Therefore, the analysis in this study focuses only on the contribution of the "rest-of-the-U.S.S.R." regions to the economies of individual republics. This is accomplished by setting the vector Y^u in the partitioned Y vector above equal to zero. In analyzing the results of calculations made with this two-region model, the X vector is also partitioned in order to analyze the share of the "rest-of-the-U.S.S.R." in the total output required for the production of a given vector of final demand in a single republic.

B. The Role of Trade in the Economies of Republics

The overall importance of interregional shipments for the economies of the 11 republics included in this study is reflected by two ratios given in table 7: (1) Exports as a percentage of total output; and (2) imports as a percentage of total supply within the republic (gross output plus imports less exports). For republics of quite different size, there is an inverse relation between the share of interregional shipments in total production and consumption in a republic and the size of the republic. This is reflected in the relatively lower percentage ratios for the R.S.F.S.R., the Ukraine, and Kazakhstan in table 7 and must be kept in mind in interpreting the results of comparisons of republics made below. However, eight of the republics for which it was possible to construct an interregional input-output model are of approximately the same size, and the comparisons of these republics reflect primarily structural differences.

TABLE 7.—EXPORTS AS A PERCENTAGE OF TOTAL OUTPUT AND IMPORTS AS A PERCENTAGE OF TOTAL SUPPLY FOR 11 REPUBLICS, 1966

[In percent]

Republic	Export ratio	Import ratio
R.S.F.S.R.	6.1	5.0
Ukrainian S.S.R.	14.8	13.0
Moldavian S.S.R.	24.3	21.8
Latvian S.S.R.	28.1	26.3
Estonian S.S.R.	24.1	24.5
Georgian S.S.R.	23.1	25.1
Armenian S.S.R.	29.3	31.4
Azerbaydzhan S.S.R.	25.6	25.8
Kazakh S.S.R.	14.6	20.2
Kirgiz S.S.R.	23.6	29.5
Tadzhik S.S.R.	26.8	29.5

Source: Based on data from reconstructed input-output tables; see the sources cited in footnote 31.

The pattern of net interregional shipments by sector for each republic is illustrated in figure 2, which gives the signs of the export-import balances of all sectors involved in interregional trade. The frequency of net import balances for the set of less developed republics for which data are available reflects the extensive dependence of these republics on the rest of the U.S.S.R. for many basic manufactured goods. The major positive export-import balances for these republics are, with few exceptions, clustered in the extractive and consumer goods branches: "Textiles and apparel" in Tadzhikistan, "Food products" and "Agriculture" in Kirgizstan, "Metallurgy" and "Agriculture" in Kazakhstan, "Fuels" in Azerbaydzhan, and "Food products" in Georgia and Moldavia. Armenia and Azerbaydzhan are net exporters of "Chemicals," and Armenia also has a small positive balance for "Machine-building and metalworking" (MBMW), but a comparison of the individual import and export coefficients for these sectors in the two republics shows that both import large shares of the products of these sectors used within the republic.

FIGURE 2

SIGNS OF EXPORT-IMPORT BALANCES BY SECTOR FOR 11 REPUBLICS: 1966

[—Indicates a net import balance; + indicates a net export balance]

Sector	R.S.F.S.R.	Ukrainian S.S.R.	Moldavian S.S.R.	Latvian S.S.R.	Estonian S.S.R.	Georgian S.S.R.	Armenian S.S.R.	Azerbaydzhan S.S.R.	Kazakh S.S.R.	Kirgiz S.S.R.	Tadzhik S.S.R.
Metallurgy	—	+	—	—	—	+	—	—	+	—	—
Fuels	+	+	—	—	—	—	—	+	—	—	—
Power	—	+	+	—	+	—	—	+	—	+	—
MBMW	+	+	—	+	—	—	+	—	—	—	—
Chemicals	+	+	—	—	—	—	+	+	—	—	—
Wood and paper	+	—	—	+	+	—	—	—	—	—	—
Construction materials	+	—	—	+	+	—	—	—	—	—	—
Textiles and apparel	+	—	—	+	+	—	+	+	—	—	+
Food products	—	+	+	+	+	+	—	—	—	+	—
Industry n.e.c.	+	+	+	+	+	—	+	—	—	—	—
Agriculture	—	+	+	—	—	—	—	—	+	—	—
Other branches	+	—	—	—	+	—	—	—	—	+	+

[1] Source: Based on data from reconstructed input-output tables; see the sources cited in footnote 31.

Import and export ratios for each sector, analogous to those given in table 7 for the economy as a whole, are presented in tables 8 and 9. A comparison of each export coefficient with the corresponding import coefficient reveals a widespread pattern of proportionately large flows both into and out of each republic for several industrial sectors. For example, Georgia, Azerbaydzhan, Kirgizstan, and Tadzhikistan each export more than 70 percent of their output of "Metallurgy" while importing an equally large percentage of the products of this sector used within the republic. For Kirgizstan and Tadzhikistan, this is a result of the fact that they import most of their needs for ferrous metals and export most of their production of nonferrous metals. A similar pattern probably holds for Georgia and Azerbaydzhan, although these two republics produce both ferrous and nonferrous metals. At the 15-sector level of aggregation used in this study, there are large two-way flows of machinery and chemical products (and to a lesser extent food and light industrial products) for most small republics as well. For each of the small republics in tables 8 and 9 except Moldavia and Kirgizstan, both the import and export ratios for "Chemicals" are greater than 45 percent. Five republics also have export and import ratios for MBMW which are both greater than 45 percent.

TABLE 8.—SHARE OF IMPORTS IN THE TOTAL USE OF OUTPUT BY SECTOR FOR 11 REPUBLICS, 1966

[In percent]

Sector	R.S.F.S.R.	Ukrainian S.S.R.	Moldavian S.S.R.	Latvian S.S.R.	Estonian S.S.R.	Georgian S.S.R.	Armenian S.S.R.	Azerbaydzhan S.S.R.	Kazakh S.S.R.	Kirgiz S.S.R.	Tadzhik S.S.R.
Metallurgy	12.3	8.4	95.8	88.3	90.9	69.7	60.6	82.8	35.9	91.1	88.2
Fuels	7.5	20.3	91.1	80.0	37.3	37.5	86.3	7.7	49.0	77.0	81.7
Power	2.1	4.1	.2	56.0	5.1	3.2	13.7	1.7	6.8	4.3	7.4
MBMW	6.5	25.2	53.4	50.6	52.4	57.0	56.9	47.2	46.3	59.2	60.5
Chemicals	7.3	32.4	79.7	75.5	70.5	77.9	54.0	68.0	71.1	86.0	88.7
Wood and paper	3.0	42.9	49.7	22.7	19.4	47.0	44.9	59.2	44.7	60.4	60.2
Construction materials	4.5	15.9	29.7	12.6	10.5	19.3	23.3	22.1	11.4	33.3	19.3
Textiles and apparel	9.8	36.2	49.2	29.4	39.1	38.9	42.3	33.0	52.5	46.1	37.6
Food products	10.8	8.2	9.1	18.9	19.6	27.4	29.7	37.5	19.3	21.6	37.1
Industry n.e.c	5.0	27.4	29.3	18.2	19.4	19.9	7.0	28.2	28.4	65.5	32.2
Agriculture	2.9	1.7	3.2	10.6	7.4	8.9	11.2	9.1	1.2	7.6	10.3
Other branches	4.2	14.9	46.9	17.2	23.0	7.4	21.5	9.7	20.5	6.6	12.8

Source: Based on data from reconstructed input-output tables; see the sources cited in footnote 31.

TABLE 9.—SHARE OF EXPORTS IN GROSS OUTPUT BY SECTOR FOR 11 REPUBLICS, 1966

[In percent]

Sector	R.S.F.S.R.	Ukrainian S.S.R.	Moldavian S.S.R.	Latvian S.S.R.	Estonian S.S R.	Georgian S.S.R.	Armenian S.S.R.	Azerbaydzhan S.S.R.	Kazakh S.S R	Kirgiz S.S.R.	Tadzhik S.S.R.
Metallurgy	10.8	29.8	0	63.8	11.5	71.7	56.3	71.9	58.3	80.7	74.1
Fuels	11.0	21.7	0	64.7	16.7	16.3	0	52.6	25.5	57.7	23.2
Power	.8	5.1	26.9	35.6	44.6	2.0	2.0	13.5	4.6	10.6	2.0
MBMW	12.0	29.3	3.8	56.8	48.4	47.3	58.3	33.9	13.8	49.6	25.8
Chemicals	16.9	27.1	4.4	64.4	52.7	66.6	66.1	78.4	46.7	7.4	47.3
Wood and paper	12.0	6.3	2.3	28.8	28.6	8.3	.4	.6	2.0	.2	2.2
Construction materials	4.9	2.3	9.9	21.9	18.6	2.3	4.1	4.9	2.3	8.7	11.4
Textiles and apparel	9.9	10.6	28.1	37.9	41.8	35.6	53.1	40.8	39.6	41.4	64.1
Food products	2.8	22.6	47.2	30.1	27.5	36.4	18.7	21.0	12.0	27.9	25.2
Industry n.e.c	5.0	37.1	31.6	26.4	37.7	9.8	12.3	11.6	3.4	26.0	2.7
Agriculture	.8	4.9	7.3	3.1	3.3	6.6	5.4	6.9	12.4	16.3	1.9
Other branches	3.3	0	10.0	10.5	5.8	3.5	7.6	5.2	17.1	3.3	27.2

Source: Based on data from reconstructed imput-output tables; see the sources cited in footnote 31.

Using the interregional input-output model for each republic, it is possible to analyze another aspect of interregional trade flows—the total output required for the production of vectors of exports and imports for each republic. The ratio of total output requirements per ruble of exports for each republic provides a measure of the degree to which a republic's primary export sectors are integrated with the rest of the economy. A similar ratio can also be calculated for the bill of goods imported by each republic. The vector of total output requirements in each sector both within a republic and in the "rest-of-the-U.S.S.R." was calculated according to the equation:

$$X = (I - TA)^{-1}E \qquad (5)$$

where T and A are the (30 x 30) trade and direct input coefficient matrixes defined in the preceding section, and E is a (30 x 1) vector with the exports for a republic in rows 1 through 15 and zeros in rows 16 through 30 reflecting the fact that these exported goods are produced solely within the republic.[34] The vector of total output requirements for the production of imports was calculated similarly, with the exception that the republic's imports appear in rows 16 through 30 (since they are produced in the "rest-of-the-U.S.S.R."), and rows 1 through 15 of the import vector are zero.

The sum of all elements of the X vector in equation (5) was divided by the total value of exports for each republic to derive the ratios given in column 1 in table 10. The import ratios in column 2 were calculated analogously. A comparison of the two ratios for each republic shows that the export ratio exceeds the import ratio only for three of the more developed republics in this sample—the R.S.F.S.R., Latvia, and Estonia. These ratios reflect the fact that the major exports of most less developed republics are commodities at or near the primary stage of production, while the imports of these republics are the output of a several-stage production process. A summary measure formed from these two ratios—the export ratio as a percentage of the import ratio—was found to be highly correlated with the relative levels of development of republics. The Spearman rank correlation coefficient relating the percentage ratios in column 3 of this table to the 1966 per capita national income figures for the 11 republics was 0.673. Thus, these percentage ratios appear to capture differences among republics in the degree of economic integration, which is a primary characteristic distinguishing economies at different levels of development.

[34] The treatment of a republic's exports and imports in the interregional model differs from that of other components of final demand. Since exports (imports) are produced solely by the republic ("rest-of-the-U.S.S.R.") equation (5) differs from equation (4) in that vectors of exports and imports are not premultiplied by the trade matrix. No attempt was made to distinguish between "competitive" and "noncompetitive" imports in these calculations.

TABLE 10.—TOTAL OUTPUT REQUIRED FOR THE PRODUCTION OF 1 RUBLE OF THE EXPORTS AND IMPORTS OF 11 REPUBLICS, 1966

Republic	Exports (in rubles)	Imports (in rubles)	Col. 1 as a percentage of col. 2
	(1)	(2)	(3)
R.S.F.S.R.	2.275	2.231	102.0
Ukrainian S.S.R.	2.224	2.261	98.4
Moldavian S.S.R.	2.144	2.233	96.0
Latvian S.S.R.	2.273	2.207	103.0
Estonian S.S.R.	2.317	2.253	102.8
Georgian S.S.R.	2.229	2.239	99.6
Armenian S.S.R.	2.132	2.254	94.6
Azerbaydzhan S.S.R.	2.026	2.260	89.6
Kazakh S.S.R.	2.146	2.263	94.8
Kirgiz S.S.R.	2.084	2.236	93.2
Tadzhik S.S.R.	2.225	2.235	99.6

Source: Author's calculations, see text.

C. Interdependence of Individual Republics With the Rest of the U.S.S.R.

The interregional input-output model constructed for each republic was used to calculate the total output required for the production of the actual vectors of consumption and capital accumulation from the 1966 input-output tables according to equation (4). The resulting vectors of total output by sector in each region were partitioned as described above, and the sums of output in all sectors generated within the republic and in the "rest-of-the-U.S.S.R." were calculated in each case. To facilitate comparisons of republics, all output figures were converted to values of output required for the production of 1,000 rubles of each type of final demand in each republic. The results of these calculations for vectors of consumption and capital accumulation are presented in tables 11 and 12.

For most republics the "rest-of-the-U.S.S.R." shares of total output requirements are lower for vectors of capital accumulation than for consumption. This is in part a result of the fact that a large share of capital accumulation consists of output of the "Construction" sector. Because of the way the output of "Construction" is treated in Soviet input-output tables, there is no indirect output (i.e., output in the "rest-of-the-U.S.S.R.") generated for this sector.[35] The three exceptions (where the share of total output requirements outside the republic is lower for consumption) are republics with highly developed agriculture and food sectors—Moldavia, Latvia, and Estonia. These three republics are less dependent on the "rest-of-the-U.S.S.R." in supplying their needs for consumption than are any of the southern-belt republics.

[35] In Soviet (regional as well as national) input-output tables, all output of the "Construction" sector is recorded in the final-demand quadrant. All row entries for "Construction" in the first quadrant (interindustry flows) are by definition zero. Thus, the row for "Construction" in the inverse matrix also contains only zeros (except for the diagonal entry, which is one).

TABLE 11.—TOTAL OUTPUT REQUIRED FOR THE PRODUCTION OF 1,000 RUBLES OF CONSUMPTION IN 11 REPUBLICS, 1966

Republic	Republic and "rest-of-U.S.S.R." (rubles)	"Rest-of-U.S.S.R." only (rubles)	"Rest-of-U.S.S.R." share (percent)
R.S.F.S.R.	2,213	265	12.0
Ukrainian S.S.R.	2,122	506	23.9
Moldavian S.S.R.	2,037	693	34.0
Latvian S.S.R.	2,267	700	30.9
Estonian S.S.R.	2,310	743	32.2
Georgian S.S.R.	2,057	727	35.3
Armenian S.S.R.	2,162	876	40.5
Azerbaydzhan S.S.R.	2,093	812	38.8
Kazakh S.S.R.	2,187	757	34.6
Kirgiz S.S.R.	2,108	824	39.1
Tadzhik S.S.R.	2,128	904	42.5

Source: Author's calculations, see text.

TABLE 12.—TOTAL OUTPUT REQUIRED FOR THE PRODUCTION OF 1,000 RUBLES OF CAPITAL ACCUMULATION IN 11 REPUBLICS, 1966

Republic	Republic and "rest-of-U.S.S.R." (rubles)	"Rest-of-U.S.S.R." only (rubles)	"Rest-of-U.S.S.R." share (percent)
R.S.F.S.R.	2,077	156	7.5
Ukrainian S.S.R.	2,077	378	18.2
Moldavian S.S.R.	2,010	695	34.6
Latvian S.S.R.	2,119	756	35.7
Estonian S.S.R.	2,171	736	33.9
Georgian S.S.R.	2,068	632	30.6
Armenian S.S.R.	2,116	711	33.6
Azerbaydzhan S.S.R.	2,054	603	29.3
Kazakh S.S.R.	1,920	508	26.4
Kirgiz S.S.R.	2,018	760	37.7
Tadzhik S.S.R.	2,198	853	38.8

Source: Author's calculations, see text.

The values of total national output requirements per 1,000 rubles of consumption in the first column of table 11 are positively correlated with the values of per capita consumption for these 11 republics. The Spearman rank correlation coefficient is 0.645. This positive correlation reflects the fact that republics with higher levels of per capita consumption purchases relatively larger amounts of goods that are the end products of more complex production processes than food processing and textiles and apparel manufacturing. The correlation of these values of total output requirements by republic with per capita consumption of the products of the "Machine-building and metalworking" and "Chemicals" sectors (e.g., appliances, automobiles, plastic goods, etc.) was found to be even greater ($r_{sp}=0.782$).

A comparison of the percentage ratios in table 12 shows that the two republics which are most dependent on the "rest-of-the-U.S.S.R." in supplying their needs for capital accumulation are Tadzhikistan and Kirgizstan. For each of the Transcaucasus republics, however, the share of total output generated in the "rest-of-the-U.S.S.R." is lower than the corresponding ratios for the two developed republics of comparable size in this sample—Latvia and Estonia. This result is due largely to differences in the structure and composition of the vectors of capital accumulation in these republics in 1966 and to the way in which "Construction" output is recorded in Soviet input-output tables

as described above. For Latvia and Estonia, the output of "Construction" accounts for less than 40 percent of total capital accumulation, while for the Transcaucasus republics this share ranges from 58 to 64 percent. Thus, indirect output (both within and outside the republic) is generated on a larger proportion of the value of capital accumulation in the two Baltic republics. For Latvia this low share of "Construction" output in total capital accumulation is explained by the fact that machine-building accounted for a much larger share of fixed capital accumulation in 1966 than in any other republic. In Estonia the share of "Construction" was low in 1966 because fixed capital accumulation accounted for a much lower share of total capital accumulation than in other republics, and the share of additions to working capital was greater.

As a final exercise with the interregional input-output model for each republic, the total output required to produce an identical vector of final demand in all republics was calculated. Of primary interest for this study is the interdependence of republics in the process of fixed capital formation. However, the vectors of capital accumulation for each republic in 1966 used in the calculations described above include additions to working capital as well, and significant differences among republics in the branch structure of these additions to working capital have a substantial effect on the results obtained. Therefore, a hypothetical vector of fixed capital accumulation was constructed for use in the interregional model of each republic. A vector consisting of 700 rubles of the output of "Construction" and 300 rubles of the output of "Machine-building and metalworking" was selected, corresponding to the approximate shares of each of these sectors in the input-output table for the U.S.S.R. as a whole in 1966. Alternative vectors, varying the value of each sector by ± 100 rubles, were also tested, but the results of these calculations did not alter the conclusions reached on the basis of the initial vector selected.

The components of total output generated by this identical vector of fixed capital accumulation in each republic are given in table 13. These calculations show a somewhat different ranking of republics by shares of total output required from the "rest-of-the-U.S.S.R." than did the calculations based on vectors of total capital accumulation in each republic (compare table 13 with table 12). For this identical vector of fixed capital accumulation, Latvia and Estonia require lower shares of total output from the "rest-of-the-U.S.S.R." than any less developed republic of comparable size. Even for these two more developed republics, however, approximately 30 percent of total output requirements are generated outside the republic, and the results for other small republics must be evaluated in relation to the degree of interdependence observed for these Baltic republics. Among the less developed republics for which these calculations were made, the degree of dependence on the "rest-of-the-U.S.S.R." varies considerably. For each of the three Transcaucasus republics the share of total output generated outside the republic is approximately 34 percent—only slightly above the corresponding ratios for the Baltic republics. For Moldavia and for each of the two Central Asian republics, however, this ratio exceeds 40 percent.

TABLE 13.—TOTAL OUTPUT REQUIRED TO SUPPLY AN IDENTICAL VECTOR OF 1,000 RUBLES OF FIXED CAPITAL ACCUMULATION IN 11 REPUBLICS, 1966

Republic	Republic and "rest-of-U.S.S.R." (rubles)	"Rest-of-U.S.S.R." only (rubles)	"Rest-of-U.S.S.R." share (percent)
R.S.F.S.R.	2,131	169	7.9
Ukrainian S.S.R.	2,141	419	19.6
Moldavian S.S.R.	2,279	935	41.0
Latvian S.S.R.	2,117	636	30.0
Estonian S.S.R.	2,172	677	31.2
Georgian S.S.R.	2,076	706	34.0
Armenian S.S.R.	2,115	722	34.1
Azerbaydzhan S.S.R.	2,138	721	33.7
Kazakh S.S.R.	2,089	642	30.7
Kirgiz S.S.R.	2,136	875	41.0
Tadzhik S.S.R.	2,226	936	42.0

Source: Author's calculations, see text.

D. Structural Differences and Regional Interdependence

The patterns of regional economic interdependence that have been identified here are the result of structural differences in the economies of republics. Since these results are based on interregional models for only a single year, an important factor to be considered in discussing their implications is the extent of structural change in the economies of republics over time. A study of industrial location policy in the U.S.S.R. by Wagener provides a useful background against which to evaluate the results of these model calculations.[36] Wagener analyzed differences in the branch structure of industry among republics and changes in structure during the 1960's using location quotients based on capital stock and employment data for 8 to 10 individual sectors.[37] He focused on the separate roles of the seemingly contradictory principles of specialization and "complex development" in Soviet location theory. While regional specialization in certain sectors is expected to arise from different natural and social conditions of production—primarily natural resource endowments—"complex development" (the convergence of economic structures) is seen as the result of economic development. Wagener concluded that: (1) "historical developments have resulted in a large amount of specialization"; (2) "yet, in the course of general industrialization of the whole country, the trend has been toward more complex development"; (3) in particular, the regional distribution of the energy and construction materials sectors has become increasingly more balanced; however (4) "there is a higher tendency toward complexity in the more than in the less developed areas." [38]

The balanced regional distribution of the energy and construction materials sectors reflects an attempt to establish a basis for industrialization in all republics. However, while isolated trends toward more balanced development were identified by Wagener, specialization in the light and food industries and, in some cases, in extractive sectors was still the dominant feature of most of the less developed

[36] Wagener, "Rules of," 1973.
[37] The location quotient based on capital stock (K) for sector i in region (republic) r is defined as: $LQ_r^i = (K_r^i/K_r)/(K_u^i/K_u)$ where the subscript u indicates the U.S.S.R. as a whole and the absence of a superscript indicates an industry total. Employment or some other variable may be substituted for capital stock in this expression.
[38] Wagener, "Rules of," 1973.

republics in 1970. In the important machine-building sector, location quotients for several less developed republics increased from very low levels during the 1960's, but this sector remained significantly underrepresented at the end of the decade in all southern-belt republics except Armenia and Kirgizstan.[39]

The major characteristics of interrepublic trade identified above with the input-output models for republics reflect these structural differences. There was an identifiable relation between the levels of development of republics and the degree to which their major exporting and importing sectors are integrated with the rest of the economy. This was due in part to the fact that the major exports of less developed republics were commodities at or near the primary stage of production, while the imports of these republics were the output of a several-stage production process. Furthermore, at the 15-sector level of aggregation used here, there was a high incidence of proportionately large interregional flows both into and out of many republics, especially in chemicals, extractive sectors, and machine-building. Thus, the trend toward a somewhat more equal regional distribution of some producers' goods sectors such as chemicals and machine-building, which is apparent in comparing location quotients at the beginning and end of the 1960's, may not have resulted in a greater degree of integration of the economies of republics.

As noted above, the first interregional input-output model implemented for any country was developed for the purpose of analyzing the effects of regional economic interdependence on possible strategies for reducing regional disparities in levels of development. Chenery's model for the Italian economy revealed that a policy of increasing the level of investment in the less developed southern half of the country would indirectly generate nearly as much output and income in the more developed north as the total generated in the south because of the heavy reliance of the south on the north for both intermediate and finished goods. Although in the context of the non-market Soviet economy, a direct causal relation cannot be established between such patterns of dependence for less developed republics and the failure of government policy to reduce the development gap between republics, the results of calculations made here with vectors of fixed capital accumulation in the models for republics strongly resemble those of Chenery's model. For all less developed republics, a larger share of the total output required to supply an identical vector of fixed capital accumulation was generated outside the republic than was the case for either of the two more developed republics of comparable size for which models were constructed.

While most of the less developed republics have apparently benefited from the interrepublic redistribution of national income, it would be inaccurate to conclude that this policy was motivated solely (or even primarily) by egalitarian concerns. A number of Western specialists have pointed to the exploitation of natural resources as a primary explanation for the above-average levels of investment in some less developed republics.[40] This is reflected especially in the high

[39] A repetition of Wagener's study of location quotients using data for 1974—the most recent year for which complete labor and capital data for branches of industry by republic could be assembled—suggested no significant changes in the conclusions which he drew.

[40] See, for example, Woroniak, "Regional," 1973, p. 295.

ratios of per capita capital formation in Kazakhstan and Turkmenistan during the period considered here.[41] From the data on interrepublic trade, it is clear that a large share of the output of extractive sectors in southern-belt republics is shipped out of these republics. The role of the southern-belt republics as suppliers of important commodities to the rest of the country also extends to agricultural products such as grain from Kazakhstan and cotton from Central Asia. Furthermore, as the trade coefficients calculated for these republics show, even where certain other producer goods sectors have been developed, a large share of their output is exported. Thus, the role of natural resource exploitation in the development of these republics that has been noted by other Western specialists may be seen as part of a broader pattern of specialization and production for export.

The concern of Soviet economists in less developed republics about the effects of such patterns of specialization on the development of their economies is reflected in a recent monograph on regional development published in Kazakhstan.[42] Change in the composition of manufacturing industry is seen as a decisive factor in the process of evening out the levels of industrialization of regions. The author of this study argues that in spite of the shortage of skilled labor in less developed regions, an attempt must be made to locate higher technology industry in these regions:[43]

> The opinion predominates that it is expedient to locate this branch [machine-building], and especially precision machine-building, only in regions which have trained skilled workers. If this point of view is adhered to in distributing productive forces, then the process of industrial development of less developed regions may stretch out for an indefinitely long time because of the absence or weak development of machine-building, since this is the basis of contemporary scientific-technical progress.

Although all southern-belt republics have been grouped together in much of the analysis in this paper, the results obtained for the Transcaucasus republics differ in important respects from those for the Central Asian republics and Kazakhstan. It was found in part III that the redistribution of national income to the Transcaucasus republics has been steadily reduced since about 1970 to the point where their balances of produced and used national income are near zero, while the redistribution to the Central Asian republics and Kazakhstan has continued. At the same time, the rates of economic growth of the Transcaucasus republics have been among the highest in the U.S.S.R in recent years, while the economic performance of the Central Asian republics and Kazakhstan has in general been less than satisfactory.[44] One factor which must be considered in explaining these contrasting results is the lower degree of dependence of the Transcaucasus republics on the "rest-of-the-U.S.S.R." in satisfying their needs for capital accumulation as shown by the calculations with interregional input-output models here.

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[41] During the period 1960 to 1974, 65 percent of all capital formation in industry in Turkmenistan was allocated to the oil extraction and gas sectors, Arazkuliyev, Effektivnost', 1976, p. 14.
[42] Zakumbayev, Ekonomicheskoye, 1977.
[43] Ibid., pp. 181 and 183.
[44] See, for example, Sheehy, "Overall," 1979.

Finally, the policy of subsidizing the economic development of the Central Asian republics and Kazakhstan has not succeeded in reducing the overall development gap for these republics, and the results presented here suggest that Soviet leaders have not pursued development strategies which would put these regions on a path of self-sustaining growth. This may be attributed in part to their desire to develop the raw material resources in these regions as rapidly as possible (i.e., by processing them in already existing facilities in other regions) and in part to an underlying policy of keeping these republics economically dependent on the rest of the U.S.S.R. In any case, the question of raising the levels of development of these republics will take on a new dimension in the next two decades since a disproportionate share of net additions to the country's labor force will occur in these republics, while the ability to subsidize their economic development may be constrained by a slowing of national economic growth.

Appendix A

Estimates of Industrial Output for Economic Regions and Republics

Most recent studies of the levels of industrial development of regions in the U.S.S.R. have been based on values of industrial output derived by applying published growth rates to base year values for 1960 estimated by Cook.[45] This appendix describes the estimation of values of industrial output for economic regions as well as republics for a later base year, 1970, values that reflect the substantial changes in the relative prices of industrial products introduced by the 1967 price reform.

Values of industrial output for union republics in 1970 were derived from a source reporting both the percentage shares of total output by republic and coefficients of output per worker for each republic relative to the U.S.S.R.[46] Values of industrial output in 1972 for the large economic regions into which the U.S.S.R. is divided were derived from a second source which reported output/capital ratios for these regions.[47] Estimates of output by economic region for 1970, calculated using growth rates published in statistical handbooks for the 1970–1972 period, were quite consistent with the 1970 values derived for republics. Although the price base used is not reported in either of these sources, both sets of data are apparently in constant prices of July 1, 1967.[48]

By applying published growth rates to these estimates for 1970, values of industrial output were also calculated for all regions and republics in 1960 and 1975 and for republics only in 1978.[49] (Growth rates of industrial output for the large economic regions—and oblast-level regions—within the R.S.F.S.R. and the Ukraine have not been published in the statistical handbooks of these republics since 1975.) Indexes of these values in per capita terms relative to the corresponding value for the U.S.S.R. in each year are given in table A–1.[50] The coefficients of variation reported at the bottom of table A–1 are population weighted.

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[45] Cook, "The Administration," 1962, pp. 704–733.

[46] Divilov, Chislennost', 1976, p. 77. The estimation of these values is described further in Gillula, Regional, 1978, pp. 146–148 and 153.

[47] Zakumbayev, Ekonomicheskoye, 1977, p. 83. It was first necessary to estimate the values of industrial capital stock by economic region using other data given by Zakumbayev. These calculations are described in Gillula, "The Regional," 1979.

[48] Values of industrial output in 1970 in current prices published for three republics do not agree with the data given in Divilov. Valuation in constant 1967 prices is the only conceivable alternative. See Gillula, Regional, 1978, pp. 146–148, for a further discussion of this.

[49] 1960—Nar. khoz. 72, p. 168. 1975—regions of the R.S.F.S.R. from Nar. khoz. RSFSR 75, pp. 49–50; regions of the Ukrainian S.S.R. from Nar. hosp. Uk. RSR, p. 83; other republics from Nar. khoz. 75, p. 203. 1978—growth rates to 1977 from Nar. khoz. 77, pp. 127–128, and 1978 as a percentage of 1977 from Pravda, Jan. 20, 1979 p,. 1.

[50] Population figures for 1960, 1970, and 1975 used in these calculations are from Baldwin, Population (forthcoming). Population for 1978 was taken from Nar. khoz. 77, p. 10.

TABLE A–1.—INDEXES OF PER CAPITA INDUSTRIAL OUTPUT FOR ECONOMIC REGIONS AND UNION REPUBLICS, 1960–78

[U.S.S.R.=100]

Regions and republics	1960	1970	1975	1978
U.S.S.R.	100	100	100	100
R.S.F.S.R.	116	117	118	118
Northwest region	146	131	124	(1)
Central region	162	144	142	(1)
Volga-Vyatka region	90	105	113	(1)
Central-Black Earth region	68	84	93	(1)
Volga region	96	110	118	(1)
Northern Caucasus region	88	85	80	(1)
Urals region	135	142	143	(1)
Western Siberia region	95	104	112	(1)
Eastern Siberia region	90	105	110	(1)
Far East region	107	108	99	(1)
Ukrainian S.S.R.	92	97	97	98
Don-Dnepr region	137	132	128	(1)
Southwest region	53	65	70	(1)
South region	85	89	84	(1)
Moldavian S.S.R.	53	64	67	68
Belorussian S.S.R.	64	86	99	108
Baltic region	103	122	120	(1)
Latvian S.S.R.	125	141	134	131
Lithuanian S.S.R.	79	107	111	113
Estonian S.S.R.	124	135	133	130
Transcaucasus region	73	64	63	(1)
Georgian S.S.R.	67	65	64	67
Armenian S.S.R.	76	78	74	78
Azerbaydzhan S.S.R.	76	56	57	60
Kazakh S.S.R.	66	65	62	60
Central Asia region	58	46	43	(1)
Uzbek S.S.R.	61	45	43	41
Kirgiz S.S.R.	44	50	50	49
Tadzhik S.S.R.	50	41	36	34
Turkmen S.S.R.	65	49	47	42
Coefficient of variation for 15 republics	0.216	0.243	0.256	0.262
Coefficient of variation for 26 regions	0.367	0.322	0.321	(1)

[1] Not available.

Source: Author's estimates; see text.

Appendix B

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PROSPECTS FOR OUTMIGRATION FROM CENTRAL ASIA AND KAZAKHSTAN IN THE NEXT DECADE

(By Murray Feshbach*)

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TABLES

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*Foreign Demographic Analysis Division, U.S. Bureau of the Census. This paper is a revised and expanded version of an unpublished paper prepared in February 1977. I am indebted to numerous scholars to whom reference is made in the text. However, the opinions and judgments rendered here are solely my own responsibility.

I. Introduction

The Soviet Union will experience an unprecedented decline during the 1980's in the size of increments to the population of able-bodied ages, which constitutes most of the labor force. The period of schooling required for the younger cohorts is longer than that for previous cohorts, which means a shorter worklife as long as the pension age remains the same. The proportion of the population in the pension ages will rise from 15 percent at the present time to 19 percent by the end of the century. At the same time, the source of new labor is shifting to the southern tier of republics. The reluctance of the Central Asians to move out of their native region poses a major problem for the U.S.S.R. Without this movement there will be serious labor shortages in the industrialized areas of the country and the rate of economic growth may slow down.

Most specialists on Central Asian affairs believe that there will be no large-scale movement of workers from Central Asia and Kazakhstan to labor-deficit areas in European Russia or in Siberia before the end of the 1980's.[1] On the basis of an examination of the literature, a discussion of the issues at a conference held in January 1977 at the Kennan Institute for Advanced Russian Studies, a further discussion also held in the same month at the Foreign Demographic Analysis Division, and numerous conversations with analysts in this country and in Europe, I believe that there will not be a massive movement out of the region during the next decade.

The region of Central Asia and Kazakhstan is very extensive. Kazakhstan alone is larger than most of Western Europe. The population of the region is less than one-sixth of the total for the U.S.S.R. but

[1] The notable exception is the position advocated by the group associated with Prof. Robert Lewis of Columbia University. Their position was first fully detailed in Lewis, Rowland, and Clem, "Nationality," 1976, especially pp. 354–381. More recently Lewis and Rowland assert their belief that the factors as they interpret them "should result in considerable out-migration in the next few decades" (see Lewis and Rowland, "East," 1977, p. 26). Early counter arguments to this thesis are presented in Besemeres, "Population," 1975, pp. 50–58, and Hodnett, "Technology," 1974, pp. 60–117, especially pp. 104–107. A more recent analysis is that by Azrael, "Emergent," 1978, pp. 363–390, especially p. 369, where Azrael concludes that the chances of a spontaneous outmigration by Central Asians "are virtually nil."

will almost double between 1970 and 2000 and its share of the total population will increase to one-fifth (see appendix table 1). Adding the three republics of the Transcaucasus brings the combined total to about 27 percent of the national figure at the end of the century. Most of this population is of Muslim origin. At the time of the 1970 census there were approximately 35 million persons of Muslim origin in the U.S.S.R.[2] The variety of peoples and language groups comprising this population according to Alexandre Bennigsen's model is given in appendix table 2. Bennigsen has estimated that there were about 40 million Muslims in the U.S.S.R. in 1975.[3] The U.S.S.R. has the fifth largest Muslim population of any country in the world exceeded only by Indonesia, Pakistan, Bangladesh, and India.

The essential proposition of those who believe that there will be significant outmigration from Central Asia in the near future is that the surplus of agricultural labor force caused in part by mechanization and significant urban/rural wage differentials will make the Muslims of Central Asia move to where the jobs are located. They expect the Central Asians to act as have many other peoples in like circumstances.[4] To them cultural impediments are "a kind of residual" that will make little difference "when the economic crunch comes." [5] They note that there has already been "a dramatic rise in educational attainment in both urban and rural areas of Central Asia," a condition which "facilitate(s) the modernization of a group and erode(s) the traditional way of life." [6]

Other authorities do not reject the idea of long-run cultural change, but they doubt that it will occur in time to solve the labor problems of the 1980's. It seems doubtful whether even in the long distant future voluntary outmigration of Central Asians would ever occur on a massive scale. There may be some movement but it will be limited by economic, demographic, and cultural considerations.

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[2] In only 11 years between the censuses of 1959 and 1970, the Muslim population increased by over 40 percent. If the present rate of increase of 3.2 percent per year were to be maintained for another 30 years, the population would grow from 35 million in 1970 (see appendix table 2) to 89.9 million by the year 2000, an increase of 2.57 times. The average annual rate of growth of the Muslim population would have to drop below 2.4 percent per year to keep the population from more than doubling in size during this period. This large a drop does not seem likely. A figure of 90 million in the year 2000 would constitute 29 percent of the total population of the U.S.S.R. by the end of the century, or almost 1 of every 3 Soviet citizens, according to the latest projections of the Foreign Demographic Analysis Division.

[3] Bennigsen, "Islam," 1975, p. 91. Muslims in the five Central Asian republics represent less than two-thirds of their total number in the country, i.e., 20.7 of 35.1 million persons, or 59 percent. (Data for the five republics are given in TsSU, Itogi 1970, vol. IV, 1973, pp. 222, 223, 284, 295, and 306. In 1959, the corresponding figures were 13.8 and 24.7 million, or 56 percent in these five republics—derived from table 53 of the 1959 census volumes of the respective republics.) Although there are certain reasons for not including it, Kazakhstan is included with the four core republics of Central Asia because its native population is growing at a much faster rate than the migrants from the R.S.F.S.R. and the Ukraine, because there is currently very little inmigration, as compared to the period before the mid-1960's, indeed even some outmigration, and because the Muslims, still largely in rural areas, behave demographically quite similarly to their brethren in the other republics of the region. Some 9.3 million, or 64 percent of the 14.4 million outside the Central Asian and Kazakhstan republics reside in the R.S.F.S.R. (ibid., pp. 43–44). Almost all of the remainder are in Azerbaydzhan. The Muslim nationalities in the R.S.F.S.R. comprised 7 percent of the republic's total population in 1970, an increase of 1 percentage point since the 1959 census. If one were to use 25 percent as the approximate future growth of the R.S.F.S.R. Muslims (instead of the more precise 27.8 percent derived from the 11-year span between the two censuses), this group will almost double by the end of the century, from 9.3 million to 18.1 million in 2000. The latter figure represents over 12 percent of the projected population of the R.S.F.S.R. in that year. The R.S.F.S.R. Muslim group will have a younger average age than the remainder of the population in the republic and therefore a disproportionate share of the labor force and military conscriptees.

[4] Lewis et al., Nationality, 1976.

[5] Ibid., p. 377.

[6] Ibid., p. 360.

The Soviet authorities are fully aware of the potential impact on the Soviet economy of the prospective changes in the regional distribution of population and labor force. For example, in the February 1979 issue of *Planovoye khozyaystvo*, V. Kirichenko, the Director of the Scientific Research Economics Institute of Gosplan U.S.S.R., discussed the drop in new increments to the labor force, the likelihood that additions from among the pension-age population will be small, and the fact that the southern tier of the country, i.e., Central Asia, the Transcaucasus, Moldavia, and Kazakhstan (in part), will be the major source of new labor. Moreover, he does not expect significant migration from Central Asia, hence the branches of the national economy and of industry will need "a more rational * * * structure" to accommodate to the changes in the relative availability of labor and capital. Lastly, he believes that Siberia and the Far East will not be able to draw upon surplus labor from Central Asia but must obtain it "from regions west of the Urals * * *."[7]

This paper summarizes the literature and the substance of the discussions with consultants and specialists relating to economic, demographic, cultural, and governmental factor affecting migration from Central Asia and Kazakhstan. Various statistical tables are appended.

II. Economic Considerations

A major issue in the debate over the prospects for large-scale migration out of Central Asia in the 1980's is whether or not economic factors will induce people to move. The relevant factors are interregional differences in level of living, labor supply problems, capital investment in Central Asia, and the expansion of economic opportunities.

A. Level of Living and Wage Differentials

Significant interregional differences in level of living and money wages may serve as an incentive for migration. In this section, the available data are examined in terms of the relative and absolute differences between the republics of the Central Asian region and other areas of the country.

Gertrude Schroeder's article in the fall 1974 issue of *ACES Bulletin*[8] demonstrates that the average earned income per collective farm family in 1970 was higher in the Central Asian republics and Kazakhstan than in the U.S.S.R. as a whole or in the R.S.F.S.R., the Ukraine, or Belorussia, the areas which might otherwise be most attractive to Central Asian migrants. The indices range from 104 for Kirgiziya to 178 for Turkmenia, with the U.S.S.R. equal to 100.

The results of a survey conducted in 1968 by the Scientific Research Institute of Labor on the cost of a market basket of goods for a family of four persons (taking taxes into account) indicated that it cost less to live in Central Asia than in the Central Oblasts, i.e., the oblasts around Moscow. In Kazakhstan the cost of such a basket was 97.7 percent and in the other Central Asian republics 90.3 percent of the cost in the central region.[9]

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[7] Kirichenko, "Intensification," 1979, pp. 43–45.
[8] Pp. 3–19.
[9] Ekonomicheskiye nauki, 1972, p. 52.

Another comparison made by the Institute of Labor indicated that expenditures for food in the eastern regions of the country (i.e., Siberia and the Far East) were 26 percent higher than in the southern regions (presumably Central Asia and the Transcaucasus). Expenditures for clothing and footwear were 47 percent higher and for housing and heating 88 percent higher.[10] According to statistics published by the Central Statistical Administration, for the rural population, which includes most of the indigenous population of Central Asia, the volume of personal services provided by the state has increased markedly in the 1970's. In the four republics of Central Asia, 43.1 percent of all expenditures for personal services in 1974 was spent in rural localities, whereas for the country as a whole only 26.7 percent was spent in rural areas.[11] Both figures have increased from the 1970 proportions of 37.3 and 23.3 percent, respectively. Given the relatively higher share of expenditures in Central Asia compared to other rural areas of the country, there is less incentive to move to these other locations if one assumes a similar level of services offered.

A comparison of money wages between collective farmers and workers and employees in Kirgiziya shows a differential of about 25 percent in favor of the workers and employees, which so far has been insufficient to draw significant amounts of labor from the rural areas into the cities of the republic in spite of urban labor shortages.[12] In three Central Asian republics, the average wage increase of collective farmers from 1976 to 1977 was greater than that of workers and employees. In Tadzhikistan the increases were 2.0 and 0.1 percent, respectively, in Kirgiziya 3.0 and 1.0 percent, and in Uzbekistan 8.3 and 2.1 percent.[13] The average wages of collective farmers throughout the U.S.S.R. increased by 4.3 percent during the same period while the average wages of workers and employees increased by only 2.7 percent.[14] However, the average wages of workers and employees in all republics except Turkmenistan were lower than that of the R.S.F.S.R. (Kirgiziya—1,644 rubles/year; Tadzhikistan—1,644; Turkmenistan—1,968; Uzbekistan—1,716; Kazakhstan—1,848; and the R.S.F.S.R.—1,955).[15] Whether the monetary differential is sufficient to attract them to the R.S.F.S.R. where the labor deficit is greatest is moot inasmuch as the difference does not exceed 25.9 rubles per month in the worst cases (Kirgiziya and Tadzhikistan as compared to the R.S.F.S.R.). Thus, it appears that differences in levels of living will not cause large-scale migration from the region.

B. Labor Demand and Supply

Despite its high rate of population growth, Central Asia has been experiencing a labor shortage. It exists in the cities as well as in some rural areas of the region. In June 1975, a *Pravda* correspondent, O. Latifi, reported that the "problem of cadre shortages is characteristic of all Central Asia. This is the consequence of high rates of indus-

[10] Ivanova, "On the Development," 1973, p. 44.
[11] Vestnik statistiki, 1975, p. 88.
[12] LalIyev, Proizvoditel'nost', 1973, p. 49.
[13] Pravda vostoka, Feb. 1, 1978, p. 1; Sovetskaya Kirgiziya, Feb. 1, 1978, p. 1; and Kommunist Tadzhikistana, Jan. 31, 1978, p. 1.
[14] Nar. khoz. 77, p. 385.
[15] Kazakhstanskaya pravda, Feb. 4, 1978, p. 2; Pravda vostoka, Feb. 1, 1978, p. 2; Sovetskaya Kirgiziya, Feb. 1, 1978, p. 2; Kommunist Tadzhikistana, Jan. 31, 1978, p. 2; Turkmenskaya iskra, Jan. 31, 1978, p. 2; and Nar. khoz. 77, p. 385.

trialization."[16] There are numerous reports of a continuing shortage of skilled workers in the cities of Central Asia. N. P. Fedorenko, Director of the Central Mathematical Economics Institute, observes that migrants from rural areas in the R.S.F.S.R. and the Ukraine go to the Far East to work on a contract basis, acquire a skill, and then either return to cities in the western republics or in Central Asia and the Transcaucasus. Those who go to Central Asia work in industry and construction. In spite of adequate labor resources in the region, there is an acute shortage (*ostrvy defitsit*) of skilled workers in Central Asian industrial enterprises.[17]

The evidence suggests that labor shortages are found in all of the Central Asian republics. In 1970 a report from Kazakhstan indicated that labor shortages on state and collective farms in the five northern oblasts had increased from 38,000 in 1966 to 85,000 in 1970.[18] A conference on labor force utilization held in Alma-Ata in 1974 found that recruitment of labor was becoming more difficult.[19] In 1975, the Chairman of the Kazakh State Committee on Labor Resources Utilization told a national conference that the agricultural sector in Kazakhstan was experiencing a "significant shortage" (*znachitel'nyy defitsit*) of labor.[20] In view of the apparent net outmigration from the republic in recent years (see table 2), the farm labor shortage has probably continued in the years since 1976.

In Kirgizia a labor shortage coexists with a labor surplus according to a January 1978 article by M. Yendovitskiy, Chairman of the Kirgiz State Committee on Labor.[21] In another article, S. Begaliyev, Chairman of the Kirgiz Gosplan, wrote about the need to improve vocational orientation and training because of the "inadequate (*nedostatka*) number of skilled wageworkers." Begaliyev proposed that branch machine-building factories be established in small cities and workers' settlements, and that light, food, local and construction materials enterprises be set up in various small towns on the assumption that "improvement in the location of productive forces throughout the republic's territory will make it possible to draw significant labor resources into social production.[22]

A similar situation exists in Tadzhikistan. In November 1978. Dr. D. Kh. Kharimov, head of the Scientific Research Institute of Economics and Mathematical Economics Planning, said that "significant reserves of labor resources" of Tadzhikistan's rural areas "are not employed, or are inadequately employed in social production."[23] Kh. Saidmuradov, Chairman of the Council for the Study of Productive Forces of the Tadzhik Academy of Sciences addressed the issue more directly. "A paradoxial situation arises: on one hand there is an acute shortfall (*ostraya nekhvata*) in labor resources; on the other hand, an undoubted surplus.[24] After an analysis of the low proportion of rural migrants, of the differences in living conditions for large rural fam-

[16] Latifi, "When," 1975, p. 2.
[17] Federenko, Vosproizvodstvo, 1976, p. 137.
[18] See Narodnoye khozyaystvo Kazakhstana, 1973, p. 77. These oblasts are more Russian than Kazakh and this factor may limit the movement of other Central Asians to this part of Kazakhstan.
[19] Kazakhstanskaya pravda, June 21, 1974, p. 3, cited in ACSEES, 1974, p. 59.
[20] Cited from Altynov and Dunin, "Resources," 1976, p. 157.
[21] Yendovitskiy, "The Training," 1978, pp. 24 and 27.
[22] Begaliyev, "Socio-economic," 1977, pp. 9–10.
[23] Kommunist Tadzhikistana, Nov. 26, 1978, p. 3.
[24] Saidmuradov, "Potential," 1978, p. 2.

ilies when they move to cities, and of the need to expand labor-intensive industry, Saidmuradov indicates that the central ministries have ignored his appeal to establish subsidiary plants (*filialy*) in the republic. Only one Leningrad plant has agreed to form such a subsidiary.[25] In his speech at a conference, he also emphasized the linkage between growth in labor supply and job opportunities.[26] Additional jobs have been created by the development of a new, large-scale South Tadzhik Territorial Production Complex (*territorial'no-proizvodstvennyy kompleks*). This project was expect in part to provide jobs for the excess rural labor supply created by increasing agricultural mechanization, but because few Tadzhik rural workers would move to the site of the project and because few had needed skills, workers from outside Tadzhikistan, and even from labor-deficit regions, were invited to work in Tadzhikistan. As the *Pravda* commentators wrote, the importing of outside labor:

> * * * is taking place in Tadzhikistan, which has the fastest population growth rate in the country and which does not utilize its [own] labor resources. Is it correct to draw people from BAM [Baykal-Amur Mainline Railroad] and from Nakhodka [to the Nurek project] and what is worse, to Tadzhikistan's overpopulated valley.[27]

Obviously not much change can be expected in the lack of migration from rural areas if we accept the statement of the Chairman of the Tadzhik Gosplan, K. Makhkamov, that even by 1981 the urban population will constitute less than 40 percent of the republic's population. Inasmuch as the preliminary census results show that the urban share was 35 percent at the beginning of 1979, the local authorities cannot count on much migration of workers to urban industrial sites.[28]

The same anomaly is found in Turkmenistan. In 1976, M. G. Gapurov, the First Secretary of the Turkmen Communist Party, indicated that "in rural areas, owing to the swift growth of the population and the rising level of agricultural mechanization, the available labor force is larger than is needed." [29] However, since the Eighth Five-Year Plan period (1966–1970), construction workers from Bulgaria have been involved in numerous Turkmen construction projects.[30]

In Uzbekistan there are problems in employing new increments to the rural labor force. M. Daniyar-Khodzhayev, Deputy Chairman of the Uzbek State Committee for Labor Resources Utilization wrote that:

> Finding work for young people in the countryside is an especially complicated problem. Special conditions apply here. The fact is that the percentage of rural inhabitants in Uzbekistan is higher than in other republics, which can be attributed among other things to the high birth rate and the slow rate of migration from rural areas, both of which make the problem of creating jobs for young people more difficult.

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[25] Ibid.
[26] "Rationally," 1978, p. 2.
[27] Beketov and Latifi, "Tactics," 1976, p. 2.
[28] Trud, April 22, 1979, p. 3; Nar. khoz. 77, pp. 10–11; and Makhkamov, "The Industry," 1977, p. 2.
[29] Turkmenkaya iskra, March 12, 1976, p. 2, cited in RFE/RL, Current Abstracts, 1977, p. 25.
[30] BBC, Survey, Dec. 3, 1976, from Ashkhabad, 0238 GMT, Oct. 13, 1976, and Mitrin, "Labor," 1975, p.13.

> * * * Very often career advice given in rural schools is aimed exclusively at propagandizing professions involving agriculture. When whole classes of graduates remain behind on their native kolkhoz or sovkhoz, they contribute to a lowering of the general rate of employment for workers. * * * [31]

On the other hand, a number of sources indicate a widespread and very large labor shortage in Uzbekistan. A leading Uzbek commentator on population and human resources, R. A. Ubaydullayeva, said that at the beginning of 1978 the "vast territories of new development regions [were] experiencing an acute shortage in labor resources." [32] Two years earlier she reported that the shortage of skilled labor in Uzbekistan was 528,600 persons, of which industry accounted for 134,800 and construction 153,400.[33] This shortage is equal to one-quarter of the total number of workers and employees actually employed in the state sector of the republic in 1975.[34] The shortage applies not only to the urban workforce but to collective and state farm workers as well. For example, in 1975 there was a shortage (*ne khvatayet*) for more than 40,000 machinery operators in the collective and state farms of the republic.[35] In addition, although there have been efforts to mechanize the cotton growing and picking processes, many thousands of urban workers, employees, students, and even military personnel are sent to the fields every year to help bring in the harvest. The average annual number of persons brought to the farms from enterprises, organizations and institutions, increased by over one-third in Uzbekistan between 1970 and 1975.[36]

Thus, despite high rates of population growth leading to sizeable increments to the supply of labor, and undoubtedly to underemployment as well, there is an unsatisfied demand for labor. It is unlikely that there will be a massive movement out of Central Asia for economic reasons as long as labor shortages persist in the region itself.

C. Capital Investment

Capital investment in the past served to expand job opportunities in the region, but it is unclear whether this will continue since the rate of new fixed capital investment in the Central Asian republics seems to be slackening. In 1961–1965 the average annual rate of growth in investment in the five republics ranged from 8.1 percent to 12.7 percent compared with 6.3 percent for the country as a whole (see appendix table 4). But in 1966–1970 only three of the republics had a rate higher than the national average and in 1971–1975 only two had rates that equalled or exceeded the national average. The levels of investment by republic for the current 5-year plan period (1976–1980) were not specified in the initial publication of basic indicators of the plan, but the annual capital investment plans for the country as a whole show a much lower rate of growth than that planned for national income and industrial production.[37] Even though it is diffi-

[31] Pravda vostoka, Aug. 7, 1976, p. 3, abstracted in RFE/RL, "Reports," Radio Library Research Bulletin, RL 424/76, 1976.
[32] Ubaydullayeva, "Labor," 1978, p. 8.
[33] Ubaydullayeva, "The Twenty-Fifth," 1976, p. 14.
[34] That is, 528,600 shortage divided by 2,273,000 workers and employees, equal 23.3 percent. The republic employment figure is from Nar. khoz. 75, p. 439.
[35] Zakirov, "Skill," 1975, pp. 92–97.
[36] Nar. khoz. Uzbekskoy SSR v 1975, 1976, p. 223.
[37] Izvestiya, Oct. 30, 1976, p. 1.

cult to determine the precise level of investment contemplated for the Central Asian republics, it is not likely to be larger than in the past, because the level of investment in the R.S.F.S.R. is higher than in other republics in the first two years of the plan.[38] The disproportionately high allocations to the R.S.F.S.R. reflects the huge investments in the BAM railroad construction, Tyumen' oil, the Ekibastuz and Kansk-Achinsk coal basins, and the Non-Black Earth Region agricultural development. Future energy and food supply considerations apparently take precedence in investment decisions regardless of labor constraints.

Soviet data show that per capita income in the Central Asian republics and Kazakhstan fell farther behind the national average between 1960 and 1975, and per capita industrial production lost ground relatively in four of the five republics (see appendix table 6). The data seem to support the observation made by Richard Pipes more than 10 years ago in *Problems of Communism* that economic development in the U.S.S.R. has increased the economic differentials between republics of the country.[39]

However, Soviet authorities have for some time been talking about increased investment in industry in Central Asia. A directive was issued on December 27, 1976, raising wages in Central Asia and Siberia. The wage increases in Central Asia appear to be consistent with the expectation that there will be no major exodus to Siberia; otherwise the raise should have been limited to Siberia. Individuals and organizations representing components of Gosplan U.S.S.R. imply that bringing new industry to Central Asia is the solution to the problem of the "irrational" distribution of the labor supply. In 1971, V. G. Kostakov, head of the Labor Resources Sector of the Scientific Research Economics Institute of Gosplan U.S.S.R., called for the establishment in Central Asia of labor-intensive industries, such as general machine-building, chemical, radio-technology, electronics, and the light and food industries, in view of the reluctance of Central Asian labor to migrate. He proposed that such production activities be brought close to the labor force by locating them "directly in rural localities next to collective and state farms." [40] In 1976 Kostakov again pointed out the need to place labor-intensive industry "in the union republics and economic regions with a positive balance of labor" in order to solve the problems of labor shortages expected in the late 1970's and 1980's.[41] He suggested that the cotton textile industry should be in Uzbekistan—where the production of raw cotton is concentrated—instead of the central regions where it now is.[42]

Two writers who appear to be staff members of the Council on the Study of Productive Forces of Gosplan also stress the need to locate

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[38] See the paper prepared by James Gillula in this compendium, entitled "The Economic Interdependence of Soviet Republics."

[39] Pipes, "The Forces," 1964, pp. 1–6.

[40] Serlya ekonomicheskaya, 1971, pp. 89–90.

[41] Kostakov, Trudovyye, 1976, p. 56. Teresa Rakowska-Harmstone says that several years ago a member of the Long Range Planning Department of Gosplan U.S.S.R. whose last name is Vorob"yev, in a speech at Carleton University, Ottawa, Canada, indicated that, contrary to Kostakov's view, Gosplan U.S.S.R.'s policy is to reallocate the labor rather than the investment. Prof. Rakowska-Harmstone also says that Alec Nove, speaking at Columbia University, endorsed a position similar to that held by Kostakov. On the basis of his evaluation of present and possible future trends in the region's economy and culture, Nove concluded that the Central Asian workers will not voluntarily move out of the region. Prof. Rakowska-Harmstone feels that they might move to the cities of the five republics but that they would rather starve or be killed than be moved from the region.

[42] Ibid.

industry in the Central Asian region.[43] One of the writers, M. B. Mazanova, predicts that in the future the available labor resources in each of the five republics will be employed internally because of low mobility within and between republics. The only "outside" area to which she expects a significant part of this labor to migrate is Kazakhstan. Although the "extensive" development of the economy requires large amounts of outside capital investment, she urges the development of light industry in the small and medium-sized cities of Central Asia to attract and hold workers from the nearby villages.

An editorial on the need to improve labor utilization in the November 1976 issue of Gosplan's journal, *Planovoye khozyaystvo*, contends that it is necessary to improve the use of labor because "never has the problem been so acute as today," [44] and that in the 1980's, "practically all the growth" will occur in Central Asia and the Transcaucasus, whereas labor resources in the R.S.F.S.R. and the Ukraine will show a net decrease. The editorial concludes that under these circumstances "the policy for location of industry must be structured so as to take account of the available labor resources in each region and especially to bring them into production." [45]

In August 1977, Gosplan issued a *prikaz* (order) to its component units that investment plans for different regions for the 1980's should reflect the availability of labor resources.[46] The investment allocations for the European R.S.F.S.R., the Ukraine, Belorussia (except for its western oblasts), and the Baltic republics are to be primarily for reconstruction and reequipping of enterprises now in operation, whereas in Central Asia and Azerbaydzhan, where labor is said to be abundant, new construction is permitted. The *prikaz* stipulates further that consideration must be given to using local raw materials and raising the labor force participation rate of the indigenous population. This provision strongly implies that the Soviet central authorities do not expect many workers to move from the south to other parts of the Soviet Union during the next decade.

D. Irrigation [47]

The augmentation of arable land through irrigation is one means of increasing the demand for labor within the region. Irrigation is therefore an area of crucial concern to the local republic authorities and to the central government.

Robert Lewis and his associates examined Soviet plans for expansion of irrigated land in the Central Asian region and concluded that the expansion will not be enough to accommodate all the surplus labor expected to be available on the farms. Therefore, they argued that there will be a push outwards from within the farm sector.[48] Ann Sheehy

[43] Afanas'yevskiy, Legkaya, 1976, pp. 36 and 216, and Mazanova, Territorial'nyye, 1974, especially, pp. 185–192 and 197–198.
[44] Planovoye khozyaystvo, 1976, pp. 19–22.
[45] Ibid., p. 22.
[46] "In Gosplan," 1977, pp. 150–157.
[47] An analysis of the developments and controversies relating to irrigation is contained in an unpublished paper by Dr. Philip P. Micklin entitled: "Irrigation Development in the U.S.S.R. During the Tenth Five Year Plan (1976–1980)." 41 pp. The political aspect of the debate over the diversion of the Siberian rivers is fully analyzed in Thane Gustafson's paper on "Institutional and Regional Forces in Soviet Politics: The Debate Over Re-routing Major Rivers to the South," 34 pp., a paper prepared for the 1977 Annual Meeting of the American Political Science Association.
[48] Lewis et al., Nationality, 1976, pp. 356–357.

agrees that even the demand for labor as a result of the planned growth of labor-intensive horticulture and viticulture will be insufficient to absorb the available labor which will therefore have to find work outside agriculture. She also feels that the lack of water is a major constraint on the economic development of the region.[49]

However, a significant expansion of irrigated land in Kazakhstan and Central Asia is planned during the current 15-year plan period. The full extent of this expansion is not known. Kazakhstan and Uzbekistan alone account for about 22 percent of the land to be brought under irrigation in the Tenth Five-Year Plan (FYP) period.[50] According to Philip Micklin, the most important irrigation projects of the 10th FYP are the extension of the Kara-Kum canal in Turkmenia, the Karshi Steppe irrigation system along the upper Amu-Darya river and the expansion of the Golodnaya (Hungry) Steppe and Fergana Valley projects on the upper Syr-Darya in Uzbekistan.[51]

The flow of water from the Irtysh is stored in the reservoirs of the Bakhtar and Ust-Kamenogorsk hydroelectric power stations, from which it is channelled to Karaganda and elsewhere and is therefore not likely to provide much additional irrigation for Kazakhstan. Some 250,000 hectares of new land is to be irrigated in Kazakhstan during the current 5-year plan period.[52] An additional 750,000 hectares is to be irrigated in Uzbekistan, Tadzhikistan, and Turkmenia,[53] providing agricultural employment for about 160,000 persons.[54] Soviet plans for drawing trillions of gallons of water from the Ob', Irtysh, and Yenisey rivers for irrigation in Central Asia and Kazakhstan reflect the importance attached to providing water for that region.[55] A directive issued in December 1978 calls for the technical-engineering specifications of the construction work to begin in 1980 on a diversion of water from the Ob' and Irtysh rivers of Siberia to Central Asia and Kazakhstan.[56] These projects may not meet all of the water needs of the region, but they will greatly increase the supply required for the expansion of agriculture and industry in the next decades, and therefore will lead to a retention of labor in the region.

An article in *Pravda Vostoka* in 1973 discussing irrigated lands in Uzbekistan, said that these lands would be insufficient to absorb the extra 5 million people that must be "drawn into production" in order to maintain the present labor force participation rate of 44 to 45 percent.[57] Instead, the article indicated, new industry must be developed in the rural areas of the republic to absorb the surplus labor, which is not expected to move to the cities. However, even with the further mechanization of cotton operations, the demand for agricultural labor in the region will continue because the cotton growing area is increasing, and the Kara-Kum canal will add significantly to the supply of

[49] Personal communication to the author.
[50] Ivanov and Pchelkin, Stroitel'naya, 1976, p. 41.
[51] Micklin, "Irrigation," pp. 12–13.
[52] BBC, Survey, Sept. 3, 1976, p. A–8, from Moscow Radio I, 1530 GMT, Aug. 15, 1976. The Director of the Institute of Soil Sciences of the Kazakh Academy of Sciences, V. Borovskiy, estimated that 116.8 million hectares of land could be reclaimed in Kazakhstan. Only 1.7 million had been irrigated by the beginning of 1977, however. Kazakhstan's own rivers can irrigate up to 4.5 million hectares. He added, "as for the rest, we have to count on the Siberian rivers" (Borovskiy, "Siberia," 1977, p. 1). One hectare equals 2.471 acres.
[53] BBC, Survey, Mar. 17, 1978, from Moscow Radio II, 0200 GMT, Mar. 8, 1978, p. A–8.
[54] Based on a statement by Ubaydullayeva that 462,000 hectares would require about 100,000 workers (Ubaydullayeva, "Labor," 1978, p. 8).
[55] L'vovich, "Reflections," 1978, p. 96.
[56] "On the Conduct," 1979, p. 91.
[57] Pravda vostoka, Dec. 8, 1973, p. 2.

arable land when completed.[58] Besides, pastoral nomadism, rather than ranching, is acknowledged by the Soviets as the most suitable way to raise sheep and livestock in the region. Since this is a much more labor-intensive approach than ranching, it is less likely to create a labor surplus.[59]

In 1977, a number of articles appeared in the Tadzhik, Kirgiz and Uzbek press regarding the possible development of agro-industrial complexes in these republics. The press discussion was prompted by the CPSU Central Committee decree "On Further Development of Specialization and Concentration of Agricultural Production on the Basis of Interfarm Cooperation and Agro-Industrial Integration." [60] While this program calls for production specialization and increases in labor productivity, it is also intended "to utilize the labor force more evenly in the different seasons of the year; to train skilled personnel, and to solve social and other problems more efficiently." [61] The reduction in seasonality of employment would contribute to a retention of workers in the area rather than increasing the likelihood of their outmigration.

From the viewpoint of industrial development, the discovery of gas deposits in the Shurtan area of Uzbekistan has been labeled as "enormously" significant by the Uzbek authorities.[62] The exploitation of the new deposit is to be initiated by 1980. If this plan is realized, the new industry may provide new jobs to replace those lost as other Central Asian gas fields peak and decline.[63]

Thus, of the four economic factors discussed above, three—the higher living standards of Central Asia, the increased capital investments in the region, and the expansion of its irrigated lands—would strengthen rather than weaken the ties of the Central Asian peoples to their native areas. The matter of labor supply and demand is more complex but the evidence suggests that there are significant labor shortages which offset the surplusses in the region.

III. Demographic Considerations

A. Migration

The demographic evidence that the major nationality groups in Central Asia and Kazakhstan are reluctant to migrate outside the region is overwhelming. According to the 1970 census, of the major nationalities in the Central Asian region, only the Kazakhs represented as much as 0.1 percent of the population in any republic outside the region (see appendix table 9). There were some 477,800 Kazakhs in the R.S.F.S.R., or 0.4 percent of the population, in 1970.[64] Of these, 69.4 percent lived in five oblasts contiguous to Kazakhstan (the Astrakhanskaya, Omskaya, Orenburgskaya, Saratovskaya, and Volgogradskaya oblasts), and 82.2 percent of these persons resided in rural

[58] "Machines," 1978, p. 2, and Salimov and Manyakov, "On the Method," 1977, p. 13.
[59] See the very interesting article by Dienes, "Pasturalism," 1975, pp. 343–365, especially pp. 364–365. According to Dienes, 40 to 80 percent of the marketed share of animal products in all of Central Asia and Kazakhstan derives from sheepherding. Given the low proportion of prepared fodder, sheepherding is "critically dependent on natural pastures." (Ibid., pp. 358–359.)
[60] Lapkin and Usmanov, "Along the Path," 1977, pp. 35–42; Sovetskaya Kirgiziya, July 7, 1977; and Kommunist Tadzhikistana, Apr. 6, 1977, pp. 2–3.
[61] Lapkin and Usmanov, "Along the Path," 1977, p. 6.
[62] Pravda vostoka, Dec. 29, 1977, cited in RFE/RL, Current Abstracts, 1978, p. 12.
[63] See, CIA, U.S.S.R., 1978, pp. 35–38.
[64] TsSU, Itogi 1970, vol. IV, 1973, p. 12.

areas.[65] From the location of the five oblasts it appears that the Kazakh settlement in the R.S.F.S.R. is merely an extension of traditional Kazakh pastoral activities in pasture lands across an administrative boundary.

According to one source, in the 2 years preceding the January 1970 census of population, only the Kazakhs moved outside the region in significant numbers. Of the Turkmen who changed their place of residence, 96.4 percent stayed in their own republic, as did 76.4 percent of the Uzbek migrants. The data are as follows:[66]

Nationality	Total number of migrants in 1968 and 1969	Percent moving within the republic	Percent moving to other republics	
Kazakhs	236,500	82.9	R.S.F.S.R.	10.4
			Uzbekistan	6.0
			Turkmenistan	.7
Kirgiz	95,400	95.4	Uzbekistan	2.4
			Turkmenistan	2.2
Tadzhiks	43,900	89.8	Uzbekistan	10.2
Turkmen	21,200	96.4	do	3.6
Uzbeks	127,500	76.0	Tadzhikistan	14.8
			Kirgizistan	3.9
			Turkmenistan	3.3
			Kazakhstan	2.0

An article in the January 1975 issue of *Kommunist Uzbekistana* projects an increase in the population of Uzbekistan from 12 million in 1970 to 22 million in 1990.[67] Gosplan U.S.S.R. and TsSU U.S.S.R. have projected an increase of more than 50 percent in the republic's population between 1975 and 1990,[68] which implies a total of more than 20,500,000 in 1990 based on the reported figure of 13,689,000 for 1975. The projected figure for 1990 according to the medium series by Godfrey Baldwin of the Foreign Demographic Analysis Division is 20,919,000, assuming no net migration,[69] hence the presumption is that Gosplan and TsSU also are assuming relatively little outmigration. An Uzbek academician projects a total population for Central Asia without Kazakhstan of 36 million in 1990 and 48 million in the year 2000.[70] The first figure is close to the total projected by the Foreign Demographic Analysis Division (see appendix table 1), but the second is some 4 million above the corresponding Foreign Demographic Analysis Division figure indicating that the Uzbek analyst also does not project significant outmigration. According to a source published in Uzbekistan, the proportion of Uzbeks in the population of the republic is expected to grow from 65.5 percent in 1970 to 72 percent in 1990 and to about 75 percent in the year 2000, an expectation that apparently does not assume any large-scale outmigration of Uzbeks.[71] A similar growth pattern is foreseen for Tadzhikistan. The population of that republic is projected by Perevedentsev, as well as by Radio Moscow, to grow from over 3 million to 7 million by the year 2000.[72]

[65] Ibid., pp. 61–151.
[66] Korovayeva, "Population," 1976, p. 259.
[67] Lapkin and Bedrintsev, "Long-Term," 1975, p. 26.
[68] Akhmedov, Ekonomika, 1977, p. 216.
[69] Baldwin, Population, 1979 (forthcoming).
[70] Ziyadullayev, "On the Question," 1979, pp. 13–14.
[71] Voprosy ekonomiki otrasley narodnogo khozyaystva Uzbekistana, 1973, abstracted in Referativnyy zhurnal, 1974, p. 33.
[72] V. Perevedentsev in Literaturnaya gazeta, Sept. 22, 1976, p. 10, and Radio Moscow, 1100 GMT, Jan. 4, 1976.

The higher wages available in labor-deficit areas do not seem to attract large numbers of Central Asians out of their native regions. Data for 1959 cited by Perevedentsev show that only 1 percent of the migrants from Central Asia to Novosibirsk were Central Asians, whereas 86 percent were Russians. Of those who had left Kazakhstan for Novosibirsk, 2 percent were Kazakhs and 78 percent were Russians.[73] There have been reports recently that "hundreds" of persons have moved from Uzbekistan to state farms in the Novgorod region, but the numbers are small and may not include many Uzbeks.[74] Scattered reports of Central Asians working in other parts of the country include the report of 1,000 persons from Tadzhikistan (presumably Tadzhiks) working on BAM, on construction projects located in west Siberia, in the Non-Black Earth Zone, and on olympic game facilities.[75] In addition, there is a report that Kazakhs work at the Vorkuta coal mines of the Komi A.S.S.R., Yakutiya, Buryatiya, Magadan, Kamchatka, the gold mines of Aldan in the Far East, the Volga Automotive Plant, and the Far North.[76] The full extent of these movements cannot be assessed until the complete 1979 census results are available.

Educational training is another means by which the central authorities will attempt to encourage Central Asians to move to other areas. In what appears to be the paper which he delivered at the all-union conference held in the spring of 1978, L. Kostin, the First Deputy Chairman of the State Committee for Labor and Social Problems, called for the assignment of Central Asian youths to other republics as part of their practical vocational training.[77] Whether many will remain in the places where they are sent is uncertain.

A strong case against the likelihood of large-scale migration out of the region during the 1980's is made by John Armstrong, who argues his case from a non-cultural as well as a cultural basis.[78] He contends that there is a "total lack of evidence" attesting to any specific governmental policy to move Muslims from Central Asia to European cities. Armstrong maintains that the Soviets would be averse to creating a large and economically depressed Muslim minority in the European cities, and he cites a 1965 Soviet book which, he says, "sharply rejects the possibility of a large-scale transfer." [79]

Armstrong recently pointed out that the lack of Central Asian settlements outside the region means that there are no established ethnic settlements there to act as poles of attraction. Usually, he asserts, it takes about a decade to build up a channel for information and to establish ethnic settlements. Since the nuclear settlements have not already been established, there is no basis for a massive movement before 1990.

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[73] Perevedentsev, Metody, 1975, p. 125. The entire thrust of an article by Zayonchkovskaya ("The Interrelationship," 1976, pp. 185–204) is that, although it is irrational, the population is migrating from north to south within the country and major changes in patterns of migration and nonmigration are not expected.

[74] See Chernyayev, "The Rise," 1979, p. 4; Troyanovskiy, "Renewal," 1978, p. 2; and Ikramov, "How to Be," 1977, p. 2.

[75] BBC, Survey, Oct. 27, 1978, p. A5, from Moscow Radio II, 0001 GMT, Oct. 7, 1978.

[76] Shatayev, Migratsiya, 1977, p. 71.

[77] Kostin, "Management," 1970, p. 19.

[78] Based on Armstrong, "The Ethnic," 1968, pp. 3–49, and personal communication to the author.

[79] Based on Egyazaryan, Obosnovnykh, 1965, cited in Armstrong, "The Ethnic," 1968, p. 49, footnote 46.

Not only are the Central Asians reluctant to move to cities in other parts of the country, but they do not seem to move readily into the cities of their own region, as Manevich, of the Institute of Economics of the U.S.S.R. Academy of Sciences, has observed.[80] Their reluctance to move is apparent from the labor shortages in Central Asian cities [81] and also from data on rural to urban movements within each republic. The proportion of rural migrants in the increments to the urban population in Turkmenistan dropped from 68.6 percent in 1960, to 52.7 percent in 1965, and then down sharply to 27.0 percent in 1970. In Tadzhikistan, the number of rural-to-urban migrants was reportedly never more than 5,000 in any year between 1960 and 1972. In 1970, rural migrants represented only 16.9 percent of the new arrivals in the cities in Uzbekistan, 25.2 in Kazakhstan, 28.5 in the Ukraine, and 41.6 in Belorussia.[82] Commuting could supply a part of urban labor needs in lieu of permanent migration, but the data from the last two censuses show that commuting to the cities in Central Asia was less than half the rate for the country as a whole. In 1959, 31 per 1,000 rural inhabitants in the U.S.S.R. commuted to the cities, and in 1970 the figure was 39 per 1,000. However, the unweighted averages for Central Asia and Kazakhstan are 14.8 and 18.0, respectively. Data on the changes between the 1959 and 1970 censuses in the proportion of workers in Central Asia who are members of Central Asian nationalities also show that movement to the cities was not on a large scale. Although the number of wageworkers employed in all branches of the national economy in the five republics doubled over the intercensal period, the proportion of these wageworkers drawn from the local nationality groups increased only slightly, from 28 to 34 percent (see table 1). These figures undoubtedly also include some state farm wageworkers, but most wageworkers work in the cities hence the data reflect primarily trends in urban employment.

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[80] "The indigenous peoples of the Transcaucasian republics move to the cities of their own republics but very rarely to other regions of the country, and the Central Asian indigenous peoples resettle unwillingly even in the cities of their own republics" (Manevich, "Population," 1978, p. 39).

[81] In February 1970, a Tadzhik language newspaper article cited a directive of the Central Committee of the Communist Party of the Soviet Union that "* * * the industrial sector of the republic is suffering acute labor shortages. * * * not enough attention has been paid to the development of cadres of workers from the local population, and it has created a situation where there are very few Tadzhik workers in industries such as the chemical, machine tool, and metallurgical industries" (Kommunisti tojikiston, February 1970, pp. 9–13).

[82] Akademiya nauk SSSR, and Akademiya nauk U.S.S.R., Metodologicheskiy, 1973, pp. 231, 293–294, and 303.

TABLE 1.—THE NUMBER OF STATE SECTOR WAGEWORKERS, TOTAL AND TITULAR NATIONALITY, BY REPUBLIC, 1959 AND 1970

[In thousands, except percent]

Republic	1959			1970		
	Total number of wage-workers	Of which, titular nationality	Percent	Total number of wage-workers	Of which, titular nationality	Percent
Total	4,119	1,158	28.1	6,608	2,243	33.9
Kazakhstan	2,125	412	19.4	3,410	823	24.1
Kirgiziya	328	71	21.6	551	172	31.2
Tadzhikistan	231	75	32.5	397	176	44.3
Turkmenistan	217	74	34.1	435	144	33.1
Uzbekistan	1,218	526	43.2	1,815	928	51.1

Source: Stepyanyan, Rabochiy, 1975, p. 405. Percentage figures for Kazakhstan and Uzbekistan and total figures were derived from data in this source. It is not clear why the republic figures from this source on the number and nationality of wageworkers are lower than the published census results. For example, the table shows that the total number of wage-workers in Uzbekistan in 1970 was 1,815,000. This figure is less than the total urban and rural census figure of 1,938,959 (TsSU, Itogi 1970, vol. V, 1973, p. 28). The same pattern is displayed by the figures for three of the other four republics (i.e., except Turkmenistan).

Movement of workers from other regions, including labor deficit regions, to Central Asia (not including the movement to Kazakhstan)[83] is decried by the planners but it takes place nonetheless. For example, for every 100 persons who left Central Asia for West Siberia during the period 1959 to 1972, 159 persons moved from West Siberia to Central Asia. Origin and destination patterns between Central Asia and the East Siberian and the Far Eastern regions show a similar imbalance.[84] However, N. Nekrasov, Head of the Council for the Study of Productive Forces of Gosplan U.S.S.R., stresses the need to use local "nationality cadres" in the industry of Central Asia and Kazakhstan, in part because "in the future there will be a sharp reduction in the migration of workers from the R.S.F.S.R., the Ukraine, and Belorussia to the Central Asian and Transcaucasian republics."[85] In fact, some slight outmigration from the Central Asian republics and Kazakhstan has manifested itself in recent years, although it is not possible to fully determine to which republics or economic regions these persons have moved. Movement to and from Kirgiziya, Tadzhikistan, and Turkmenistan is quite small. Kazakhstan and Uzbekistan show a larger volume perhaps reflecting the larger size of their populations. However, the outmigration from Kazakhstan has become significant and seems to be oriented toward the R.S.F.S.R. which for the first time in about 25 years displays a positive migration balance (see table 2), very likely associated with the priority construction and development projects referred to earlier. It is doubtful whether the migrants from Central Asia are composed mostly of local nationality workers; more likely they are of Russian and other non-Central Asian groups.[86] However, massive outmigration might weaken the Russian domination of the capital cities where control is exercised and native elites had been expected to become Sovietized and assimilated. If too

[83] The movement to Kazakhstan is a result of the growth in the nonferrous metallurgical industry and the space program, and the Virgin Lands program in the past.

[84] Topilin, Territorial'noye, 1975, p. 56. This source is used extensively in the paper by Rywkin, "Central," 1979, pp. 1–13.

[85] Nekrasov, Regional'naya, 1978, p. 268. As long ago as 1975, the head of territorial planning for Kazakhstan wrote that "in future years" there will be "a significant decrease in inmigration from other union republics" (Isentayev, "Industrial," 1975, p. 91).

[86] Rywkin, "Central," 1979, p. 9.

many Russians move out this could jeopardize the central government's policy.[87]

TABLE 2.—NET MIGRATION IN THE R.S.F.S.R., KAZAKHSTAN, AND THE CENTRAL ASIAN REPUBLICS, 1950–77

[In thousands, figures may not add to totals due to rounding]

Year	R.S.F.S.R.	Kazakhstan	Central Asia	Of which—			
				Kirgiziya	Tadzhikistan	Turkmenistan	Uzbekistan
1950	−208	48	113	6	11	−6	101
1951	−124	70	−24	−37	29	−17	0
1952	318	−75	58	−13	5	2	65
1953	−3	−14	−11	−16	0	−9	15
1954	172	150	−3	2	7	2	−14
1955	−202	358	−37	−14	7	−10	−20
1956	−138	54	9	−13	9	−5	18
1957	−248	44	31	−23	11	7	36
1958	−168	137	35	12	2	7	14
1959	−285	186	51	9	16	−1	25
1960	−176	175	71	16	16	2	38
1961	−119	180	109	18	28	3	60
1962	−92	171	89	7	26	3	53
1963	−69	−28	89	24	15	2	49
1964	−90	58	58	10	15	1	31
1965	−152	26	63	19	11	−3	36
1966	−147	33	27	17	1	−7	58
1967	−164	30	87	17	6	6	16
1968	−93	−16	82	15	7	−2	62
1969	−84	−19	61	7	11	10	33
1970	−124	−5	22	2	4	2	13
1971	−88	4	40	−4	14	7	23
1972	−72	−8	32	−1	1	5	27
1973	−56	2	44	1	3	5	35
1974	−30	−5	42	3	6	9	25
1975	116	−73	13	−4	0	7	11
1976	154	−85	−13	−4	0	−2	−7
1977	176	−71	−35	−9	−1	1	−26

Source: 1950–75: Baldwin, Population, 1979 (forthcoming). 1976–77: Unpublished estimates and projections prepared by the Foreign Demographic Analysis Division, U.S. Bureau of the Census, April 1979.

Recognition at the national planning level of the low mobility of Central Asians undoubtedly underlies the comment in a December 1978 editorial in Gosplan's journal that:

> A different approach is needed toward location of production facilities in the Central Asian republics, Azerbaydzhan and Armenia * * * as well as in the south of Kazakhstan * * *. It is appropriate to take fully into account the low mobility of the population.[88]

Consequently, according to an article in *Kommunist*, the Tenth Five-Year Plan "stipulated the location of labor-intensive production in republics and regions with a favorable balance of labor resources." [89] Following the issuance of the Draft and the Basic Directions of the Tenth Five-Year Plan, the Uzbek Communist Party Central Committee and Council of Ministers issued its own directives ordering the construction of machine-building, light, food, mixed livestock feed, and small-scale local industry plants of various economic branches in several dozen small and medium-sized cities and urban settlements.[90]

It would seem unlikely, therefore, that a large outflow of the indigenous population from Central Asia and Kazakhstan can take

[87] See Bennigsen and Wimbush, "Migration," 1978, pp. 173–187.
[88] "Effectiveness," 1978, p. 5.
[89] Pavlenko, "The Contemporary," 1978, p. 18. Also see, Shokin, "Several," 1976, pp. 56 and 58, who states that in the future labor intensive industry must be located in Central Asia (p. 58). Shokin is a specialist on location of industry and a sector chief at the Institute of Economics of the Academy of Sciences U.S.S.R.
[90] Shister, "Certain," 1977, pp. 28–34, and Anisimkin, "The Construction," 1977, p. 1.

place in the next decade. The unlikelihood of heavy migration to the other regions of the U.S.S.R. is underscored when one looks at other push-pull policies and their effects on migration. The many efforts of the Soviet authorities over a long period of time to attract Central Asian workers to Siberia and the Far East have been eminently unsuccessful. In the sunbelt region, the standard of living, as we have seen, is not distinctly worse (if it is worse at all) than that in labor deficit areas. In addition, the differential supply of consumer goods in the deficit area remains less than any significant amount of additional income would be able to purchase. There is no parallel to the transfer of hard currency as done by migrants from Turkey, Yugoslavia, etc., to build houses or acquire goods.

B. Family Formation and Fertility

Another one of the arguments sometimes advanced in support of the prediction that Central Asians will begin to migrate is that a change is taking place in the attitudes of Central Asians in regard to family formation. The evidence for the change is the fact that the proportion of females aged 16 to 19 who are married has declined sharply in Central Asia.[91] For the five major Central Asian Muslim nationalities, the percentage married in this age group in 1970 was one-third to one-half the 1959 figure.[92] The decline in marriages, according to proponents of this line of reasoning, signifies a cultural change and hence there is the prospect of other cultural changes, including a change in attitude toward migration. However, these changes will have no significant effect on the labor supply in Central Asia in the 1980's because the delay in marriage has not yet affected total fertility. Thus, the number of young persons entering the labor force in this region will not drop significantly in the 1980's. The postponement of age of marriage may well be one consequence of the change in the draft law in 1967, which lowered the age of conscription of males from 19 to 18. Conscription at an earlier age has probably caused some young draftees to delay marriage until their discharge at age 20 or so. The impact of this delay on total fertility seems thus far to be negligible since the census data show that the proportion of large families in this region increased between 1959 and 1970. Even in the cities, the average size of families in 1970 is either equal to or larger than the average in 1959.[93]

The average size of rural Uzbek families has grown from 4.83 persons in 1959 to 5.82 in 1970, a 20-percent increase.[94] As compared to 1958, the number of women in 1975 who received financial aid from the state for bearing seven or more children grew by 6.7 times; during the same interval the number of women in child-bearing ages grew by only 1.5 times.[95] In addition, a recent survey of 1,500 rural women in two oblasts of Uzbekistan with high proportions of the indigenous population showed that in 1976 the interval between births was shorter for women of more recent cohorts (1940–44) than for older women (1920–24); both cohorts included only women who had been married at least 10

[91] Based on data given in TsSU, Itogi 1970, vol. IV, 1973, pp. 361–364.
[92] See the Bruk and Guboglo article in Istoriya SSSR, 1974, and TsSU, Itogi 1970, vol. II, 1972, pp. 263–268.
[93] Roganova, "Number," 1976, pp. 260–275, and Vasil'yeva, Sem'ya, 1975, p. 42.
[94] Stroitel'stvo i arkhitektura Uzbekistana, 1975, pp. 36–37.
[95] Buriyeva, "Family," 1978, pp. 99–100.

years.[96] Moreover, some 15.2 percent of the women who did not regulate the size of their family or the interval between births had 15 children on the average and a 2-year interval between births. Over three-quarters of the families (77.8 percent) were comprised of women who did not use birth control but had an interval between births of 2.8 years. They gave birth to eight children on the average. The last group (7 percent of the families) practiced family planning. This group averaged one child every 3.6 years; nonetheless, on the average each of these women bore seven children.[97] With patterns of births such as this it is no wonder that the birth rate in the four core Central Asian republics has not dropped as much as it has in other republics. In Tadzhikistan, the birth rate has even increased. Due to large family size, people of this area continue to be less likely to migrate out of the region (see table 3).

TABLE 3.—CRUDE BIRTH RATES IN SELECTED REPUBLICS, 1960–77

[Per 1,000 population]

Year	R.S.F.S.R.	Kazakhstan	Kirgiziya	Tadzhikistan	Turkmenistan	Uzbekistan	Azerbaydzhan
1960	23.2	37.2	36.9	33.5	42.4	39.8	42.6
1961	21.9	36.0	35.8	34.0	41.0	38.2	42.1
1962	20.2	33.6	33.9	33.6	40.1	37.0	40.4
1963	18.7	31.1	33.3	34.5	39.5	35.8	40.8
1964	16.9	28.4	31.8	34.7	38.1	35.0	39.8
1965	15.7	26.9	31.4	36.8	37.2	34.7	36.6
1966	15.3	25.7	30.8	35.4	37.6	34.1	35.4
1967	14.4	24.7	30.5	35.2	35.5	33.0	32.5
1968	14.1	23.8	30.8	36.7	35.6	34.3	32.1
1969	14.2	23.4	30.1	34.7	34.3	32.8	29.3
1970	14.6	23.4	30.5	34.8	35.2	33.6	29.2
1971	15.1	23.8	31.6	36.8	34.7	34.5	27.7
1972	15.3	23.5	30.5	35.3	33.9	33.2	25.6
1973	15.1	23.2	30.6	35.6	34.3	33.7	25.4
1974	15.6	24.1	30.4	36.9	34.4	34.2	25.0
1975	15.7	24.1	30.3	37.0	34.2	34.5	25.1
1976	15.9	24.3	31.3	38.2	34.7	35.3	25.7
1977	15.8	23.9	30.2	36.5	34.2	33.7	25.2

Source: Baldwin, Projections, 1979 (forthcoming).

TABLE 4.—GROSS REPRODUCTION RATES IN THE U.S.S.R. AND SELECTED REPUBLICS, 1958/59 AND 1976/77

Republic	1958/59	1976/77	Index of change (1958/59=100)
U.S.S.R.	152.3	115.5	75.8
R.S.F.S.R.	127.6	96.0	75.2
Kazakhstan	216.9	156.8	72.3
Kirgiziya	209.9	233.4	111.2
Tadzhikistan	190.8	300.6	157.5
Turkmenistan	249.0	276.6	111.1
Uzbekistan	245.1	267.5	109.1
Azerbaydzhan	243.2	186.5	76.9

Note: The gross reproduction rate is defined as the number of females that will be born to 100 women during their reproductive lifetimes if a given set of birth rates by age of mother remains in effect.

Source: 1958/59: Based on data in TsSU, Naseleniye 1973, 1975, pp. 137–138. 1976/77: Based on data in Vestnik statistiki, 1978, p. 82.

The drop in the birth rate in the Azerbaydzhan republic is pointed to by some Soviet writers as the model for the future transition of the Central Asians to lower fertility levels. However, these changes are not likely to occur in the Central Asian republics until after the 1980's. Between 1958/59 and 1976/77, when Azerbaydzhan had a remark-

[96] Ibid., p. 98.
[97] Ibid., p. 101.

able 25 percent drop in the gross reproduction rate (GRR), the GRR in four of the Central Asian republics continued to rise (see table 4).[98] As the GRR rises, family size increases. This in turn has an inhibiting effect both on the proportion of women in the labor force or migration.[99] Any contemplated move, even to cities within the republic, is hampered by the lower average size of apartments in the cities as compared to rural areas. The republic GRR's may even show a further increase in the future if the low fertility non-Muslim populations move out of the region in statistically significant numbers.[100]

The Azeri are also culturally somewhat different from the Central Asian Muslims, being Shi'ia rather than Sunni. The Sunni Muslims, who predominate in Central Asia, are much more traditional. In fact, the name "Sunni" is derived from the expression *ahl al-sunnah*, "followers of custom." Moreover, Azerbaydzhan is influenced by the fact that it contains Baku, a long urbanized and industrialized area. The oil fields there were discovered in 1870, and many unskilled laborers moved in from the surrounding countryside and elsewhere in Russia to give the republic a culturally mixed population. As a result, the indigenous peoples rapidly became the most literate and advanced of the Turkic peoples in the Russian empire.[101] Hence, Azerbaydzhan is not likely to be the model for changing patterns of family formation and fertility for the Central Asian peoples, at least in the near future.

Thus, the demographic evidence suggests that large-scale migration from the Central Asian region is unlikely in the immediate future.

IV. Cultural Considerations

In addition to economic and demographic factors, various cultural elements bear on the issue of potential migration from the Central Asian region. The influence of language, education, ethnic consciousness, religion, and other traditional beliefs will be considered here.

A. Langauge

Lack of knowledge of the Russian language is a major barrier to migration by the Central Asians even into their own cities in which the predominant language is Russian, let alone to cities in European U.S.S.R.[102] Between 1955 and 1970, among four of the five major Central Asian nationalities, the proportion who gave their native tongue as their first language remained constant or increased. Only the

[98] The remarkable increase in Tadzhikistan probably is partly due to an improvement in the registration of births and partly to a real increase in fertility.

[99] One of the constraints on higher rates of participation in the labor force by Central Asian women is the lack of, or more likely, lower usage of child-care facilities in these republics. Thus, on an index of 1.000 for the U.S.S.R. in 1972, the index of 0- to 4-year-olds in kindergartens or nurseries in Central Asia was about half the national rate, e.g., 0.543 in Kirgiziya, 0.407 in Tadzhikistan, 0.494 in Turkmenistan, and 0.555 in Uzbekistan. See Zakumbayev, Ekonomicheskoye, 1977, p. 24.

[100] For example, the Kirgiz crude birth rate of about 40 per 1,000 in 1969 was "almost two times higher than that of the Russian population of the republic." See Referativnyy zhurnal, 1972, item 5Ye188, p. 29. In addition, despite the fact that the Kirgiz represented only between 41 and 44 percent of the republic's population according to the 1959 and 1970 censuses, their share of all births in the republic increased from 49 percent in 1960, to 54 percent in 1964, to 58 percent in 1965. TsSU, Itogi 1970, vol. IV, 1973, p. 14 and Ryspayev, "The Birth," 1972, p. 87.

[101] Walsh, "Azeri," 1978, p. 57.

[102] For example, see Voprosy ekonomiki, 1975, p. 152. The first combined ethnographic and sociological analysis of the "needs of the population to study a second language" took place in 1968 at the Institute of Ethnography of the Academy. The Tatar A.S.S.R. was chosen as the first region for research (Guboglo, "On the Study," 1978, p. 27).

Kazakhs showed a drop, and that was very slight (from 98.4 to 98.0 percent). In the case of Kazakhstan, the large immigration of Russians undoubtedly explains the decline. Almost 42 percent of the Kazakhs claimed to speak Russian fluently, but among the other four nationalities the proportion was only between 14 and 19 percent.[103] In Central Asia there are sharp differences in language capability by age. In Kazakhstan 73 percent of the 16- to 19-year-olds and 74 percent of the 20- to 29-year-olds claimed fluency in Russian. The weighted average figures for the other four Central Asian nationalities were 32 percent for the 16- to 19-year-olds and 37 percent for the 20- to 29-year-olds.[104] Whether the 1970 census figures on command of Russian err on the high or the low side is a debatable matter. Bruk and Guboglo, of the Soviet Institute of Ethnography, argue that the figures are much too low because according to a survey they conducted in Moldavia, some 94 percent of the urban and 84 percent of the rural population know Russian,[105] compared to published census figures indicating only 62 percent of the urban and 28 percent of the rural population knew Russian.[106]

However, there is serious doubt about the validity of some of these claims. Jonathan Pool cites a Soviet study which showed that of the 1,065 students of higher educational institutions in Tartu and Tallinn in 1968 whose language capabilities were tested, 99 percent failed to achieve the "first level of full bilingualism." [107] He continues:

> The students who were tested were also given questionnaires about their knowledge and use of Russian. Of the 709 returned questionnaires, 53, or 7.5 percent, claimed that they "freely command the Russian language" (the same wording as appears in the U.S.S.R. census), but the investigators' analysis of their test papers allowed them to grant this level of competence to only 10 of these 53, i.e., 18.9 percent. Calculated the other way, only 20.1 percent as many as rated themselves fluent were so rated by their professors. If this same ratio applies to the whole Estonian population's ability to assess its competence in Russian, then the percentage of Estonians in Estonia who were fluent in Russian as a second language in 1970 was not 27.8 percent, as reported in the census, but about 5.5 percent.[108]

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[103] Sovetskaya pedagogika, 1971, p. 65.
[104] Based on data given in TsSU, Itogi 1970, vol. IV, pp. 361–364.
[105] Sovetskaya etnografiya, 1975, pp. 17–30.
[106] Bromley, Sovremennyye, 1975, p. 305. All figures for knowledge of Russian may go up dramatically if a change in the definition of language competence now under consideration is adopted in a future census. According to the plan proposed at a December 1975 meeting of the Scientific Council on Nationality Problems of the Academy of Sciences U.S.S.R. with representatives of the Central Statistical Administration's population census office, the census would take account of "all those who can make themselves understood in the second language and not only those who are fluent in it" (Sovetskaya etnografiya, July–August 1976, pp. 172–173). Obviously, figures compiled under an expanded definition would not be comparable to those for 1979 and previous years. Census figures on minority nationalities may be affected by a changed definition as well. An alternative approach, suggested by L. N. Terentyeva of the Institute of Ethnography according to a trip report by Jonathan Pool is to follow the example of the last Yugoslav census and permit respondents to describe themselves as of "Soviet" nationality instead of naming a local ethnic group.
[107] The "first level of full bilingualism," a Soviet designation, is the level of language capability (i.e., vocabulary and grammar) that is expected of a primary school graduate. The fourth and highest level of bilingualism is that expected of university graduates.
[108] Pool, "Soviet," 1978, p. 239.

A major effort to improve the quality of knowledge of the Russian language in non-Russian higher educational institutions began in May 1964 when it was made a mandatory subject for those with inadequate ability. In the 1977–78 school year a policy of teaching the Russian language in all non-Russian schools from the first grade onward was initiated.[109] There has even been a proposal to introduce the teaching of Russian to children in kindergartens.[110] In 1977 it was reported that 45 of the 127 languages of the Soviet Union are used for instructional purposes in Soviet schools, somewhat less than the figure of 55 in 1972.[111] Between 1965 and 1972 there was a much greater increase in the number of students of native language schools than in Russian language schools. The percentage change figures are as follows:[112]

Republic	Number of students in 1972 as percent of number in 1965		Total population in 1972 as percent of number in 1965
	Native language	Russian language	
Kazakhstan	143.0	112.7	115.2
Kirgiziya	150.2	108.6	120.3
Tadzhikistan	159.0	123.1	124.7
Turkmenistan	153.5	107.1	123.1
Uzbekistan	165.5	90.9	122.2

Pool aptly summarizes Soviet discussions of language training as follows: "The mammoth Soviet literature on this subject seems to add up to the claim that everyone is learning Russian, combined with the lament that few people are learning it well."[113] Nor does the increased emphasis on learning Russian mean that the knowledge of national languages is being lost among the nationalities, as Brian Silver has pointed out.[114]

More than one-third of all elementary and high school students in the Soviet Union are in nationality schools where Russian is a "foreign" language.[115] The cumulative total of hours per week spent in all 10 grades in studying Russian at the union republic level in the mid-1970's reportedly varied from 40.5 hours in the Ukraine to 51.5 in Kirgiziya. However, at the A.S.S.R. level and lower, Russian tends more and more to be the medium of instruction for all courses rather than simply a subject of study.[116] The increased emphasis on Russian-language instruction undoubtedly is a consequence of the activities of

[109] Sovetskaya pedagogika, 1977, p. 123, and Rakhmatullin, "In Search Of," 1977, p. 3.

[110] Protchenko, "Union," 1977, p. 2. According to Silver, this proposal has been implemented in a number of schools already. (Personal communication to the author.)

[111] Ibid., and Narodnoye obrazovaniye, 1972, p. 65. The functional importance of the Russian language in Soviet policy is described in detail in Filin, Russkiy, 1977; Desheriyev and Protchenko, Razvitiye, 1968; and many others.

[112] Baldwin, Population, 1979 (forthcoming), and Bromley, Sovremenyye, 1977, p. 270.

[113] Pool, "Soviet," 1978, p. 239. It is doubtful whether students in Kirgiziya can learn Russian well as long as Kirgiz-Russian and Russian-Kirgiz dictionaries are "a bibliographic rarity" (Sovetskaya Kirgiziya, Jan. 14, 1979, p. 2, translated in JPRS 72911. Translations on U.S.S.R. Political * * *, No. 930, 1979, p. 64). A similar lack of dictionary resources in Tadzhikistan will presumably be remedied in the next several years, when the first major Russian-Tadzhik dictionary in 30 years will be published (Kozlova, "This Dictionary," 1979, p. 3).

[114] Silver states that "as long as support for the national languages is provided by schools and mass communications media, the acquisition of Russian as a second language does not necessarily portend the loss of knowledge of the traditional national languages" (Silver, "Language," 1978, p. 250). Also see Silver's earlier paper entitled "The Status," 1974, pp. 28–40.

[115] In the 1974/75 school year, 27.7 million students were enrolled in Russian-language schools and 15.4 million in nationality schools (Narodnoye obrazovaniye, 1976, pp. 18–22).

[116] See especially, Silver, "Language," 1978, pp. 250–306.

a new organization nominally formed to deal with nationality problems in general, but in fact dealing primarily with the enhancement of the position of Russian as the lingua franca in all aspects of Soviet society. This organization, the Scientific Council on Nationality Problems, was formed in June 1969 as the successor organization to a Commission on Problems of Nationality Relations attached to the Social Sciences Section of the Presidium of the Academy of Sciences U.S.S.R., created only 3 years earlier.[117] This organization has become the focus of much of the research on language and nationality issues. Thus, in October 1975, this same Council had been involved in an All-Union Scientific-Practical Conference to Discuss the Experience in Studying and Teaching the Russian Language in Schools, and Higher and Specialized Secondary Educational Institutions.[118]

The new predraft military training for young persons may also increase the knowledge of Russian among Central Asians if instruction is given in the Russian language. However, Silver is of the opinion that if the purpose of the draft is to Russify other nationality groups, it is not going to have much long-term effect.

B. Education

Educational attainment is not only a measure of cultural progress but is also seen by some Soviet and Western analysts as a stimulus for outmigration as jobs for skilled workers becomes scarcer in rural areas. Educational attainment rose in all republics of the Central Asian region and Kazakhstan between 1959 and 1970, and especially among women and the rural population (see appendix tables 11 and 12). Particularly striking is the fact that among the rural population the number of persons per 1,000 who have attained general secondary education was higher in 1970 in every one of these republics than in the U.S.S.R. as a whole. However, the quality of education in rural areas is notoriously poor and this measure is subject to some question.

The rate of increase of both enrollments in and graduations from vocational-technical schools in the five republics is generally greater than the national average (see appendix tables 13 and 14). Enrollment in vocational-technical schools in Central Asia grew from 10.7 percent of the national total in 1960 to 11.8 percent in 1974, and the number of graduates increased from 5.7 percent of the total in 1950 to 13.6 percent in 1975. The number of vocational-technical school graduates in the country as a whole has increased by more than four times since 1950, while in Central Asia it has grown by more than 10 times. Yet Perevedentsev, Kostakov, and others complain about the shortage of vocational-technical schools in Central Asia and the fact that enrollment rates of young people in Kirgiziya, Tadzhikistan, Turkmenistan, and Uzbekistan are only 7 to 8 per 1,000 population compared with 15 per 1,000 in the R.S.F.S.R., the Ukraine, Belorussia, and Kazakhstan.[119] Many of the students in the vocational-technical schools in the Central Asian republics do not come from among the indigenous populations. On January 29, 1973. *Pravda* described the students in the Dushanbe

[117] Drobizheva, "Scientific," 1970, p. 222.
[118] Voprosy istorii, 1976, p. 138.
[119] See Kostakov, Trudovyye, 1976, p. 57, and Perevedentsev, in Literaturnaya gazeta, Sept. 22, 1976, p. 10.

schools as being mainly "young men and women from Sakhalin, the Urals, Siberia, and Kazakhstan, whereas the local persons can be counted on the fingers of one hand." [120] A small percentage of the Central Asian students are female. In Tadzhikistan, for example, women comprised only 16 percent of the total enrollment. The low proportion undoubtedly is a result of a traditional reluctance to study or work in urban localities. Even schools that train textile workers "have great difficulty in recruiting girls from the local nationalities." [121] The Basic Directions call for an increase of 11 million vocational-technical school graduates in the country as a whole during the current 5-year plan period, 16 percent more than the 9.5 million graduated during 1971–1975.

In addition to emphasizing vocational-technical education in Central Asia, an expansion is planned in the number and types of students, especially those from among the titular nationality groups. This expansion is designed both to satisfy local demand for skilled workers in labor-short industries of the region, and to assign some students to other areas for training not only to meet the needs of these labor-deficit regions but also to increase outmigration from Central Asia. However, as Kostin recognizes, "social, moral, and nationality problems" must first be resolved by a "purposeful and joint effort of all interested organizations." [122]

Before this policy can be successful, the scope of training afforded to the local populations will have to be greatly expanded. According to a recent source, up to 1,100 skilled trade are taught under the vocational-technical educational system, but only 250 are offered in Kazakhstan and 150 in Kirgiziya. Because the range of training provided is too limited to meet Central Asian needs for skilled cadres, it is necessary to have "state planned redistribution from other republics." [123]

The increasing enrollment in vocational-technical schools in Central Asia probably does not mean that there has been a significant decrease in ethnic consciousness among the major nationalities of the region. Even in areas with a great deal of interaction between ethnic groups, such as North Kazakhstan, marriages between Muslims and non-Muslims are infrequent (see pp. 682–683). The resistance to the adoption of the Russian language as a native language also suggests that literacy and education have not greatly weakened traditional in-group bonds.[124]

Silver argues that changes reflecting modernization occur first in those relationships that are directly affected by technological development (i.e., urbanization, education, and changes in occupational structure), and only subsequently do they affect the attitude and practices associated with primary group relations (i.e., family and home life, and intermarriage).[125] As regards the Muslim community, Silver believes that changes in primary group relations may be particularly delayed.

Regardless of improvement in educational attainment a strong sense of ethnic consciousness is preserved. Jeremy Azrael and Steven Burg find evidence from a major study of the population of the Tatar

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[120] Pravda, Jan. 29, 1973, p. 2.
[121] Rizoyeva, "Working," 1977, p. 3.
[122] Kostin, "Management," 1978, p. 19.
[123] Desheriyev, Natsional'nyy, 1978, pp. 36–37.
[124] Based on a personal communication from Brian Silver.
[125] Silver, "Levels," 1974, pp. 1633–1634.

A.S.S.R. that "professionals * * * do not have a higher level of positive attitudes in cross-national relationships than do other sections of the population, but rather the opposite." [126] Thus, despite increases in educational attainment at all levels neither ethnic consciousness nor attitudes are affected and outmigration does not result.

C. Ethnic Consciousness and Traditional Beliefs

Cultural factors may be more important in the lives of the Central Asian peoples than is generally appreciated in the West. On the basis of his interpretation of experience elsewhere in the world, Lewis insists that "people move primarily for jobs and economic improvement" and that "cultural factors * * * can impede migration, but they will not stop it." [127] However, it appears that Central Asia may be the exception to the rule. Culture is not merely a "residual factor," but seems to be becoming more important in the Central Asian Muslim community. The cohesiveness of the Muslim community is expressed by a saying widely repeated among Muslims that "Love of one's motherland is part of one's faith" ("Hub al Watan-l Min al-Jiman"). As Bennigsen has remarked, the acquisition of Russian language capabilities may make one bilingual but not necessarily bicultural.

The resilience of culture was recognized years ago by the Central Committee ideologist Suslov, who stated that "ethnic antagonism" is one of the three major obstacles to the building of communism.[128] Yu. V. Bromley, head of the Academy's Scientific Council on Nationality Problems, director of the Institute of Ethnography of the Academy of Sciences U.S.S.R., and chief editor of a major volume on ethnic issues in the U.S.S.R., notes that:

> Nationality factors play, and in the foreseeable future will [continue to] play, a leading role in our life, and it is not accidental [*ne sluchayno*] that their analysis * * * is given so much substantive attention in the program documents of the C.P.S.U. and at Party congresses.[129]

In 1972, Brezhnev declared that "even in the period of a society of mature socialism (*zrelogo sotsializma*), nationality relations are a continuously developing reality which bring forth new problems and tasks." Brezhnev added that "the Party keeps these questions constantly in mind." [130] According to Geoffrey Wheeler, the regime has always considered it necessary to dismantle the "whole fabric of Islamic culture and society," including "religious practice, education, languages, literature, historiography, family life, the status of women, the graphic and plastic arts, music, the drama and the cinema," in order to modernize and industrialize.[131]

Bennigsen finds that in the last decade there has been a policy shift away from *sblizheniye i sliyaniye* (rapprochement and assimilation)

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[126] Arutyunyan, "A Concrete," 1969, cited in Azrael and Burg, "Political," 1978, pp. 9–10.
[127] Lewis et al., Nationality, 1976, p. 361.
[128] Suslov, "Social," 1972, p. 23, cited in Rakowska-Harmstone, "The Dialectics," p. 17. The other two "particularly urgent problems to overcome [are the] substantive differences between the city and the village [and] between physical and mental labor" (Suslov, "Social," 1972, p. 20).
[129] Bromley, Sovremennyye, 1977, p. 4, and Bromley, Sovremennyye, 1975, p. 4.
[130] Bromley, Sovremennyye, 1977, p. 4, and Brezhnev, "On the Fiftieth," 1974, p. 63.
[131] Wheeler, "The Study," 1976, p. 172.

to a *rastvet* (flourishing) of individual Soviet nationalities. While the term *rastvet* has by no means replaced *sblizheniye* in official pronouncements, it appears more frequently as time passes. *Sliyaniye* has all but disappeared. Hélène Carrère d'Encausse has noted that not a single reference to *sliyaniye* was made at the Twenty-Fifth Party Congress, which spoke only of a "unity (*yedinstvo*) of cooperating nations." [132] The objective is apparently to foster a sense of common national purpose in order to offset ethnic divisiveness. The divisiveness has recently found concrete expression in two forms. First, there is the drive for Pan-Turkism, which has involved Turkic Muslims in other countries as well as those in the Soviet Union, and the emergence of Iran as a model of a Muslim society. These and other recent Middle Eastern developments have led to a build-up of self-confidence in the Soviet Muslim community, on the part of the general population as well as the elites, according to Bennigsen. Second, there is the drive by the local intelligentsia in Central Asia to become self-sufficient and to control the development of their own region. If the Muslims of the U.S.S.R. were to form a cohesive ethnic bloc, this could be a threat to the central authorities in the event of any future conflagration in the area. Both these developments reflect a rising nationalism among the Central Asian people. The Soviet authorities are very much aware of them and have been trying to counter them.

Bennigsen has noted that Muslim culture is more resistant to change than Russian culture. He says that to the Muslims culture is much more than "simple folklorics." He also feels that it is an even stronger force today than 10 or 20 years ago.[133] and that the Party and the government take this matter very seriously.[134] Bennigsen does not think it is realistic to expect that the Muslim cultural cohesiveness will be weakened during the next decade.[135]

Mirasism (the preoccupation with cultural heritage, a term derived from the Arabic word *mirs*, "heritage"), is becoming stronger according to David Staats.[136] It penetrates all levels of Central Asian society, is apolitical, and revitalizes and preserves the traditional culture. It is a spontaneous response to attempts by the Soviet central authorities to weaken the Central Asian cultures. Staats traces the historical development of the movement, showing that *mirasism* is not a passing phenomenon. It derives from the late *jadid* reformist educational, cultural, and political philosophy prevalent in this region prior to 1917. It was institutionalized by two literary organizations, the *Chaghatay Gurungi* ("Chaghatay Circle") from 1918 to 1924 and the *Qizil Qalam* ("Red Pen") from 1928 to 1930. After two decades of quiescence under Stalin, the movement reemerged in 1953, to defend the national epics of the Central Asian people which were being attacked by the central government for their "feudal character and lack

[132] Lecture delivered at the U.S. Department of State, Mar. 7, 1977. Also see, for example, Pravda, Feb. 1, 1977 and Dec. 11, 1976.

[133] At the St. Louis convention of the American Association for the Advancement of Slavic Studies in 1976, Alexandre Bennigsen expressed his belief that Central Asians between 20 and 40 years of age are more xenophobic than the "white beards." Also see the articles by Edward Allworth, Barry M. Rosen, and Anna Procyk in Allworth, The Nationality, 1973, p. 221.

[134] For example, the local newspapers, Sovetskaya Kirgiziya, Pravda Vostoka, and Kazakhstanskaya pravda, contain repeated attacks on the traditional attitudes of the local populations. Usubaliyev, the first Secretary of Kirgiziya, regularly condemns the "remnants" of the past about every 6 months.

[135] View expressed at a conference held early in 1977 at the Foreign Demographic Analysis Division, U.S. Department of Commerce, Washington, D.C.

[136] In a personal communication to the author.

of proletarian internationalism." Mirasism today, Staats points out, is reflected in the examination of interaction among cultures and how this will contribute to changes in the intellectual life of the region in the future. It both reflects and helps to maintain the cultural cohesiveness of the entire Muslim community.[137]

The Muslim peoples of the Central Asian republics feel that their region is the cradle of civilization. The cities of Samarkand, Bokhara, and Tashkent are ancient and still retain some of the attributes of centers of empire. The descendants of the Turko-Mongol conquerors are alive today and are very conscious of their heritage. They have a deep attachment to the ancestral land and believe that to leave *Dar-ul-Islam* (the Abode of Islam) for *Dar-ul-Harb* (the Abode of War, i.e., the outside world) is a sin against the *Ulus* (the community).

Armstrong has pointed out that the Muslims of Central Asia are reacting very much like those of Yugoslavia, who have not taken part in the *Gastarbeiter* flow to other parts of Europe but have limited their movements to other parts of Yugoslavia. All this suggests that Muslims will not readily move to a radically different ambience.[138] The Turks and North Africans who have moved to Europe are from Muslim communities which were secularized much earlier. Ataturk changed Turkish society some five decades ago.[139] Despite the efforts of the Soviet Government, the traditional way of life is still much intact in Central Asia.

Opposition to the marriage of Muslim women outside of the Muslim faith is still strong even in Kazakhstan, where many Russians have come to work and where knowledge of the Russian language is much greater among indigenous peoples than in the other republics of the region. Between 1959 and 1970, mixed marriages among the rural population in Kazakhstan increased from 11.9 to 17.0 percent.[140] However, since Muslim women in Kazakhstan (and in the other Central Asian republics) almost never marry out of their traditional groups, the mixed marriages are primarily between nonindigenous nationalities who have migrated to the republic. One survey found that between 1935 and 1970 every fourth marriage in the Petropavlovsk region of North Kazakhstan was a mixed marriage, but only 31 of the 1,565 mixed marriages, or 2 percent, were between Kazakh women and Russian men.[141] The same survey indicated that when the father was a Kazakh and the mother a Russian or a Tatar, 67 and 90

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[137] Another development which will help preserve the cultural inheritance of these republics, is the appearance during the 1970's of native-language encyclopedias for all the republics of Central Asia and Kazakhstan. The first to appear was that of the Uzbeks in 1971, followed by the Kazakh in 1972, the Turkmen in 1974, the Kirgiz in 1976, and the scheduled appearance of a Tadzhik series in 1978. Details are given in Soper, "Volume I," 1978. The importance attached by the Uzbeks to this matter can be seen in their strongly laudatory review of a Western commentary on their encyclopedia by James Critchlow. See Mukhtar, "American," 1978. Critchlow's review appeared in the March 1978 issue of Slavic Review.

[138] One American scholar tells of seeing Central Asians returning to the region from outside and kissing the ground upon debarking from their plane or train as though they had returned from exile.

[139] For example, in 1924 he eliminated the caliphate. Later he also "closed down all institutions based on Muslim canon law" (The New Encyclopedia Britannica, vol. 2, 1974, p. 257).

[140] Kozlov, Natsional'nosti, 1975, pp. 235 and 246.

[141] Yegurnev, "Inter-nationality," 1973, pp. 28–34. For more evidence on ethnic intermarriage also see Dunn and Dunn, "Ethnic," 1973, pp. 45–58; Vestnik Moskovskogo, 1972, pp. 73–82; and the following issues of Sovetskaya etnografiya: June 1971, pp. 112–118; April 1971, pp. 80–85; May 1969, pp. 16–29; April 1967, pp. 137–143; and March 1962, pp. 18–34. These sources contain additional information on the existence of intermarriage as well as on its rarity between Muslims and non-Muslims and on the slowness with which these changes are occurring. Also see Anderson, "Changes," 1979, p. 27.

percent, respectively, of the couples chose Kazakh as the nationality of the children, again demonstrating the force of tradition. In Turkmen-Russian families about 90 percent of the children call themselves Turkmen.[142] Among Uzbeks, who are reported to be the most endogamous nationality after the Kirgiz, Kazakhs, Turkmen, and Azeri, the percentage of families of mixed nationality grew by only 2.7 percent between 1959 and 1970. The increase was 3.7 percent in the cities and only 1 percent in rural areas.[143] Hence ethnic identity still strongly affects the selection of marital partners by persons of Muslim origin throughout the region.[144]

One of the long-term strategies used by the central government to combat ethnic separatism is to encourage intermingling (*razmezhivaniye*) of the nationalities in all the non-Russian republics, a policy that is said to have great "scientific and political significance."[145] The data in table 5 show that a considerable increase took place between 1959 and 1970 in the numbers of nationalities in four of the five republics of Central Asia. However, most of the new additions in 1970 probably reflect the movement of nonindigenous peoples into the cities and therefore do not involve much direct personal contact with the Central Asians.

TABLE 5.—DISTRIBUTION OF NATIONALITIES AMONG THE NON-RUSSIAN REPUBLICS, 1959 AND 1970

[Number of nationalities in each republic having 1,000 or more members]

Republic	1959	1970
Ukraine	31	45
Belorussia	13	20
Moldavia	12	13
Estonia	10	11
Latvia	10	13
Lithuania	9	10
Armenia	8	10
Azerbaydzhan	21	25
Georgia	16	22
Kazakhstan	25	46
Kirgiziya	19	29
Tadzhikistan	17	22
Turkmenistan	16	17
Uzbekistan	22	39

Note: The peoples of Dagestan are counted as 1 unit.

Source: Tsameryan, Zakonomernosti, 1976. p. 47.

Sheehy has noted the formation in Uzbekistan in 1975 of "Councils for Raising the Culture of Everyday Life," the purpose of which was apparently to encourage Uzbeks to abandon their "backward" customs. The Councils are part of an organization that extends up to the republic level, with First Secretary Rashidov at its head.[146] In 1978, the Turkmen press carried reports about "councils of elders" at the collective farm level and "Oblast Councils to Introduce New Customs and Traditions" at the oblast level, the purpose of which was to obliterate the vestiges of "old ways," including religious practices, the sale of girls for "bride-money," marriages of minors, exclusion of women

[142] Bromley, "Ethnic," 1977, p. 21. The same source, however, gives evidence of opposite behavior. The children of mixed Chuvash-Russian families are reported to be designated as Russians in 98 percent of the cases.
[143] Mullyadzhanov, "The Population," 1979, p. 49.
[144] Also see the different viewpoints expressed in the papers by Fisher, "Ethnic," 1977, pp. 395–408 and the comment by Silver, "Ethnic," 1978, pp. 107–116.
[145] Tsameryan, Zakonomernosti, 1976, p. 46.
[146] Personal communication to the author.

from specialized secondary and higher schools, circumcision, and large families.[147] Referring to the campaign against "bride-money," First Secretary Gapurov said in March 1978 that "the measures taken have still not produced tangible results." [148]

The Soviet authorities are deeply concerned about the relationship between religion and nationalism in Central Asia. An article in an Uzbek journal says:

> Nationalistic and religious prejudices can be observed, as a rule, at the level of ordinary consciousness, in the sphere of everyday family relations, and in the form of obsolete customs and traditions. And it has to be said that they are interwoven here in a most complex way and are marked by great vitality. * * * The identification of religious with national membership also manifests itself in a hostile attitude toward marriages between representatives of different national-religious communities and in the separate burial of the deceased in accordance with their national and sometimes, tribal origins. * * * [149]

Another author writes that:

> Nationalism is closely interwoven with the deviations from the norms and principles of socialist morality * * *. Religion has always played (and sometimes still plays) a considerable role in the exaggerated or distorted manifestation of national characteristics. Religion is closely linked with the population's everyday life. It is well known that the nationality factor is preserved most firmly in the people's traditions. * * * Nationality feelings frequently have a religious content. Believers frequently interpret people's attitudes toward their nationality through a religious prism and nurture feelings of sympathy or antipathy for other nationality groups depending on their religious adherence. Thus, for instance, the leaders of modern Islam in the Chechen-Ingush A.S.S.R. maintain the population in a state of constant anxiety over the fate of outdated nationality traditions and customs, setting them against everything that is new and progressive.[150]

Bennigsen points out that there is a definite growth of interest in Islamic traditions in Central Asia, manifested in the observance of a "corpus of beliefs and rites" which comprise the "aggregate of cultural, psychological and social traditions, attitudes and customs which govern the whole way of life of the believers." [151] Not only do these beliefs and rites appear in formal observances in the mosques but they are reflected in the activities of the *sūfi* brotherhoods, or *tariqas*, which are now experiencing a revival. The brotherhoods lack a formal institutional structure but have a markedly hierarchical structure of personal relationships. They combine theology and mysticism and have

[147] Mollayeva, "Soviet," 1978, p. 2, and N. Kakabayeva, in Turkmenskaya iskra, Mar. 21, 1978, p. 3.
[148] Gapurov, "Fighting," 1978, p. 1.
[149] Artykov and Nurmatova, "Atheistic," 1977, pp. 44–49.
[150] Chizhova, "Propagandizing," 1978, pp. 50–51.
[151] Bennigsen, "The Nature," 1978. Also see Bennigsen and Lemercier-Quelquejay, "Muslim," 1979 (forthcoming), and Bennigsen and Winbush, "Muslim," 1976, pp. 133–146.

since the 18th century represented "the hard core of Muslim resistance to Russian conquest." [152] Bennigsen and Lemercier-Quelquejay have found evidence of *sūfi* orders in all areas of Central Asia, in the Volga, and in the northern part of the Caucasus (i.e., the Chechen-Ingush and Dagestan A.S.S.R.'s). They cite a Soviet source that says that "'* * * more than half of all believers and almost all clerics * * * belong to a *sūfi* brotherhood.'" According to their calculations, in "the Chechen-Ingush and Daghestan republics alone, [there are] more than half a million of adepts [which implies] a fantastic number for an underground society forbidden by Soviet legislation." [153] If this is the case, and the proposition is supported by the strength of the attack on religious behavior in the Chechen-Ingush A.S.S.R. cited above, and by a recent book on the "ways to overcome" *sūfism* in Turkmenistan today,[154] then the efforts by the central authorities to impose a supranational "Soviet" nationality and to substitute the Russian language as the medium of communications instead of traditional modes becomes more understandable.

National consciousness is also manifested in local attempts to expunge Russian-derived words from the native languages. James Critchlow has written about Uzbek and Nicholas Dima about Moldavian efforts to replace Russian with original terms.[155] National consciousness is evident in other expressions of competitiveness with the Russians. For example, a Kazakh newspaper issued after the publication of the 1970 census results applauded the achievement of numerical superiority by Kazakhs over Russians in two oblasts of the republic.[156] The open flaunting of anti-Russian feeling testifies to the continuing animosity between the native populations and the Russian colonizers. Some calculations based on social, demographic, and cultural data provided by one Soviet source imply that relations between Kirgiz and Russians in Kirgiziya are worse than those between Belorussians and Russians in Belorussia.[157] Ethnic conflict, according to Rakowska-Harmstone, permeates the "political, social, economic, and cultural life" of the country. The 'rules of the game' prevent open ethnic warfare, but as these "ethnic forces press for an evolution toward greater autonomy, * * * if it is denied, there may be an explosion." [158]

Thus, the factors of nationality and religion would tend to inhibit outmigration quite apart from economic and demographic factors.

V. Other Considerations

A. Foreign Relations

Soviet options in the treatment of the peoples of Central Asia are limited by foreign policy considerations. It is unlikely that the Soviet Union could impose an unpopular forced migration policy in the face

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[153] Bennigsen and Wimbush, "Muslim," 1976, p. 140. Also see, Bennigsen and Wimbush, Muslim, 1979, p. 6.
[153] Bennigsen and Lemercier-Quelquejay, "Muslim," 1979, p. 5 of manuscript.
[154] Ashkhabad Domestic Service, in Russia, 1335 GMT, Jan. 14, 1979, in FBIS, Daily Report, Soviet Union, Mar. 12, 1979, p. R–1.
[155] See especially Critchlow, "Signs," 1973, pp. 18–28, and an unpublished paper by Nicholas Dima, "Soviet Moldavians," 1978, 12 pp., and personal communication by Dima to the author.
[156] Personal communication to the author by Alexandre Bennigsen.
[157] Susokolov, "The Influence," 1976, p. 105.
[158] Rakowska-Harmstone, "Ethnicity," 1977, pp. 73 and 87.

of adverse reaction not only among Central Asians but also among Muslim countries with which the U.S.S.R. is trying to establish or maintain close relations. Carrère d'Encausse says that the Soviet central authorities are very much aware of the fact that the Muslims of Central Asia are a compact, cohesive group located on the country's borders and that this has foreign policy implications.[159]

The Soviet Union has also attempted to win points in Asia by representing the Central Asian republics as a model for Asian development,[160] but to accomplish this it cannot afford to diminish the Central Asian advantages in living standards, tolerance for local traditions, and freedom from police surveillance. Any central policies that would have an adverse impact on the Central Asian republics would obviously end their usefulness for Soviet propaganda purposes.

Soviet awareness of the role of Islam on the world scene is apparent in the changes in the description of Islam in the two latest editions of the *Great Soviet Encyclopedia* (*Bol'shaya Sovetskaya entsiklopediya—BSE*). In the Second Edition, issued in 1953, Islam in the U.S.S.R. is described as "existing only as a survival of one of the ideological forms of an exploitative society." [161] Nineteen years later, in the 1972 Third Edition of the *Encyclopedia*, reference to the "exploitative" origins of Islam is dropped. Instead we find this statement: "In the U.S.S.R. and other socialist countries, where the social core of religion has been shaken [*podorvany*], Islam, like other religions, is becoming more and more a vestige of the past." [162] Indeed, the 1972 article, unlike the 1953 article, even gives the locations of those Muslims who reside in the U.S.S.R.[163]

Soviet sensitivity to public opinion in the Muslim world is evident in Soviet radio broadcasts for foreign consumption. On one hand, in an English language broadcast to North America on March 30, 1979, Moscow Radio attempted to downplay the size and rate of growth of the Soviet Muslim population, but on the other hand, in two broadcasts in Arabic and Turkish in April 1979 Ziyanddin Khan Babakhan, Mufti for Central Asia, emphasized freedom of religion for Muslims in the Soviet Union. In the April 1 broadcast, Mufti Babakhan asserted that "religious relations between the Soviet Muslims and all the Arab and Islamic countries are close." On April 5, the Mufti stated that there are "over 40 million Muslims in the Soviet Union." [164] The use of the 40-million figure by the Mufti is significant because it implies that all members of Muslim nationalities are regarded as "believers."

The entire southern border of the Soviet Union, which faces Turkey, Iran, Afghanistan, and China, is occupied by predominantly Muslim nationalities. Religion has been a matter of small concern in relations

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[159] Carrère d'Encausse, L'Empire, 1978, chaps. VII and VIII, passim, and lecture at U.S. Department of State, Mar. 7, 1977.

[160] However, according to Dr. Igor Birman, there are only three Muslims in the Politburo—Aliyev, Kunayev, and Rashidov—who hold ex officio positions as First Secretaries in their republics but are not in positions of control. Z. N. Nuriyev, a Muslim from Bashkiriya, is one of ten deputy ministers under Kosygin and the Council of Ministers. Formerly, he was the Minister of Agricultural Procurement, but this represents only 1 of about 100 ministers. Overall, this suggests a lack of trust of Muslims by the Russians, who occupy the commanding heights.

[161] BSE, vol. 18, 1953, p. 519.

[162] BSE, vol. 10, 1972, col. 1446. I am indebted to Prof. Yaakov Ro'i of Tel Aviv University for pointing out this comparison to me. It is further developed in his paper, "The Role," 1975, pp. 160–161.

[163] BSE, vol. 10, 1972, col. 1439.

[164] FBIS, Daily Report, Soviet Union, Apr. 6, 1979, pp. R5–R6, broadcast of Apr. 5, 1979, 1400 GMT; Apr. 3, 1979, pp. R1–R2, broadcast of Apr. 1, 1979, 1530 GMT; and Apr. 2, 1979, p. R1, broadcast of Mar. 30, 1979, 0030 GMT.

with Turkey, but recent changes in Iran have made the matter of religion a more sensitive issue.[165] The Iranians seem to be taking a much more aggressive role in the Islamic community and in relations with their coreligionists in the Soviet Union. One of the Ayatollah Khomeini's aides in France is reported to have indicated that although the Iranians had "no intention of meddling in Soviet internal affairs," they do "intend to press [Iran's] views among its Soviet Moslem coreligionists and Persian-speaking minorities in the Soviet Union." The aide added "we have the same right to propagate our views as the Soviets have [to propagate] their ideology." [166]

So far as Afghanistan is concerned, there are reports of Soviet Tadzhiks and Uzbeks among the technical and military aides sent to the aid of the new regime in Kabul [167] in its struggle with the Muslim hill tribesmen who are reportedly being aided by Pakistan.[168] This situation may create even greater problems than the Iranian situation for Soviet control of its own Muslim population.

The most serious complication in Soviet foreign relations that involves Soviet Muslims is the confrontation with China over the treatment of Kazakhs and Uighurs on both sides of the border in Central Asia and Sinkiang. The U.S.S.R. has about 5.3 million Kazakhs and 173,000 Uighurs, and China has about 700,000 Kazakhs and 5 million Uighurs. Both sides attempt through radio broadcasts and publications to stir up trouble among Muslims across the border.[169] For example, Rasma Karklins cites a German-language newspaper published in Kazakhstan which carried stories comparing the "great happiness" of the Soviet Uighurs with the "base policy of genocide" practiced against Uighurs in Sinkiang.[170] The Alma-Ata Uighur-language newspaper Kommunizm tughi claimed that the Chinese do not value the Uighur people or their culture but only want their land and its resources.[171] During 1978, broadcasts from the Soviet Union to Sinkiang in Uighur repeatedly attacked the Chinese for mistreatment of national minorities [172] and the Chinese launched similar attacks on Soviet nationality policies and practices.[173] As long as the Soviet Union is criticized for its treatment of minorities and is criticizing the treatment of minorities in other countries, it cannot indulge in draconian measures domestically that could be represented as persecution of Central Asians. The

[165] However, the recent resurgence of sufism in otherwise secular Turkey may signal a more active interest in Muslims in other countries in the future. See Mardin, "Religion," 1978, pp. 279–297.

[166] Koven, "Khomeini," 1979, p. A–21.

[167] Frye and Naby, "The Muslim," 1978, p. 10.

[168] Among others, Kramer, "Leftist," 1979. Kramer notes that even with Soviet assistance the Marxist-led takeover has trouble because it "runs counter to the strong resurgence of conservative Moslem thought that has been sweeping Moslem countries of western Asia."

[169] This section is based primarily on Dreyer, "Ethnic," 1979 (forthcoming), chap. 8; Soper, "Is the Soviet," 1979, p. 3; and Karklins, The Interrelationship, 1975, pp. 161–202.

[170] Karklins, The Interrelationship, 1975, p. 182.

[171] The original source is translated in Soper, "Is the Soviet," 1979, p. 2. Besemeres ("Population," 1975, p. 68) cites a similar claim made by N. Bashkalov in vol. II, Tyurkskiye yazyki, of Yazyki narodov SSSR (1966–68).

[172] See FBIS, Daily Report, Soviet Union, Oct. 27, 1978, pp. C3–C4; Oct. 13, 1978, pp. C4–C5; and Aug. 8, 1978, pp. C4–C7. In the June 17, 1978, broadcast, the commentator refers to "more than 7 million Uighurs in Sinkiang," a much higher figure than that usually cited. The Oct. 2, 1978, broadcast refers to a figure of "about 200,000" Soviet Uighurs. This is not the first time that a concentrated set of broadcasts has been made. See Dreyer, "Ethnic," 1979, pp. 35ff, manuscript; Karklins, The Interrelationship, 1975, p. 181; and Hetmanek, "The Turkic," 1969, p. 3.

[173] Among others, see FBIS, Daily Report, People's Republic, Jan. 26, 1979, pp. A2–A3, broadcast of Jan. 22, 1979, 0310 GMT, and Jacob, "A Watchful," 1979, p. 11.

measures to be taken by the Kazakh Branch of the Moscow-run Soviet Rodina Society, an organization which maintains contacts with co-nationals in other countries, to "further tighten and expand relations with compatriots abroad" confirm Ro'i's view that the Soviet leadership attaches much significance to "Islam and the Soviet Muslims" as a factor in foreign policy.[174]

B. Administrative and Political Considerations

Some aspects of Soviet domestic administration would facilitate and some would hinder the migration of surplus labor out of Soviet Central Asia. The plan to issue internal passports for the entire population would facilitate the documentation required of a controlled migration. Wage differentials that favor the Far North, Siberia, and the Far East may have some value as incentives, although they seem to have had little appeal for Central Asians thus far. Some analysts have speculated that an offer of multiple wage differentials for movement to specific plants in European Russia might be able to attract the Central Asian workers, but it is more likely that such measures would draw off first the workers of Russian and other Slavic nationalities now in Central Asia,[175] and that, as a result, Central Asian cities would be stripped of non-Asian workers before there were enough indigenous skilled workers to take their place.

If substantial numbers of Central Asians were to move to European Russia, the traditional antagonisms between them and the Russians would probably lead to the development of ghettos, which, given the shortages of available housing, would increase the antagonisms, perhaps to the point of open conflict. The value of the additional labor resources might not be worth the political costs. A forced relocation of Central Asian labor using the methods employed during World War II [176] would have even greater political consequences. Little productivity could be expected from workers who had been relocated against their will. It is the consensus of most authorities that forced labor would not be attempted.

The importance of the Central Asian migration issue and of labor supply problems probably were among the reasons for recent administrative changes in the agencies dealing with labor problems. In August 1976, a new union-republic level State Committee on Labor and Social Problems (Goskomtrud) was created. Simultaneously, the former national-level State Committee on Labor and Wage Problems was abolished, as were the 15 republic State Committees on Labor Resources Utilization. The duties of these agencies were transferred to the new national and 15 republic State Labor Committees.[177] When first formed, the Committee's new functions reflected in the organizational designation of "Social Problems", were not completely understood. The published regulations make it clear that this relates primarily to social security issues and potential employment of the pension-age population. Suggestive, however, of the growing concern about Central Asia, is the fact that Vladimir G. Lomonosov, a Great Russian, was

[174] Alma-Ata Domestic Service, in Russian, Jan. 22, 1979, 1511 GMT, in JPRS 72963, Translations on U.S.S.R. Political * * * No. 934, Mar. 9, 1979, p. 67.
[175] Rywkin, "Central," 1979, p. 12, also comes to this conclusion.
[176] See the fascinating book by Nekrich, The Punished, 1978, p. 238.
[177] Also see, Duevel, "Creation," 1976, p. 4.

recalled to Moscow from his position as Second Secretary of the Communist Party in Uzbekistan to be the head of the new agency. Having had this and other assignments related to Central Asia, he would be aware of the potential negative implications of the "social problems" of the Central Asian area for the country as a whole.

Subsequently, an Uzbek Branch of the Scientific Research Institute of Labor (of Goskomtrud) was opened in 1978 in Tashkent.[178] It is also understood that a similar branch was organized in Alma-Ata.

Several administrative developments related to labor allocations that might affect Central Asia have recently been reported. On September 12, 1978, Goskomtrud issued a "Temporary Directive on State Control over the Utilization of the Labor Force," giving the Committee greater authority to coordinate and control the utilization of labor resources, to seek labor reserves, to reduce labor turnover, to increase labor mechanization, to reduce losses of worktime, to train skilled workers, to improve the utilization of women, and to provide better (*moral'nyye i material'nyye*) incentives.[179] The national Goskomtrud has responsibility for overall supervision and coordination of the work of 11 union republic ministries, agencies, and state labor committees as well as the right to maintain control over labor utilization in all "enterprises and organizations regardless of their agency subordination."[180] Thus, the administrative apparatus and legal authority needed to exercise greater control over the Central Asian labor force is already in existence.

Undoubtedly this Directive was based on the recommendations of the all-union conference on labor resources held in April 1978. It was not until November 1978, that the detailed list of recommendations from the conference was published.[181] The conference also recommended two particular innovations which are especially pertinent to the problem under study. First, the Central Statistical Administration (TsSU U.S.S.R.) was advised that "in order to improve statistics on labor resources" it should review the question about the "expediency" of conducting a quinquennial census of the population the results of which could be processed in time to provide the data needed for the five-year national-economic plans.[182] If this recommendation is implemented, the authorities would be much better able to keep track of current population, employment and nationality trends throughout the U.S.S.R. Second, one of the final recommendations of the conference was that the formation of a Scientific Research Institute of Labor Resources and Population should be studied.[183] Specifically, the Institute would be concerned not just with the theoretical but also with the applied problems of the growth of labor resources and of the population, presumably with emphasis on regional differences in labor supply and demand as well as the coordination of scientific research work on this subject throughout the country.

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[178] Pravda vostoka, May 24, 1978.
[179] "On the Approval," 1979, pp. 3–7.
[180] Ibid., p. 4.
[181] "Recommendations," 1978, pp. 73–86.
[182] Ibid., p. 83.
[183] Ibid., p. 86.

C. Military Considerations

Another possible way to relocate Central Asian labor would be to enlist young male Central Asians in the military for very extended periods of time and assign them to economic activities in other parts of the country. This is already being done on a limited scale. However, most Sovietologists do not think that this approach could be used for a major relocation of Central Asian labor. Armstrong notes that the Soviet military is "an intensely Russian institution," and other observers have alluded to Soviet concern about the possible "yellowing" (*ozhelteniye*) of the armed forces,[184] and recent Soviet publications on military history have shown an increasing awareness of rising ethnic tensions in the U.S.S.R.[185]

The lack of Russian-language capability on the part of young Central Asians also limits the possibilities for their assignment after conscription into the Soviet Armed Forces. The number of 18-year-old males from Central Asia and Kazakhstan who have not learned Russian well becomes more significant as their proportion of the U.S.S.R. population increases from 13.5 percent in 1970 to an estimated 23.7 percent in 1990. Taking the 18-year-old male population of the entire southern tier (i.e., also including the Transcaucasus) as a percentage of that for the R.S.F.S.R., the south's proportion doubles over this period, from 32.7 percent in 1970 to 66.2 percent in 1990 (see appendix table 15). This occurs because the number of males in the R.S.F.S.R. drops in absolute terms by one-quarter, whereas the number in the southern tier increases by almost 60 percent between 1970 and 1990. Without fluency in Russian, Central Asian recruits are not eligible for assignment to technical and elite components of the military. An article in a Soviet journal in 1976 said that:

> The importance of the language of inter-nationality intercourse has great significance for the defense capability of the country since the entire process of training and indoctrinating [*vospitaniye*] of military personnel, of operational and tactical training, preparation of documentation, issuance of military training literature is [all] carried out in the Russian language.[186]

Thus, graduates of non-Russian language schools who have poor command of the Russian language "experience serious difficulty in mastering military affairs, contemporary technology, and armaments * * *."[187] The use of the military service as a means of national, i.e., Soviet integration is also a prime goal of the draft.[188] It is not clear whether any Russian-language instruction is given in pre-military training or on active duty, but scattered sources indicate at least that it is not a standard practice. A recent *Pravda vostoka* article says that the problem of the teaching of Russian to "draft-age youths" is "almost completely solved" in the Fergana and Samarkand oblasts of

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[184] See Azrael, Emergent, 1977, pp. 5 and 7.
[185] Personal communication from Vladimir G. Treml.
[186] Plyashkevich, "The Friendship," 1976, p. 32.
[187] Averin, "A Higher," 1978, p. 26.
[188] See Carrère d'Encausse, L'Empire, 1978, pp. 160–167, and Rakowska-Harmstone, "Red Army," 1975, 37 pp. However, according to a personal communication received from Silver, military service is probably much less influential than schooling, general contacts with persons of other nationalities at work, and the mass media, as a factor in the Russification of minority nationalities.

Uzbekistan, but this implies that the problem has not been solved elsewhere.[189] An extensive study conducted by a staff member of the Ural'sk State Pedagogical Institute of Kazakhstan found that knowledge and use of Russian words were both abysmally low.[190] The study concluded:

> The research data show that graduates of nationality schools which do not have a Russian language environment are drafted into the army with inadequate language preparation. Most cannot always call to mind such simple words such as *rank*, *column*, *right flank*, and others which are most frequently used in primary military training textbooks.* * * *[191]

Not only is the military efficiency of Central Asian conscripts adversely affected by their limited command of the Russian language, but because of a poor knowledge of Russian they "often suffer from depression" and sometimes have "a negative attitude towards [military] service." [192] If this is the kind of experience Central Asian youth have in the military, it may also reinforce their reluctance to move to a Russian ambience once they have returned home.

VI. Conclusion

The overwhelming weight of the evidence indicates that migration of labor from Central Asia to the labor-deficit areas of the U.S.S.R. will not be on the scale required to offset the anticipated multi-millions labor shortage in European Russia during the 1980's. Whether enough machinery can be purchased abroad or manufactured at home to modernize the Soviet industrial plant, enough foreign labor imported, and enough increase in labor productivity attained to make up for the impending shortage of workers are the major imponderables. These seem to be the key elements of current Soviet economic development strategy for the future. It is doubtful, however, whether they will be entirely successful. Rather, it can be expected that there will be further retardation in the rate of economic growth in the Soviet Union during the 1980's. The implications that such a reduction in economic growth would have for the allocation of resources between investment, consumption, and defense are beyond the scope of this paper.

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[189] Pravda vostoka, Jan. 31, 1979, abstracted in RFE/RL, Current Abstracts and Annotations, 1979, p. 3.
[190] Abuzyarov, "Language," 1978, pp. 64–69. Ann Sheehy made the first Western use of this source in her "Language," 1978, 9 pp.
[191] Abuzyarov, "Language," 1978, p. 65.
[192] Ibid.

APPENDIX A

APPENDIX TABLES

APPENDIX TABLE 1.—POPULATION OF THE U.S.S.R. AND SELECTED REPUBLICS, SELECTED YEARS, 1950–2000

(In thousands; as of July 1, figures may not add due to rounding)

Republic	1950		1960		1970		1980		1990		2000	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
U.S.S.R.	180,075	100.0	214,329	100.0	242,756	100.0	266,304	100.0	290,235	100.0	308,893	100.0
R.S.F.S.R.	102,191	56.7	119,906	55.9	130,360	53.7	138,369	52.0	145,026	50.0	147,948	47.9
Central Asia and Kazakhstan	17,499	9.7	24,402	11.4	33,187	13.7	42,126	15.8	53,270	18.3	64,552	20.9
Kazakhstan	6,628	3.7	9,850	4.6	13,116	5.4	15,504	5.8	18,287	6.3	20,610	6.7
Kirgiziya	1,740	1.0	2,172	1.0	2,968	1.2	3,737	1.4	4,693	1.6	5,661	1.8
Tadzhikistan	1,532	.9	2,082	1.0	2,943	1.2	3,979	1.5	5,278	1.8	6,657	2.2
Turkmenistan	1,210	.7	1,594	.7	2,190	.9	2,917	1.1	3,814	1.3	4,768	1.5
Uzbekistan	6,389	3.5	8,704	4.1	11,970	4.9	15,989	6.0	21,198	7.3	26,856	8.7
Transcaucasus	7,777	4.3	9,921	4.6	12,393	5.1	14,485	5.4	17,119	5.9	19,417	6.3
Armenia	1,354	.8	1,867	.9	2,518	1.0	3,074	1.2	3,659	1.3	4,122	1.3
Azerbaydzhan	2,896	1.6	3,894	1.8	5,166	2.2	6,218	2.3	7,689	2.6	9,074	2.9
Georgia	3,527	2.0	4,160	1.9	4,709	1.9	5,198	2.0	5,771	2.0	6,221	2.0

Note: Unless otherwise indicated, all appendix tables are derived from data found in the standard Soviet statistical yearbooks and census volumes, or from plan reports for the U.S.S.R. as a whole and for individual republics.

Source: 1950, 1960: TsSU SSSR, Naseleniye SSSR (chislennost', sostav i dvizheniye naseleniya.) 1973, Statisticheskiy sbornik, Moscow, Statistika, 1975, pp. 10–11. 1970: TsSU SSSR, Nar. khoz SSSR v 1970, p. 12. 1980–2000: Estimates and projections prepared by the Foreign Demographic Analysis Division, U.S. Bureau of the Census, in March 1977.

APPENDIX TABLE 2.—MUSLIMS IN THE U.S.S.R., BY LANGUAGE GROUP, 1939–70

Language group	1939	1959	1970
Total	20,669,000	24,743,723	35,083,690
Turkic	17,601,600	21,104,170	29,843,808
Uzbeks	4,844,000	6,015,416	9,195,093
Tatars	4,300,000	4,967,701	5,930,670
Kazakhs	3,099,000	3,621,610	5,298,818
Azeris	2,275,000	2,939,728	4,379,937
Turkmen	812,000	1,001,585	1,525,284
Kirgiz	884,000	968,659	1,452,222
Bashkirs	843,000	989,040	1,239,681
Karakalpaks	186,000	172,556	236,000
Kumyks	95,000	134,967	188,792
Uyghurs	109,000	95,208	173,276
Karachays	76,000	81,403	112,741
Balkars	42,600	42,408	59,501
Nogays	36,000	38,583	51,784
Turks	NA	35,306	NA
Iranian	1,697,000	1,910,256	2,774,228
Tadzhiks	1,229,000	1,396,939	2,135,883
Osetins	354,000	412,592	488,039
Kurds	46,000	58,799	88,930
Iranians	39,000	20,766	27,501
Tats	[1] 29,000	11,463	17,109
Baluches	NA	7,842	12,582
Afghans	NA	1,855	4,184
Ibero-caucasian	1,343,000	1,694,124	2,422,608
Chechens	408,000	418,756	612,674
Kabardians	164,000	203,620	279,928
Ingushes	92,000	105,980	157,605
Adygeis	[2] 88,000	79,631	99,855
Abkhaz	59,000	65,430	83,240
Cherkess	([3])	30,453	39,785
Abazins	[3] 14,000	19,591	25,448
Dagestanians	518,800	770,663	1,124,073
Avars	[3] 167,000	270,394	396,297
Lezghins	[3] 134,000	223,129	323,829
Dargins	126,000	158,149	230,932
Laks	40,000	63,529	85,822
Tabasarans	28,000	34,700	55,188
Rutuls	13,000	6,732	12,071
Tsakhurs	3,300	7,321	11,103
Aguls	7,500	6,709	8,831
Other	26,600	35,173	43,046
Dungans	4,600	21,928	38,644
Arabs	22,000	7,987	NA
Albanians	NA	5,258	4,402

NA—Not available.
[1] In 1926.
[2] Reported as a combined figure for the 2 groups.
[3] In 1926.

Source: The listing and structure of the table, as well as the 1939 data, are based on Alexandre Bennigsen, "Islamic or Local Consciousness Among Soviet Nationalities," in Edward Allworth (Ed.), Soviet Nationality Problems, New York and London, Columbia University Press, 1971, pp. 170–173. All 1959 and 1970 data, except for the number of Turks and Arabs, are from TsSU SSSR, Itogi Vsesoyuznoy perepisi naseleniya 1970 goda. vol. IV, Natsional'nyy sostay naseleniya SSSR Moscow, Statistika, 1973, pp. 9–11. The 1959 data for Turks and Arabs are from table 53 of TsSU SSSR, Itogi Vsesoyuzony perepisi naseleniya 1959 goda; SSSR, sovdnyy tom, Moscow, Gosstatizdat, 1962, pp. 184–189. Also see a similar but slightly less complete table for 1959, in Geoffrey Wheeler, "The Muslims of Central Asia," Problems of Communism, vol. XVI, p. 5. September-October 1967, p. 74.

APPENDIX TABLE 3.—ANNUAL AVERAGE NUMBER OF WORKERS AND EMPLOYEES AND COLLECTIVE FARMERS IN THE U.S.S.R., R.S.F.S.R., CENTRAL ASIA, AND KAZAKHSTAN, 1950–75

[In thousands; percents may not add to total due to rounding]

	1950		1960		1965		1970		1975	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Total (workers and employees plus collective farmers) U.S.S.R.	67,725	100	83,765	100	95,559	100	106,901	100	117,333	100
Of which:										
R.S.F.S.R.	40,484	60	48,731	58	54,817	57	60,679	57	66,154	56
Central Asia and Kazakhstan	5,961	9	7,900	9	9,645	10	11,217	10	13,064	11
Kazakhstan	2,256	3	3,542	4	4,384	5	4,942	5	5,655	5
Kirgizya	519	1	645	1	833	1	995	1	1,140	1
Tadzhikistan	502	1	614	1	729	1	849	1	1,010	1
Turkmenistan	441	1	534	1	607	1	722	1	869	1
Uzbekistan	2,243	3	2,565	3	3,092	3	3,709	3	4,390	4
Industry (workers and employees) U.S.S.R.	15,317	100	22,620	100	27,447	100	31,593	100	34,054	100
Of which:										
R.S.F.S.R.	10,827	71	15,139	67	17,846	65	20,206	64	21,420	63
Central Asia and Kazakhstan	780	5	1,175	5	1,589	6	2,057	7	2,353	7
Kazakhstan	365	2	561	2	773	3	1,048	3	1,161	3
Kirgizya	66	0	107	0	148	1	204	1	240	1
Tadzhikistan	44	0	74	0	104	0	131	0	153	0
Turkmenistan	51	0	67	0	79	0	91	0	102	0
Uzbekistan	254	2	366	2	485	2	583	2	697	2
Agriculture (workers and employees plus collective farmers) U.S.S.R.	30,737	100	28,526	100	27,348	100	25,895	100	25,438	100
Of which:										
R.S.F.S.R.	15,869	52	13,396	47	12,503	46	11,384	44	10,885	43
Central Asia and Kazakhstan	3,463	11	3,534	12	3,707	14	3,696	14	4,019	16
Kazakhstan	1,087	4	1,306	5	1,389	5	1,240	5	1,341	5
Kirgizya	315	1	287	1	326	1	331	1	349	1
Tadzhikistan	344	1	325	1	325	1	331	1	368	1
Turkmenistan	242	1	287	1	296	1	335	1	332	1
Uzbekistan	1,475	5	1,329	5	1,371	5	1,459	6	1,629	6

Source: Appendix tables 3–8 and 11–13 are based on various statistical yearbooks, plans, and plan fulfillment reports.

APPENDIX TABLE 4.—AVERAGE ANNUAL RATES OF GROWTH OF NEW FIXED CAPITAL INVESTMENT, BY REPUBLIC, 1961–65 TO 1971–75

[In percent]

Republic	1961–65	1966–70	1971–75
U.S.S.R.	6.3	7.6	7.0
R.S.F.S.R.	5.2	7.7	7.6
Ukraine	5.8	6.7	6.2
Central Asia and Kazakhstan:			
Kazakhstan	8.1	5.8	5.0
Kirgiziya	10.1	8.3	3.8
Tadzhikistan	12.0	4.4	5.9
Turkmenistan	8.9	8.5	8.1
Uzbekistan	12.7	8.5	7.0

APPENDIX TABLE 5.—ANNUAL AVERAGE PER CAPITA NEW FIXED CAPITAL INVESTMENT, BY REPUBLIC, 1961–65 TO 1971–75

[In rubles]

Republic	1961–65	1966–70	Annual average change (1966–70/1961–65)	1971–75	Annual average change (1971–75/1966–70)
R.S.F.S.R.	1,073	1,413	5.7	1,938	6.5
Ukraine	862	1,114	5.3	1,455	5.5
Central Asia and Kazakshtan	5,056	6,414	4.9	7,895	4.2
Kazakshtan	1,514	1,692	2.2	1,854	1.8
Kirgiziya	785	1,027	5.5	1,348	5.6
Tadzhikistan	822	978	3.5	1,222	4.6
Turkmenistan	1,140	1,560	6.5	2,054	5.7
Uzbekistan	795	1,157	7.8	1,417	4.1

APPENDIX TABLE 6.—DIFFERENCES IN NATIONAL INCOME AND INDUSTRIAL PRODUCTION PER CAPITA, BY REPUBLIC, 1960, 1970, AND 1975

[Percent above or below national average]

Republic	Per capita national income			Per capita industrial production		
	1960	1970	1975	1960	1970	1975
R.S.F.S.R.	11	14	17	13	14	15
Central Asia and Kazakhstan:						
Kazakhstan	−26	−29	−38	−44	−44	−46
Kirgiziya	−35	−40	−47	−49	−41	−41
Tadzhikistan	−45	−53	−57	−52	−60	−65
Turkmenistan	−26	−49	−55	−53	−65	−66
Uzbekistan	−33	−47	−49	−50	−64	−65

APPENDIX TABLE 7.—AVERAGE ANNUAL RATES OF GROWTH OF NATIONAL INCOME, 1961–65 TO 1976–80

[In percent]

Republic	1961–65 actual	1966–70 actual	1971–75		1976–80 planned
			Planned	Actual	
U.S.S.R.	6.5	7.7	6.8	5.7	5.8
R.S.F.S.R.	6.2	8.0	7.0	5.8	5.8
Central Asia and Kazakhstan:					
Kazakhstan	5.5	10.3	7.3	4.0	6.7
Kirgiziya	8.4	7.7	7.0	4.7	NA
Tadzhikistan	9.3	6.5	6.3	6.2	NA
Turkmenistan	5.5	5.7	6.5	5.3	4.7
Uzbekistan	7.7	6.8	7.3	6.9	5.7

NA—Not available.

APPENDIX TABLE 8.—AVERAGE ANNUAL RATE OF GROWTH OF INDUSTRIAL PRODUCTION, 1961–65 TO 1976–80

[In percent]

Republic	1961–65 actual	1966–70 actual	1971–75		1976–80 planned
			Planned	Actual	
U.S.S.R.	8.6	8.4	8.0	7.4	6.3
R.S.F.S.R.	7.6	8.2	8.0	7.3	6.3
Central Asia and Kazakhstan:					
Kazakhstan	10.5	9.2	9.7	7.3	7.0
Kirgiziya	10.8	13.0	9.2	8.8	6.5
Tadzhikistan	8.8	8.4	6.7	6.8	6.8
Turkmenistan	6.4	8.4	10.4	9.2	5.4
Uzbekistan	8.4	5.9	8.6	8.8	6.3

APPENDIX TABLE 9.—NATIONALITY COMPOSITION OF THE POPULATION OF THE U.S.S.R. AND THE UNION REPUBLICS, 1970

[In percent]

Union republics	Total population	Russians	Ukrainians	Belorussians	Uzbeks	Kazakhs	Georgians	Azerbaydzhans	Lithuanians	Moldavians	Latvians	Kirgiz	Tadzhiks	Armenians	Turkmen	Estonians	Tatars	Jews	Other nationalities
U.S.S.R.	100	53.4	16.9	3.7	3.8	2.2	1.3	1.8	1.1	1.1	0.6	0.6	0.9	1.5	0.6	0.4	2.4	0.9	6.8
R.S.F.S.R.	100	82.8	2.6	.7	(1)	.4	.1	.1	(1)	.1	(1)	(1)	(1)	.2	(1)	(1)	3.7	.6	8.7
Ukrainian SSR	100	19.4	74.9	.8	(1)	(1)	(1)	(1)	(1)	.6	(1)	(1)	(1)	(1)	(1)	(1)	(1)	1.6	2.7
Belorussian SSR	100	10.4	2.1	81.0	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	1.6	4.9
Uzbek SSR	100	12.5	.9	(1)	65.5	4.0	(1)	(1)	(1)	(1)	(1)	.9	3.8	(1)	.6	(1)	4.9	.9	6.9
Kazakh SSR	100	42.4	7.2	1.5	1.7	32.6	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	2.2	(1)	12.4
Georgian SSR	100	8.5	1.1	(1)	(1)	(1)	66.8	4.6	(1)	(1)	(1)	(1)	(1)	9.7	(1)	(1)	(1)	1.2	8.1
Azerbaydzhan SSR	100	10.0	(1)	(1)	(1)	(1)	(1)	73.8	(1)	(1)	(1)	(1)	(1)	9.4	(1)	(1)	(1)	(1)	6.8
Lithuanian SSR	100	8.6	.8	1.5	(1)	(1)	(1)	(1)	80.1	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	.8	8.2
Moldavian SSR	100	11.6	14.2	(1)	(1)	(1)	(1)	(1)	(1)	64.6	(1)	(1)	(1)	(1)	(1)	(1)	(1)	2.7	6.9
Latvian SSR	100	29.8	2.3	4.0	(1)	(1)	(1)	(1)	1.7	(1)	56.8	(1)	(1)	(1)	(1)	(1)	(1)	1.6	3.8
Kirgiz SSR	100	29.2	4.1	(1)	11.3	.8	(1)	(1)	(1)	(1)	(1)	43.8	.7	(1)	(1)	(1)	2.4	(1)	7.7
Tadzhik SSR	100	11.9	1.1	(1)	23.0	.3	(1)	(1)	(1)	(1)	(1)	1.2	56.2	(1)	.4	(1)	2.4	.5	3.0
Armenian SSR	100	2.7	(1)	(1)	(1)	(1)	(1)	5.9	(1)	(1)	(1)	(1)	(1)	88.6	(1)	(1)	(1)	(1)	2.8
Turkmenian SSR	100	14.5	1.6	(1)	8.3	3.2	(1)	(1)	(1)	(1)	(1)	(1)	(1)	1.1	65.6	(1)	1.7	(1)	4.0
Estonian SSR	100	24.7	2.1	1.4	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	68.2	(1)	.4	3.2

[1] Not available.

Source: A. Ya. Boyarskiy (Ed.). Naseleniye SSSR, spravochnik, Moscow, Politizdat, 1974, pp. 90–91.

APPENDIX TABLE 10.—RURAL POPULATION AS A PERCENT OF TOTAL POPULATION AND TOTAL NATIONALITY BY REPUBLIC AND BY NATIONALITY, 1959 AND 1970

Republic	Total republic population		Nationality population		Nationality within titular republic		Nationality
	1959	1970	1959	1970	1959	1970	
	(1)	(2)	(3)	(4)	(5)	(6)	
U.S.S.R.	52.1	43.7	52.1	43.7	(1)	(1)	
Baltic republics	51.7	42.6	58.7	49.9	59.7	50.8	Baltic nationalities.
Estonia	43.5	35.0	52.9	44.9	53.1	45.3	Estonians.
Latvia	43.9	37.5	52.5	47.3	53.3	48.3	Latvians.
Lithuania	61.4	49.8	64.9	53.3	66.4	54.1	Lithuanians.
R.S.F.S.R.	47.6	37.7	42.3	32.0	45.1	34.4	Russians.
Belorussia	69.2	56.6	67.6	56.3	74.5	62.9	Belorussians.
Ukraine	54.3	45.5	60.8	51.5	63.4	54.2	Ukrainians.
Moldavia	77.7	68.3	87.1	79.6	90.4	82.8	Moldavians.
Transcaucasian republics	54.1	48.9	57.6	51.1	60.5	53.0	Transcaucasians.
Georgia	57.6	52.2	63.9	56.0	65.1	57.2	Georgians.
Armenia	50.0	40.5	43.4	35.2	47.8	37.3	Armenians.
Azerbaydzhan	52.2	49.9	65.2	60.3	63.7	58.7	Azerbaydzhani.
Kazakhstan	56.2	49.7	75.9	73.3	75.7	73.7	Kazakhs.
Central Asia	65.1	61.9	79.1	75.3	80.2	76.5	Central Asians.
Uzbekistan	66.4	63.4	78.2	75.1	79.8	77.0	Uzbeks.
Turkmenia	53.8	52.1	74.6	79.0	73.7	68.3	Turkmen.
Kirgiziya	66.3	62.6	89.2	85.4	89.0	85.5	Kirgiz.
Tadzhikistan	67.4	62.9	79.4	74.0	80.4	74.5	Tadzhiks.

[1] Not applicable.

Source: Murray Feshbach and Stephen Rapawy, "Soviet Population and Manpower Trends and Policies," in U.S. Congress, Joint Economic Committee, Soviet Economy in a New Perspective, Washington, D.C., 1976, p. 127.

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APPENDIX TABLE 11.—EDUCATIONAL ATTAINMENT IN THE U.S.S.R. AND IN SELECTED NATIONALITY GROUPS, 1959 AND 1970

	Number per 1,000 persons 10 yrs of age and over with given level of education								Percent of the national rates							
	Higher		Incomplete higher		Specialized secondary		General secondary		Higher		Incomplete higher		Specialized secondary		General secondary	
	1959	1970	1959	1970	1959	1970	1959	1970	1959	1970	1959	1970	1959	1970	1959	1970
U.S.S.R. (urban and rural):																
Both sexes	23	42	11	13	48	68	61	119	100	100	100	100	100	100	100	100
Males	27	48	12	15	48	65	63	125	100	100	100	100	100	100	100	100
Females	20	37	10	12	49	71	60	114	100	100	100	100	100	100	100	100
Russians:																
Both sexes	25	45	11	14	57	80	63	117	109	107	100	108	119	118	103	98
Males	28	50	12	15	56	72	60	115	104	104	100	100	117	111	95	92
Females	23	42	11	13	59	85	65	118	115	114	110	108	120	120	108	104
Central Asians:																
Kazakhs:																
Both sexes	11	29	10	13	20	34	50	115	48	69	91	100	42	50	82	97
Males	18	41	15	16	31	41	72	134	67	85	125	107	65	63	114	107
Females	4	17	5	10	11	28	31	96	20	46	50	83	22	39	52	84
Kirgiz:																
Both sexes	9	26	12	12	17	27	54	125	39	62	109	92	34	40	89	105
Males	15	39	18	15	26	35	85	156	56	81	150	100	54	54	135	125
Females	4	14	6	8	9	20	28	97	20	38	60	67	18	28	47	85
Tadzhiks:																
Both sexes	8	21	8	11	17	21	43	117	35	50	73	85	35	31	70	98
Males	13	35	14	17	28	33	66	147	48	73	117	113	58	51	105	118
Females	2	7	3	5	6	10	21	86	10	19	30	42	12	14	35	75
Turkmen:																
Both sexes	11	25	8	11	17	24	48	112	48	60	73	85	35	35	79	94
Males	20	42	14	17	29	39	70	132	74	88	117	113	60	60	111	106
Females	3	9	3	5	5	10	26	92	15	24	30	42	10	14	43	81
Uzbeks:																
Both sexes	9	24	8	13	15	24	57	138	39	57	73	100	31	35	93	116
Males	15	37	12	19	23	33	87	176	56	77	100	127	48	51	138	141
Females	3	12	4	8	7	15	28	101	15	32	40	67	14	21	47	89

APPENDIX TABLE 12.—EDUCATIONAL ATTAINMENT OF THE RURAL POPULATION OF THE U.S.S.R. AND SELECTED NATIONALITY GROUPS, 1959 AND 1970

	Number per 1,000 persons 10 yr of age and over with given level of education								Percent of the national rates							
	Higher		Incomplete higher		Specialized secondary		General secondary		Higher		Incomplete higher		Specialized secondary		General secondary	
	1959	1970	1959	1970	1959	1970	1959	1970	1959	1970	1959	1970	1959	1970	1959	1970
U.S.S.R.:																
Both sexes	7	14	5	5	29	36	31	67	100	100	100	100	100	100	100	100
Males	9	18	5	5	31	34	37	80	100	100	100	100	100	100	100	100
Females	6	11	4	4	29	39	26	57	100	100	100	100	100	100	100	100
Russians:																
Both sexes	9	15	5	5	37	45	28	54	129	107	100	100	128	125	90	81
Males	10	16	5	5	36	36	31	60	111	89	100	100	116	106	84	75
Females	7	14	6	5	38	51	27	50	117	127	150	120	131	131	104	88
Central Asians:																
Kazakhs:																
Both sexes	7	19	6	6	19	30	38	42	100	136	120	120	66	83	123	137
Males	12	29	10	8	30	37	57	112	133	161	200	160	97	109	154	140
Females	2	10	3	4	9	23	22	74	33	91	75	100	31	59	85	130
Kirgiz:																
Both sexes	6	19	8	6	15	24	41	104	86	136	160	120	52	67	132	155
Males	10	29	14	9	24	33	67	135	111	161	280	180	77	97	181	169
Females	2	9	3	4	8	16	19	77	33	82	75	100	28	41	73	135
Tadzhiks:																
Both sexes	4	14	6	6	15	18	32	100	57	100	120	120	52	50	103	149
Males	8	26	10	10	27	31	50	124	89	144	200	200	87	91	135	155
Females	1	3	1	2	4	6	16	77	17	27	25	50	14	15	62	135
Turkmen:																
Both sexes	7	17	5	5	14	19	36	101	100	121	100	100	48	53	116	151
Males	14	31	9	9	25	33	53	117	156	172	180	180	81	97	143	146
Females	1	4	1	2	4	7	22	87	17	36	25	50	14	18	85	152
Uzbeks:																
Both sexes	5	17	4	7	12	20	46	123	71	121	80	140	41	56	148	184
Males	9	29	8	11	21	30	74	160	100	161	160	220	68	88	200	200
Females	1	5	1	3	4	10	20	88	17	45	25	75	14	26	77	154

APPENDIX TABLE 13.—NUMBER OF STUDENTS IN VOCATIONAL-TECHNICAL EDUCATIONAL SCHOOLS, 1950–74

[In thousands]

Republic	1950	1960	1970	1974	Annual average rate of change 1960/50	1970/60	1974/70
U.S.S.R.	520.0	1,035.0	2,380.0	2,956.0	7.1	8.7	5.6
R.S.F.S.R.	NA	674.0	1,406.0	1,612.0	NA	7.6	3.5
Central Asia and Kazakhstan	NA	110.3	261.4	347.5	NA	9.0	7.4
Kazakhstan	NA	73.5	157.8	204.8	NA	7.9	6.7
Kirgiziya	2.0	7.7	24.4	34.7	14.4	12.2	11.5
Tadzhikistan	NA	6.7	17.1	20.3	NA	9.8	5.9
Turkmenistan	1.9	4.4	14.2	16.2	8.8	11.2	4.5
Uzbekistan	NA	18.0	47.9	71.5	NA	10.3	14.4

NA—Not available.

APPENDIX TABLE 14.—NUMBER OF VOCATIONAL-TECHNICAL SCHOOL GRADUATES, U.S.S.R. AND BY REPUBLIC 1950–75

[In thousands]

Republic	1950	1960	1965	1970	1975
U.S.S.R.	493.4	741.1	1,100.4	1,638.2	2,094.3
R.S.F.S.R.	315.4	444.8	699.6	994.6	1,230.1
Central Asia and Kazakhstan	28.1	93.3	128.3	195.5	285.1
Kazakhstan	18.4	68.2	88.7	117.8	160.9
Kirgiziya	1.7	5.6	7.8	16.9	24.9
Tadzhikistan	1.2	5.9	5.9	12.2	13.9
Turkmenistan	1.3	3.5	4.8	6.8	10.7
Uzbekistan	5.5	10.1	21.1	41.8	74.7

APPENDIX TABLE 15.—ESTIMATES AND PROJECTIONS OF THE NUMBER OF 18-YEAR OLD MALES IN THE U.S.S.R., R.S.F.S.R., CENTRAL ASIA, KAZAKHSTAN, AND TRANSCAUCASUS, 1970–2000

[In thousands, except percent]

Year	U.S.S.R.	R.S.F.S.R.	Central Asia, Kazakhstan and Transcaucasus	Central Asia and Kazakhstan	Central Asia	Kazakhstan	Transcaucasus	Central Asia, Kazakhstan and Transcaucasus as a percent of U.S.S.R.	Central Asia and Kazakhstan as a percent of U.S.S.R.	R.S.F.S.R. as a percent of U.S.S.R.	Central Asia, Kazakhstan and Transcaucasus as a percent of R.S.F.S.R.
1970	2,229	1,258	411	301	171	130	110	18.4	13.5	56.4	32.7
1971	2,247	1,264	430	312	185	127	118	19.1	13.9	56.7	34.0
1972	2,174	1,226	424	312	185	127	112	19.5	14.4	56.4	34.6
1973	2,410	1,327	485	354	213	141	131	20.1	14.7	55.1	36.5
1974	2,469	1,345	534	392	244	148	142	21.6	15.9	54.5	39.7
1975	2,465	1,301	556	408	257	151	148	22.6	16.6	52.8	42.7
1976	2,526	1,327	577	425	265	160	152	22.8	16.8	52.5	43.5
1977	2,593	1,335	608	447	280	167	161	23.4	17.2	51.5	45.5
1978	2,619	1,330	630	461	287	174	169	24.1	17.6	50.8	47.4
1979	2,674	1,354	663	492	312	180	171	24.8	18.4	50.6	49.0
1980	2,601	1,296	670	497	315	182	173	25.8	19.1	49.8	51.7
1981	2,484	1,206	663	494	316	178	169	26.7	19.9	48.6	55.0
1982	2,383	1,132	661	491	321	170	170	27.7	20.6	47.4	58.4
1983	2,236	1,030	652	485	325	160	167	29.2	21.7	46.1	63.3
1984	2,111	979	620	465	306	159	155	29.4	22.0	46.4	63.3
1985	2,102	962	618	466	310	156	152	29.4	22.2	45.8	64.2
1986	2,024	906	606	462	310	152	144	29.9	22.8	44.8	66.9
1987	2,016	886	623	478	329	149	145	30.9	23.7	43.9	70.3
1988	2,007	895	612	474	325	149	138	30.5	23.6	44.6	68.4
1989	2,056	913	626	481	333	148	145	30.4	23.4	44.4	68.6
1990	2,128	949	650	505	352	153	145	30.5	23.7	44.6	68.5
1991	2,143	969	641	502	348	154	139	29.9	23.4	45.2	66.2
1992	2,132	961	657	516	361	155	141	30.8	24.2	45.1	68.4
1993	2,204	1,000	680	538	375	163	142	30.9	24.4	45.4	68.0
1994	2,234	1,013	695	551	386	165	144	31.1	24.7	45.3	68.6
1995	2,286	1,032	723	573	402	171	150	31.6	25.1	45.1	70.1
1996	2,336	1,054	743	588	414	174	155	31.9	25.2	45.1	70.5
1997	2,389	1,076	766	606	428	178	160	32.1	25.4	45.0	71.2
1998	2,441	1,095	789	624	441	183	165	32.3	25.6	44.9	72.1
1999	2,488	1,111	814	643	456	187	171	33.6	26.6	44.7	73.3
2000	2,529	1,121	837	661	470	191	176	33.1	26.1	44.3	74.7

Source: Unpublished estimates and projections prepared by the Foreign Demographic Analysis Division, U.S. Bureau of the Census, in March 1977.

Appendix B

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R. & D. EMPLOYMENT IN THE U.S.S.R.—DEFINITIONS, STATISTICS, AND COMPARISONS

(By Louvan E. Nolting and Murray Feshbach*)

CONTENTS

FIGURE

TABLES

* Foreign Demographic Analysis Division, U.S. Bureau of the Census. This paper is a condensation of a larger report to be published later this year by the Foreign Demographic Analysis Division, Bureau of the Census, U.S. Department of Commerce.

I. INTRODUCTION

In the face of labor shortages, the growing inaccessability of raw materials, rising capital needs and defense expenditures, and increasing economic complexity, the Soviets are relying heavily on scientific and technical progress to sustain economic growth. In viewing Soviet economic prospects, therefore, it is important to assess the nature and extent of the current Soviet investment in the development of science. The purpose of this paper is to provide a basis for this assessment by reviewing and analyzing data on the number and composition of persons engaged in research and development (R. & D.) in the Soviet Union and by making a preliminary comparison of Soviet and U.S. data on R. & D. employment.

The two main Soviet statistical series which include the numbers of R. & D. personnel are the series on employment in the "science

and science services" branch of the economy and the series on "scientific workers." The first covers employment in independent scientific organizations engaged in R. & D. and science services—that is, organizations directly subordinate to economic branch ministries and to the academies of sciences. The second covers all persons with advanced scientific degrees and titles, teachers in higher educational institutions, research managers, and scientists and engineers with higher education whose primary activity is research or general R. & D. under science plans approved by higher authority. The first series serves in this paper as the basis for estimating numbers of personnel engaged in conducting and supporting R. & D.; the second series is used to calculate personnel directly conducting R. & D. For the purposes of indicating personnel in "pure" R. & D. and making comparisons with Western R. & D. personnel, both series are deficient in that they include some non-R. & D. employment and exclude some contributors to R. & D. These inclusions and exclusions are shown in figure 1.

Section II of this paper describes the organizational composition and employment categories of the "science and science services" branch and of other sectors employing R. & D. personnel. Section III analyzes the "scientific worker" category and presents distributions of this category by function, place of work, and branch of science.

In section IV, the Soviet data on R. & D. personnel are adjusted to facilitate comparison with U.S. data, and the adjusted Soviet data are compared with U.S. figures with respect to total employment in R. & D., R. & D. employment trends since 1950, R. & D. employment in higher educational institutions, and distribution of R. & D. personnel by branch of science.

TABLE 1.—SCOPE AND COVERAGE OF SOVIET STATISTICAL SERIES OF R. & D. PERSONNEL

Personnel	Statistical series: Science and science services (branch definition)	Statistical series: Scientific workers (functional definition)
R. & D. personnel:		
In independent scientific organizations:		
Conducting R. & D.	Included in series.	Included in series.
Supporting R. & D.	do.	Excluded from series.
In higher education institutions:		
Conducting R. & D.	Excluded from series.	Included in series.
Supporting R. & D.	do.	Excluded from series.
In industrial enterprises:		
Conducting R. & D.	do.	Included in series.
Supporting R. & D.	do.	Excluded from series.
In central state administrations:		
Conducting (supervising and planning) R. & D.	do.	Included in series.
Supporting R. & D.	do.	Excluded from series.
Graduate students	do.	Do.
Science administrators	Included in series.	Included in series.
Personnel not in R. & D. or only partly in R. & D.:		
Teachers in higher educational institutions	Excluded from series.	Do.
Social scientists and humanities specialists	Included in series.	Do.
Employees in hydrometeorological and geological organizations	do.	Excluded from series.

II. Employment in Organizations Conducting and Supporting R. & D.

A. Organizations Conducting and Supporting R. & D.

The largest Soviet statistical category under which scientific personnel are reported is employment in the branch of the national economy

officially designated as "science and science services" (*nauka i nauchnoye obsluzhivaniye*). Science and science services embraces most of what are called "scientific organizations" (*nauchnyye organizatsii* or NO's), i.e., specialized organizations not incorporated into other economic enterprises or social institutions, which conduct or provide services for scientific research, development, and innovation.

Scientific organizations are divided into two categories: (1) "scientific institutions" (*nauchnyye uchrezhdeniya*); and (2) a wide variety of organizations that do not carry out scientific research but are involved in development (*opytno-konstruktorskiye raboty* or OKR—literally "test-design work"), production and testing of prototypes and development of new processes, and the provision of data and services required by scientific institutions. The first category includes only those institutions which meet the following criteria: (*a*) They "systematically conduct" scientific research work (*nauchno-issledovatel'skiye raboty* or NIR) in a field of science, including the social sciences and humanities; (*b*) they work under science plans officially approved by higher authority; (*c*) they are funded under planned financing for "science" (*nauka*); and (*d*) they are staffed by "scientific workers" (*nauchnyye rabotniki*).[1] The major types of scientific organizations and other organizations engaged in R. & D. and innovation are listed in appendix A.

Table 1 shows the total number of Soviet scientific institutions and their distribution by major type. As the table indicates, the number of scientific institutions has increased by over 50 percent, from 3,447 in 1950 to 5,327 in 1975. This growth is primarily a reflection of the increase in scientific research institutes. The sharp drop in the number of institutions under the academy system in 1961 and 1962 is a consequence of the transfer of most academy scientific research institutes engaged in technical and industrial research to the jurisdiction of agencies in charge of branches of the economy. Table 2 presents a more detailed breakdown of types of scientific institutions for the years for which data are available during the period from 1950 to 1974. The most significant changes are the twofold increase in the number of scientific research institutes and the drop in the number of independent design bureaus engaged in scientific research. Table 3 shows the distribution of branch scientific institutions by separate branches or groups of branches of the national economy for 1973,[2] the only year for which such detailed data are available.

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[1] Serov, "Classification," 1973, p. 132. The distinction explained here between a "scientific organization" and a "scientific institution" is implicit in the textual commentary of a number of authors. For example, see Ksenofontov and Mayevsky, *Kommentariv*, 1973, pp. 5–8; Zavlin et al., *Trud*, 1973, p. 33; and Zaytsev and Lapin, *Organizatsiva*, 1970, p. 47. Scientific institutions are also infrequently referred to as scientific research institutions (*nauchno-issledovatel'skiye uchrezhdeniya*—NIU's). See Duzhenkov, "The Scientific," 1976, p. 37.

[2] The number of institutions within a branch is not necessarily an indication of the proportion of persons employed in science in the branch. Because of the large size of many industrial scientific organizations, industry's share of employment is much greater than its share of institutions.

TABLE 1.—NUMBER OF SCIENTIFIC INSTITUTIONS, BY MAJOR TYPE AND AFFILIATION, U.S.S.R., 1950–78

[At end of year]

Year	Total number of scientific institutions	Of which—scientific research institutes (NII's) including their affiliates and divisions	Higher educational institutions (VUZy)	Branch scientific institutions	Academy scientific institutions	Of which—		
						U.S.S.R. Academy of Sciences	Republic academies of sciences	Specialized branch academies [1]
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1950	3,447	1,157	880	NA	NA	NA	NA	NA
1951	3,784	1,190	887	NA	NA	NA	NA	NA
1952	3,692	1,192	827	NA	NA	NA	NA	NA
1953	3,621	1,198	818	NA	NA	NA	NA	NA
1954	3,593	1,196	798	NA	NA	NA	NA	NA
1955	3,562	1,210	765	NA	NA	NA	NA	NA
1956	3,523	1,264	767	2,018	738	195	295	248
1957	3,746	1,340	763	NA	NA	NA	NA	NA
1958	3,963	1,481	766	NA	NA	NA	NA	NA
1959	4,301	1,608	753	2,451	1,097	238	365	494
1960	4,196	1,728	739	2,349	1,108	241	389	478
1961	4,172	1,832	731	2,660	781	167	401	213
1962	4,476	1,911	738	3,026	712	166	421	125
1963	4,597	1,976	742	3,159	696	192	327	168
1964	4,651	2,019	754	3,208	689	194	327	177
1965	4,867	2,146	756	3,410	701	193	349	159
1966	NA	NA	767	NA	702	194	356	152
1967	NA	NA	785	NA	730	215	361	154
1968	4,865	2,313	794	3,291	751	226	370	155
1969	4,953	2,388	800	3,373	780	226	382	172
1970	5,182	2,525	805	3,517	860	234	392	234
1971	5,307	2,648	811	3,631	865	246	396	223
1972	5,367	2,697	825	3,676	866	247	395	224
1973	5,249	2,726	834	3,567	848	245	391	212
1974	5,269	2,773	842	3,576	851	245	391	215
1975	5,327	2,805	856	3,604	867	246	393	228
1976	NA	NA	859	NA	844	244	368	232
1977	NA	NA	861	NA	NA	NA	NA	NA
1978	NA	NA	867	NA	NA	NA	NA	NA

[1] For the years 1970 to 1976 the figures for this column exclude 2 VUZy under the U.S.S.R. Academy of the Arts. These VUZy are presumably included under the total for VUZy in col. 3.

NA—Not available.

Note: The figures in col. 1 for total number of scientific institutions are not entirely consistent because of changes in the data base since the 1950's, but, with adjustment, the changes are not substantial. The published figures for 1951–59 excluded VUZy (see Kul'turnoye stroitel'stvo SSSR, 1956, p. 245), which are added in this table, thus eliminating the largest inconsistency with later figures. Since 1960 VUZy have been included in the total figures. In 1971 the classification of scientific institutions was "refined" slightly, and this refinement is reflected in the number for 1965 and for 1970 and after. This change resulted in an increase of 197 institutions for 1970 (Zavlin et al., Trud, 1973, p. 33, and Nar. khoz. 70, p. 656).

Source: The sources for this and all tables following, except where explicitly noted, are not included here. All citations will be provided in a more detailed methodological report to be published by the Foreign Demographic Analysis Division later this year.

TABLE 2.—NUMBER OF SCIENTIFIC INSTITUTIONS, BY TYPE, U.S.S.R., 1950–74

[At end of year]

Type of scientific institution	1950	1955	1960	1965	1968	1970	1973		1974
							Total	Of which—U.S.S.R. and republic academies of sciences	
Total scientific institutions	3,447	3,562	4,196	4,867	4,865	5,182	5,249	636	5,269
Scientific research institutes, their affiliates and divisions	1,157	1,210	1,728	2,146	2,313	2,525	2,726	483	2,773
Higher educational institutions	880	765	739	756	794	805	834	0	842
Scientific and experimental stations	555	574	454	510	491	483	446	10	436
Scientific research laboratories	122	142	180	237	181	134	113	6	102
Design bureaus	NA	NA	NA	103	NA	42	31	NA	26
Academies of sciences, their affiliates, divisions, and scientific centers	NA	13	NA	30	NA	34	40	40	40
Observatories	NA	38	NA	12	NA	13	15	10	NA
Museums	364	392	435	442	452	468	462	10	458
Libraries	63	61	71	NA	87	NA	NA	NA	NA
Botanical gardens, forest preserves	NA	74	NA	27	NA	24	27	20	NA
Natural parks and wildlife preserves	NA		NA	37	NA	43	18	NA	NA
Testing fields, supporting stations, experimental bases	NA	184	NA	NA	NA	NA	NA	NA	NA
Other	306	109	589	567	547	611	537	97	592

NA—Not available.

Source: See source note to table 1.

TABLE 3.—DISTRIBUTION OF SCIENTIFIC INSTITUTIONS SUBORDINATE TO BRANCH MINISTRIES AND OTHER AGENCIES, BY BRANCH OF THE ECONOMY, U.S.S.R., 1973

[In percent]

National economic branch	Percent of all branch scientific institutions[1]
Total	100.0
Industry	34.1
Construction	2.6
Transportation and communications	1.5
Agriculture	21.3
Health services, sports, tourism, social security	8.7
Culture	14.9
Geology and mineral survey	1.7
Trade, personal services, and municipal economy	1.2
Others	14.0

[1] This distribution excludes VUZy and specialized branch academies doing scientific research under specific branches.

Source: Adapted from Duzhenkov, Problemy, 1978, p. 100.

An annual series of data on the number of scientific organizations that are not "scientific institutions" is not published, but sporadic and incomplete data are available. In 1973, for example, there were 944 independent design organizations, 913 of which were not engaged in research, and in 1969 one source reported a total of 1,089 independent experimental plants.[3]

[3] Glagoleva, "Economics," 1975, p. 120, and Omarov et al., *Nauchno-*, 1969, p. 165. Some sources report that there are about 5,000 scientific institutions and over 40,000 project-design organizations in the country. However, the latter figure evidently includes design organizations that are subordinate to other organizations, such as the nearly 25,000 design departments in industrial enterprises (Glagoleva, "Economics," 1975, p. 117, and Marchuk, "Scientific," 1972, p. 114).

B. Employment in the Science and Science Services Branch

Employment statistics in the science and science services branch of the economy cover both scientists ("scientific workers") and technical, clerical, and other support personnel in scientific organizations. Table 4 shows the number of workers and employees employed in the branch as a percentage of total employment in the Soviet Union. This proportion has climbed steadily during the past 25 years, signifying that employment in science and science services has increased far more rapidly than overall employment. As indicated in the table, employment in science and science services increased by 5.7 times between 1950 and 1975 (old series) and by 1.7 times between 1965 and 1977 (new series). In contrast, total employment increased by 2.6 times between 1950 and 1977 and by 1.4 times between 1965 and 1977.

TABLE 4.—TOTAL NUMBER OF WORKERS AND EMPLOYEES AND EMPLOYMENT IN SCIENCE AND SCIENCE SERVICES, U.S.S.R., 1950–77

[Annual average figures in thousands, except percent]

Year	Total workers and employees	Employed in science and science services		Percent employed in science and science services of total employed	
		Old series	New series [1]	Old series	New series [1]
	(1)	(2)	(3)	(4)	(5)
1950	40,420	714	NA	1.8	NA
1951	42,300	772	NA	1.8	NA
1952	43,900	829	NA	1.9	NA
1953	45,400	860	NA	1.9	NA
1954	49,100	926	NA	1.9	NA
1955	50,300	992	NA	2.0	NA
1956	51,900	1,094	NA	2.1	NA
1957	54,500	1,208	NA	2.2	NA
1958	55,505	1,338	NA	2.4	NA
1959	57,909	1,474	NA	2.5	NA
1960	62,032	1,763	NA	2.8	NA
1961	65,861	2,011	NA	3.1	NA
1962	68,300	2,213	NA	3.2	NA
1963	70,526	2,370	NA	3.4	NA
1964	73,258	2,497	NA	3.4	NA
1965	76,915	2,625	2,401	3.4	3.1
1966	79,709	2,741	NA	3.4	NA
1967	82,274	2,860	NA	3.5	NA
1968	85,100	2,990	NA	3.5	NA
1969	87,922	3,128	NA	3.6	NA
1970	90,186	3,238	2,999	3.6	3.3
1971	92,799	3,374	NA	3.6	NA
1972	95,242	3,544	NA	3.7	NA
1973	97,466	3,735	NA	3.8	NA
1974	99,780	3,864	NA	3.9	NA
1975	102,160	4,046	3,790	4.0	3.7
1976	104,235	NA	3,860	NA	3.7
1977	106,393	NA	3,969	NA	3.7

[1] The new series for personnel in science and science services was adopted in 1976 and projected back for selected years to 1965 by TsSU. This series excludes employees in agricultural experimental stations not conducting research; these employees are entirely accounted for by a corresponding addition to the state agricultural labor force.

NA—Not available.

Source: See source note to table 1.

There has been a slowdown in the growth of employment in science and science services between 1975 and 1977, however, resulting in a slight decrease in the rate of growth during the 1970's as a whole. For 5-year periods since 1952 employment in the branch increased as follows:

	Percent
1952–57	45.7
1957–62	83.2
1962–67	29.2
1967–72	23.9
1972–77	18.9

The number of employees in the science portion of the science and science services branch, that is, in those scientific organizations engaged in scientific research, has been estimated at about 70 percent of the branch. Those in the science services portion of the branch—that is, in organizations involved exclusively with development work or with other scientific ad technical services—constitute 30 percent.[4]

Distributions of employees in science and science services by type of scientific organization have not been published, with the exception of the hydrometeorological and geological survey organizations for years prior to 1967. These two groups of organizations employed 16.4 percent of all employees in the science and science services branch in 1967 as compared to 24.7 percent in 1960.[5] On the assumption that the share continued to decline after 1967 at the same rate, it would be about 10 percent today, meaning that approximately 20 percent of employees in the science and science services branch work in the other science services organizations of the branch (appendix A, category I–B).

The functional categories of work developed by Soviet science analysts provide a more detailed picture of the composition of Soviet R. & D. personnel. The following group of categories is most frequently used to disaggregate scientific personnel by function:[6] (1) Scientific workers; (2) scientific-technical personnel (*nauchno-tekhnicheskiy personal*); (3) production personnel (*proizvodstvennyy personal*); (4) minor service personnel or assistants in R. & D.; (5) administrative and other service personnel; (6) library personnel; (7) research trainees (*stazhery issledovateli*); (8) instructors; and (9) others, including security personnel.

In 1970, for which the most precise data are available, scientific workers comprised 17.8 percent of total employment in science and science services.[7] This proportion probably has not changed significantly in recent years as the rate of growth of scientific workers from 1970 to 1977 was only slightly higher than the overall rate of growth for employees in the science and science services branch. For the other functional categories of R. & D. personnel there are no published official statistics for the country as a whole. A distribution by functional categories for the U.S.S.R. Academy of Sciences, excluding the Siberian Division of the Academy, is shown in table 5.

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[4] Feshbach, "Notes," 1978, p. 16. The 70 percent employed in the science portion of science and science services includes all persons employed there, not only scientific workers.

[5] TsSU, *Trud v. SSSR*, 1968, pp. 24–25.

[6] Kugel', "Changes," 1973, p. 32, and Poshekhonov, "Total," 1970, pp. 95–96.

[7] This proportion was calculated by deducting from total scientific workers in 1970 (927,700) those in VUZy (348,800), industrial enterprise (30,300), and central administrative staffs and other organizations (14,300) and then dividing the remainder (534,300) by total employment (new series) in science and science services for 1970 (2,999,000).

TABLE 5.—DISTRIBUTION OF PERSONNEL IN THE INSTITUTIONS OF THE U.S.S.R. ACADEMY OF SCIENCES (EXCLUDING THE SIBERIAN DIVISION), BY FUNCTION, 1970

[In percent]

Category of work	Percent of total
Total employees	100.0
Scientific workers	36.2
Scientific-technical personnel	29.7
Production personnel	16.4
Minor service personnel	7.4
Administrative and service personnel	6.1
Library personnel	2.2
Research trainees	.9
Instructors	.3
Others	.8

Source: Kugel', "Changes," 1973, p. 32.

The proportion of scientific workers in the Academy is approximately twice the proportion in the entire science and science services branch. The disparity between these proportions is explained by the concentration of Academy personnel on fundamental research and by the presence of a large number of development work organizations and other science service establishments in the science and science services branch. The proportion of scientific workers in the Academy (and presumably elsewhere) varies by branch of science. Their proportion of total employment in 1970 was lowest in the Academy's Section of Physical-Technical Sciences and Mathematics (26.3 percent) and highest in the Section of Social Sciences (63 percent). The proportion in the Section of Chemical-Technological and Biological Sciences was 35.6 percent, and the proportion in the Section of Earth Sciences was 36.5 percent.[8]

The proportion of scientific workers in branch scientific research institutes and other branch scientific institutions usually falls somewhere between that in total science and science services and that in the academy system. In 1968 the proportion of scientific workers in a majority of scientific research institutes and design bureaus in the precision instrument industry ranged from 20 to 35 percent with a mean proportion of 29 percent.[9] In the oil industry, however, the ratio of scientific workers in branch scientific research institutes during the 1970's is reported as 38 to 40 percent.[10]

In addition to the number of scientific workers in the science and science services branch, data on the number of specialists with higher and specialized secondary education, including the number of engineers and technicians with diplomas, are available (see table 6). In 1977, according to the new series, 52.8 percent of workers and employees in science and science services were specialists, of which 37.3 percent had higher education. In 1970, the most recent year for which such information is available, 57.4 percent of all specialists with higher education were classified as scientific workers. The remaining 42.6 percent of specialists with higher education consisted of managerial per-

[8] Kugel', "Changes," 1973, p. 32.
[9] Zavlin et al. *Trud*, 1973, p. 230.
[10] Zhdanov, "Cadres," 1977, pp. 33–34.

sonnel and of engineers engaged exclusively in routine engineering work or in development work not included in official science plans.[11]

TABLE 6.—TOTAL NUMBER OF WORKERS AND EMPLOYEES AND SPECIALISTS IN SCIENCE AND SCIENCE SERVICES, U.S.S.R., 1950–77

[In thousands, except percent]

Year	Total workers and employees		Specialists with higher education				Specialists with specialized secondary education			
					Of which—Engineers				Of which—Technicians	
	Number	Percent of total	Number	Percent of total	Number	Percent of total	Number	Percent of total	Number	Percent of total
1950	714	100	112.6	15.8	58.5	8.2	NA	NA	NA	NA
1955	992	100	170.5	17.2	89.4	9.0	77.1	7.8	61.0	6.1
1956	1,094	100	NA	NA	NA	NA	NA	NA	NA	NA
1957	1,208	100	268.6	22.2	174.4	14.4	153.9	12.7	128.8	10.7
1958	1,338	100	NA	NA	NA	NA	NA	NA	NA	NA
1959	1,474	100	NA	NA	NA	NA	NA	NA	NA	NA
1960	1,763	100	405.5	23.0	264.4	15.0	230.2	13.1	193.0	10.9
1961	2,011	100	453.8	22.6	292.6	14.5	255.0	12.7	211.6	10.5
1962	2,213	100	500.4	22.6	324.3	14.7	278.6	12.6	229.3	10.4
1963	2,370	100	560.9	23.7	360.2	15.2	302.7	12.8	248.2	10.5
1964	2,497	100	592.9	23.7	391.2	15.7	328.9	13.2	270.0	10.8
1965	2,625	100	637.4	24.3	419.7	16.0	342.1	13.0	279.1	10.6
1966	2,741	100	703.3	25.7	469.2	17.1	366.2	13.4	303.1	11.1
1967	2,860	100	NA	NA	NA	NA	NA	NA	NA	NA
1968	2,990	100	829.0	27.7	NA	NA	425.0	14.2	NA	NA
1969	3,128	100	NA	NA	NA	NA	NA	NA	NA	NA
1970	3,238	100	930.3	28.7	617.8	19.1	458.0	14.1	377.7	11.7
1971	3,374	100	NA	NA	NA	NA	NA	NA	NA	NA
1972	3,544	100	NA	NA	NA	NA	NA	NA	NA	NA
1973	3,735	100	1,204.0	32.2	NA	NA	556.0	14.9	NA	NA
1974	3,864	100	NA	NA	NA	NA	NA	NA	NA	NA
1975	4,046	100	1,370.7	33.9	NA	NA	603.7	14.9	NA	NA
1976[1]	3,860	100	NA	NA	NA	NA	NA	NA	NA	NA
1977[1]	3,969	100	1,479.0	37.3	NA	NA	617.0	15.5	NA	NA

[1] For 1976 and 1977 the new series of employees in science and science services is used. In this series employees in nonresearch agricultural experimental stations are omitted, which would tend to raise the proportion of specialists, particularly those with higher education, in science and science services.

NA—Not available.

Source: See source note to table 1.

C. Other Sectors Employing R. & D. Personnel

Soviet workers and employees conducting and supporting R. & D. are employed in three sectors other than the science and science services branch: higher educational institutions (*vysshiye uchebnyye zavedeniya*—VUZy) (including both teachers and graduate students working in R. & D.), industrial enterprise subdivisions, and central administrative scientific and technical departments. The personnel included in science and technology in the VUZy and in industrial enterprise scientific and technical subdivisions are described below. Similar information on central administrative scientific and technical departments is not available.

1. HIGHER EDUCATIONAL INSTITUTIONS (VUZy)

Table 7 shows the number and growth of the various types of VUZy scientific organizations from 1965 to 1975. The number of branch and problem laboratories has grown rapidly since the mid-

[11] The number of engineers in science and science services for 1970 is also presented (617,800), but this number overlaps with the number of scientific workers in the technical or engineering sciences (see section III); the proportion of engineers in the branch who are not scientific workers has not been revealed.

1960's due to the expansion of contract research by VUZy and to a greater effort to draw the VUZy teaching staff into research work. Although VUZy account for only 5 to 6 percent of total official science expenditures in the U.S.S.R., their share has increased during the past decade, primarily as a result of the increase in VUZ laboratory research.[12]

Total employment in VUZy was reported at 478,000 in 1966, or 6.9 percent of workers and employees in the cultural-educational branch.[13] The number of scientific workers in VUZy for that year—that is, specialists engaged in both research and teaching—was 263,000 (see table 15), or 55.1 percent of the total employed—a far higher proportion than that of scientific workers in scientific organizations in the science and science services branch. Because the primary function of the VUZy is the administration and conduct of higher education, and because VUZy scientific workers divide their working time between teaching and research, it would be misleading to compare total employees in VUZy with total employees in science and science services. Employment in VUZy comparable to that in science and science services should be calculated in terms of full-time equivalence of those VUZy personnel performing research. The same principle applies to graduate students, whose time is divided among study, work, and research.

TABLE 7.—NUMBER OF SCIENTIFIC ORGANIZATIONS IN HIGHER EDUCATIONAL INSTITUTIONS, U.S.S.R., 1965–78

[At end of year]

Year	Types of organizations							
	Scientific research institutes	Design bureaus	Branch laboratories	Problem laboratories	Scientific research sectors	Computer centers	Botanical gardens	Observatories
1965	41	NA	242	301	NA	NA	NA	NA
1966	39	NA	300+	320+	NA	NA	NA	NA
1967	NA	NA	NA	NA	NA	NA	NA	NA
1968[1]	45	NA	467	384	NA	NA	13	11
1969		52	510	404	NA	19	13	11
1970[1]		55	512	419	NA	17	13	11
1971[1]	55	4	528	419	273	17	13	11
1972	55	4	569	406	296	17	13	10
1973	NA	NA	NA	NA	NA	NA	NA	NA
1974		60	1,000+		ca. 300	NA	NA	NA
1975	57	NA	722	640	ca. 400	NA	NA	NA
1976	NA	NA	NA	NA	NA	NA	NA	NA
1977	NA	NA	NA	NA	NA	NA	NA	NA
1978	58	NA	770	540	NA	NA	NA	NA

[1] The figures for 1968, 1970, and 1971 apply only to VUZy under the Ministry of Higher and Specialized Secondary Education U.S.S.R.
NA—Not available.

Source: See source note to table 1.

2. INDUSTRIAL ENTERPRISE SCIENTIFIC AND TECHNICAL SUBDIVISIONS

Data on the types of scientific and technical subdivisions in industrial enterprises have been published only for scattered years for the U.S.S.R. as a whole (see table 8) and for various republics; the data for the latter also include figures on total employment as well as the number of engineering-technical workers (*inzhenerno-tekhniches-*

[12] Nolting, *The Financing*, 1976, pp. 13–14, 44, and Mikulinskiy, "Present-Day," 1973. p. 159.
[13] TsSU, *Trud v. SSSR*, 1968, p. 27.

kiye rabotniki—ITR) by scientific and technical subdivision.[14] Among scientific and technical subdivisions, enterprise laboratories are the most numerous and employ the largest numbers of both overall personnel and engineering-technical workers. Design organizations come next, followed by test-experimental organizations; mechanization and automation departments have the fewest number of units and personnel.

TABLE 8.—NUMBER OF SCIENTIFIC AND TECHNICAL SUBDIVISIONS IN INDUSTRIAL ENTERPRISES, U.S.S.R., 1961–73

[1961, as of Apr. 1; 1965 and 1973, as of Jan. 1]

Type of organization	Number of units		
	1961	1965	1973
	(1)	(2)	(3)
Laboratories	23,644	25,788	43,141
Central plant	13,955	NA	20,415
Shop	6,934	NA	15,013
Plant administration	2,755	NA	7,713
Design organizations	11,227	13,378	24,466
Self-supporting, carried on enterprise balance sheet	3,418	NA	NA
Incorporated in enterprise	7,809	NA	NA
Project-design, design technological, and design bureaus	NA	NA	7,242
Departments of chief designer	NA	NA	3,045
Plant administration organizations	NA	NA	10,629
Enterprise shop organizations	NA	NA	2,607
Test—experimental organizations	NA	NA	4,840
Shops	865	NA	1,804
Sections	999	NA	2,175
Workshops	349	NA	370
Others	NA	NA	489
Mechanization and automation departments	1,073	NA	NA

NA—Not available.

Source: See source note to table 1.

Employment in enterprise scientific and technical subdivision in 1973, excluding mechanization and automation departments, for which data are unavailable, was 1,345,000, of which 53 percent were engineering-technical workers and scientific workers.[15] If employment in mechanization and automation departments were added to the 1,345,000 workers and employees, the total would be increased by approximately 1.5 to 3.5 percent (based on the rough proportions of employed persons in mechanization and automation departments in various republics). However, as with total VUZy employees, total employees in enterprise scientific and technical subdivisions should not simply be added to employees in science and science services in order to arrive at total Soviet personnel conducting and supporting R&D. Much of the work of scientific and technical subdivisions is not R&D, but extends into innovation. It involves the adaptation of prototypes and installation of new manufacturing equipment, product and process improvement,

[14] See, for example, *Ekonomika i kul'ture Litovskoy SSSR*, 1975, p. 47; *Promyshlennost' Armyanskoy SSR*, 1973, p. 70; *Nar khoz Estonskoy SSR*, 1968, p. 72; and *Narkhoz, Uzbekskoy SSR*, 1968, p. 52.

[15] This number is based upon the scientific and technical subdivisions of 44,111 industrial enterprises, about 91 percent of the total. The remaining 9 percent probably consisted of small enterprises having no subdivisions of their own. (Glagoleva, "Economics," 1975, p. 117, and Kostin, *Proizvoditel'nost'*, 1974, p. 83.)

and even routine quality and technological control. It also concentrates more heavily on development than does the work of scientific organizations under science and science services. As a result, industrial enterprise scientific and technical subdivisions, although employing about 37 percent as many persons as the branch of science and science services, add only an estimated 6 percent to official R&D outlays in the U.S.S.R.[16]

III. Personnel Directly Conducting R. & D.

A. Definition of "Scientific Worker"

The statistical category of "scientific workers" covers scientific personnel who are directly engaged in or trained in scientific research and development in all branches of science—the natural sciences, the technical sciences or engineering fields, the social sciences and humanities, and the military sciences. This category is the one usually used in comparing employment in scientific and engineering research in the Soviet Union with that in other countries. The number of scientific workers is compiled annually by the Central Statistical Administration (*Tsentral'noye statisticheskoye upravleniye*—TsSU) from reports required of scientific institutions and other organizations performing R. & D. The report forms prescribe the following criteria for determining which employees should be counted as scientific workers:

1. All persons with advanced degrees (doctor of sciences and candidate of sciences) in the official branches of science and all persons with scientific titles (professor, docent, senior scientific worker [*sotrudnik*], junior scientific worker and academic assistant [*assistent*], regardless of current place or type of work.

2. Academicians (full members), acting members, and corresponding members of the U.S.S.R. Academy of Sciences, the republic academies of sciences, and the specialized branch academies. This group overlaps much of the first group, since academy members undoubtedly have earned advanced scientific degrees or titles.

3. Persons with or without advanced degrees or titles, who perform "scientific research work" in scientific institutions or are engaged in research and teaching ("science-teaching work") in VUZy.

4. Specialists without advanced degrees or titles who systematically perform "scientific work" in industrial enterprises and in "project" organizations—that is, in nonresearch design organizations carrying out product design, process design, and construction design.[17]

5. Persons holding management positions in scientific research ("scientific-supervisory positions") and persons without advanced degrees or titles holding positions of senior scientific worker or junior scientific worker.

6. All persons, whether employed in scientific institutions or in other organizations, who are engaged full-time or in conjunction with other duties in carrying out assigned research projects (*temy*) that are offi-

[16] See Nolting, *The Financing*, 1976, pp. 15 and 44.

[17] These four general groups of scientific workers are regularly specified in the "methodological explanations" of the Soviet statistical yearbooks. See, for example, *Nar. khoz. 75*, p. 780.

cially approved and are components of the overall science plans of ministries or the state.[18]

Soviet science analysts generally agree that only persons with higher education should be recorded as scientific workers, that is, persons who, though not having an advanced scientific degree or title, possess at least a VUZ diploma equivalent to a bachelor's or master's degree in the United States.[19] During the mid-1960's, however, some employees with only a secondary or specialized secondary education were counted as scientific workers. Soviet surveys of that time of employment in individual branch scientific research institutes showed that in most of the institutes surveyed approximately 5 to 16 percent of their scientific workers did not have higher education, and in some scientific research institutes the proportion was as high as 20 to 30 percent. Many of these persons were technicians (*tekhniki*) who had acquired scientific skills on the job and had been appointed to scientific posts, in such classifications as junior scientific worker.[20] However, because of the complaints of Soviet science economists about the inclusion of employees without higher education and due to the growth in the number of graduates of VUZy since the 1960's, the proportion of scientific workers with only a secondary education may have been considerably reduced and new increments probably all have higher education.[21]

Persons who are not designated scientific workers, according to Soviet descriptions, include the following:

1. Technicians and laboratory assistants without higher education who are engaged in scientific research.[22]
2. Individual inventors not already classified as scientific workers.[23]
3. Graduate students, whether on a full-time or part-time basis.[24]
4. Research trainees (*stazhery-issledovateli*) before their registration as regular employees of a scientific organization.

The main difficulty in determining the composition of the category "scientific worker" is the lack of precision in official reporting in separating employees engaged in fundamental and applied research ("scientific research work") from those engaged in development ("test-design work"). Scientific workers are defined as those engaged in scientific research work in scientific institutions or "scientific work" in industrial enterprises and project organizations (except for academy members and persons with advanced degrees and titles, who are all included among scientific workers). "Scientific work" has been defined as including research, development, and the introduction (*vnedreniye*) of scientific results.[25] However, the line between scientific research and development can by no means be considered an accurate boundary indicating inclusion in or exclusion from the category of scientific worker, for the reasons explained below.

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[18] The last two groups are essentially refinements of the third and fourth groups. They are not presented in the "methodological explanations" in the statistical yearbooks but are included in the official instructions sent to reporting organizations. See Feshbach, "Notes," 1978, p. 1; Mikulinskiy et al., *Podgotovka,* 1976, p. 9; and Serov, "Classification," 1973, p. 131.

[19] See Stanford Research Institute, "Report," 1978, p. 28, and Serov, "Classification," 1973, p. 142.

[20] Sominskiy and Yudelevich, "Labor," 1966, p. 87, and Yudelevich, "The Economic," 1966, pp. 84–85.

[21] See Stanford Research Institute, "Report," 1978, p. 29.

[22] Feshbach, "Notes," 1978, p. 1.

[23] Ibid., p. 10.

[24] Ibid., p. 9.

[25] Mikulinskiy et al. *Podgotoyka,* 1976, p. 32.

First, statistical reporting in the U.S.S.R. does not provide data on employment by stage of R. & D. Existing estimates of employment and expenditures by stage are derived only from surveys of selected scientific institutions by individual scholars. The estimates vary considerably. They have no official standing and are not used in any statistical series to categorize and distribute scientific workers or science expenditure.[26] As a result, the statistical data supplied by reporting agencies and organizations do not separate R. & D. personnel by stage of work.

Second, the dividing line between research and development has not been uniformly plotted by Soviet science scholars, let alone accurately perceived by the management of scientific organizations and enterprises when they report the numbers of scientific workers they employ. Even rigorous divisions of R. & D., such as M. L. Bashin's detailed tables of the consecutive steps in scientific research work and development work in the machine-building and precision instrument industries,[27] have had little practical impact on employment reporting, since such criteria are not sufficiently exact and are difficult to apply to the great diversity of activity involving scientific and technical personnel.[28] As S. R. Mikulinskiy remarks, "in the real course of scientific activity," the stages of R. & D. are "seldom manifested in the pure form" crystallized by the science scholars.[29] Consequently, a certain number of scientific workers are likely to engage to some extent in development or even in innovation.[30]

Third, because specialists working on research projects that are a part of science plans approved by higher authority are classified as scientific workers, and because "science plans" cover both research and development, many scientific workers are engaged both in scientific research and in development,[31] and many working predominantly in development are presumably counted as scientific workers. Such employees include those working in design and testing subdivisions of scientific research institutes, in design bureaus and experimental plants performing only development and innovation work, in project organizations, and in industrial enterprises. Development workers who qualify as scientific workers by virtue of advanced scientific degrees or titles, as well as through participation in projects that are a part of approved science plans, are included in the ranks of scientific workers.

In view of the imprecision of the definition of scientific worker and its effect on statistical reporting, and due to the constant interaction of research and development work, it is impossible at present to establish the relative proportions of research workers and development workers in the U.S.S.R. However, the Soviet definitions of scientific worker indicate that the term includes the great majority of development specialists having advanced degrees or participating in the most important R. & D. projects—that is, projects that are a part of ministerial or state science plans. Therefore, Soviet figures on the number of

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[26] Serov, "Classification," 1973, p. 144.
[27] See Bashin, *Planirovanive*, 1969, pp. 8–12, 62–63, and 112–113.
[28] Serov, "Classification," 1973, p. 144.
[29] Mikulinskiy, "Present-Day," 1973, p. 159.
[30] One source, for instance, notes that two-thirds of scientific workers are engaged in "production" scientific research and development (*proizvodstvennyye issledovaniya i razrabotki*), that is, not in research alone. Federenko et al., *Problemy*, 1972, p. 143.
[31] See Nolting, *The Planning*, 1978, pp. 15–22, and Yefimov and Tugov, "Economic," 1974, p. 85.

scientific workers embrace employment in both research and development and, with appropriate refinements such as exclusion of humanities specialists, can be considered roughly comparable with Western statistics on R. & D. employment (see section IV).

B. Numbers of Scientific Workers and Scientific Workers With Advanced Degrees and Titles

The total number of scientific workers from 1950 to 1977 is shown in table 9. Their number has increased rapidly during this period, growing by 7.9 times since 1950, 3.6 times since 1960, 1.6 times since 1965, and one-third since 1970.[32] The statistical definition of scientific workers has been broadened at least once in 1962 (see footnote, table 9). However, this change was not incorporated in subsequently published statistics on numbers of scientific workers in years prior to 1962. Therefore, the rate of growth in the number of scientific workers implied by comparing figures for 1962 and earlier years with more recent figures is somewhat overstated.

TABLE 9.—NUMBER OF SCIENTIFIC WORKERS, U.S.S.R., 1950–78

[At end of year; actual numbers, except figures in parentheses, which are rounded to the nearest hundred, and 1978, which is a rough approximation]

Year	Scientific workers	Year	Scientific workers
1950	162, 508	1965	664, 584
1951	(170, 200)	1966	712, 419
1952	(179, 100)	1967	770, 013
1953	191, 885	1968	822, 910
1954	210, 165	1969	883, 420
1955	223, 893	1970	927, 709
1956	239, 880	1971	1, 002, 930
1957	261, 571	1972	1, 056, 017
1958	284, 038	1973	(1, 108, 500)
1959	310, 022	1974	(1, 169, 700)
1960	354, 158	1975	1, 223, 428
1961	404, 126	1976	(1, 253, 500)
1962	[1] 524, 546	1977	(1, 279, 600)
1963	565, 958	1978	1, 300, 000
1964	611, 964		

[1] The sharp jump in the number of scientific workers in 1962 was accounted for by the inclusion of 38,595 persons without advanced degrees performing R. & D. in industrial enterprises and project (design) organizations. This new category included in all subsequent years (Nar. khoz. 63, p. 712, and Nar. khoz. 62, footnote, p. 583).

Source: See source note to table 1.

While the number of scientific workers has steadily increased since 1962, the annual rate of growth in the number of scientific workers has gradually declined to less than one-half the rate of the mid-1960's. For 5-year periods between 1963 and 1978 the average annual rate of growth was as follows:

	Percent
1963–68	7.8
1968–73	6.1
1973–78	3.2

Table 10 shows the number of scientific workers from 1950 to 1977 with advanced degrees and the number with scientific and pedagogic titles. The percentage of workers with advanced degrees dropped sharply in 1962 as a result of the inclusion in the scientific worker category of nondegree R. & D. employees in industrial enterprises and proj-

[32] An annual growth rate of 2 to 3 percent has been indicated by Soviet scholars at least until 1980, with a probable slowdown during the 1980's. (Feshbach, "Notes," 1978, p. 8.)

ect organizations. Since 1962, however, the number of workers with advanced degrees has generally increased more rapidly than the total number of scientific workers, their proportion gradually rising from 23 to 30.8 percent. The number of scientific workers with titles, though increasing absolutely, has declined relatively from 38 to 17.5 percent of the total. This decline reflects in part the decrease since 1966 in the proportion of scientific workers in VUZy (see table 13), in which the majority of persons with titles, and especially pedagogic titles, are found.[33]

TABLE 10.—NUMBER OF SCIENTIFIC WORKERS WITH ADVANCED DEGREES AND TITLES, U.S.S.R., 1950–77

[Absolute numbers in thousands at end of year]

Year	Total scientific workers	With advanced degrees		Percent of scientific workers with advanced degrees	With titles				Percent of scientific workers with titles
		Doctor of sciences	Candidate of sciences		Professor, academician, corresponding member of academy	Docent	Senior scientific worker	Junior scientific worker, assistant professor	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1950	162.5	8.3	45.5	33.1	8.9	21.8	11.4	19.6	38.0
1951	170.2	8.4	49.3	33.9	8.7	22.4	12.1	18.7	36.4
1952	179.1	8.4	53.8	34.7	8.6	23.4	12.4	19.0	35.4
1953	191.9	8.5	59.5	35.4	8.5	24.7	12.9	19.8	34.3
1954	210.2	9.0	69.2	37.2	8.8	26.8	14.0	16.2	31.3
1955	223.9	9.5	78.0	39.1	9.0	28.6	14.6	17.1	31.0
1956	239.9	9.8	85.7	39.8	9.1	30.4	15.6	17.8	30.4
1957	261.6	10.0	87.2	37.1	9.4	31.6	16.7	21.3	30.2
1958	284.0	10.3	90.0	35.3	9.6	32.7	17.2	23.6	29.3
1959	310.0	10.5	94.0	33.7	9.7	34.3	18.4	26.3	28.6
1960	354.2	10.9	98.3	30.8	9.9	36.2	20.3	26.7	26.3
1961	404.1	11.3	102.5	28.2	10.3	38.2	21.0	28.7	24.3
1962	524.5	11.9	108.7	23.0	11.0	40.6	23.8	45.0	23.0
1963	566.0	12.7	115.2	22.6	11.4	42.9	25.8	47.9	22.6
1964	612.0	13.7	123.9	22.5	12.0	46.0	27.2	48.2	21.8
1965	664.6	14.8	134.4	22.4	12.5	48.6	28.7	48.9	21.0
1966	712.4	16.6	152.4	23.7	13.6	52.8	30.2	47.6	20.2
1967	770.0	18.3	169.3	24.4	14.7	56.9	32.4	46.3	19.5
1968	822.9	20.0	186.4	25.1	15.9	60.9	35.1	48.0	19.4
1969	883.4	21.8	205.4	25.7	16.9	64.9	37.3	48.4	19.0
1970	927.7	23.6	224.5	26.7	18.1	68.6	39.0	48.8	18.8
1971	1,002.9	26.1	249.2	27.5	19.5	73.2	42.4	49.2	18.4
1972	1,056.0	28.1	269.5	28.2	20.6	77.0	45.4	47.5	18.0
1973	1,108.5	29.8	288.3	28.7	21.6	80.5	47.8	47.1	17.8
1974	1,169.7	31.7	309.5	29.2	22.5	84.4	50.7	46.4	17.4
1975	1,223.4	32.3	326.8	29.4	22.9	87.9	53.3	45.0	17.1
1976	1,253.5	34.6	345.4	30.3	24.0	92.5	56.3	44.3	17.3
1977	1,279.6	36.0	358.4	30.8	25.3	96.6	59.3	43.2	17.5

Source: See source note to table 1.

Since all employed persons with advanced degrees and titles, regardless of place or type of work, are entered statistically in the ranks of scientific workers, the number of scientific workers in the Soviet Union is overstated to the degree that such employees are not actually engaged in R. & D. Regular data on the number of advanced degree holders not performing R. & D. are not gathered or required in the statistical reports of scientific institutions. A survey made to determine the number, however, indicated that the total amounted to only 5,000 to 10,000 in 1970, or 0.5 to 1 percent of all scientific workers. The TsSU reportedly felt that such a small proportion of the total was not worth a separate statistical entry.[34]

[33] There is, of course, an overlap between the number of advanced degree-holders and the number of title holders. For example, professors hold doctors of sciences degrees.

[34] Campbell, "Notes," 1978, p. 1; Feshbach, "Notes," 1978, p. 10; and Feshbach, "Discussions," 1973, p. 1.

C. Classification of Scientific Workers by Type of Work

The following types of position classifications of scientific workers are designated by TsSU: [35]

1. Scientific-supervisory personnel (*nauchno-rukovodyashchiy personal*). These direct R. & D. projects while participating in the work. Pure administrators are not counted as scientific workers, but are classified as "administrative and service personnel" under science and science services and other sectors.[36] Advanced scientific degrees or titles are not prerequisite for scientific-supervisory personnel.

2. Senior scientific workers. These are required to be either doctors or candidates of sciences. (In practice, degree requirements are often waived if workers are qualified by training or experience.) They are expected to organize and plan new and original research, and to supervise training and forecasting as well as research projects.

3. Junior scientific workers. These are officially required to have the degree of candidate of sciences. They are expected to participate in theoretical or complicated applied research either independently or under the supervision of a senior scientific worker, to develop procedures for conducting experimental work, and to write scientific reports. They may also supervise working groups in laboratories.

4. Scientific workers not included in the above three categories but "systematically conducting scientific work." This type covers various positions, such as the following:

(*a*) Leading engineers who manage departments of technical laboratories, direct groups of engineers and technicians or perform independent research and development for authorized scientific projects;

(*b*) Senior engineers who perform R. & D. on design problems and conduct or supervise experimental work;

(*c*) Engineers who participate in R. & D. under the supervision of leading and senior engineers, do basic engineering calculations, and engage in experimental and testing work; and

(*d*) Technicians and laboratory assistants (*laboranty*) with higher education.

5. Research and teaching personnel (*nauchno-pedagogicheskiye rabotniki*). This type of scientific workers combines teaching and research duties in VUZy and VUZy scientific organizations and is distributed among the following positions: (*a*) Rectors or presidents of universities; (*b*) prorectors (vice-rectors) in charge of education and research; (*c*) deans or heads of faculties; (*d*) heads of departments; (*e*) professors; (*f*) docents, or associate professors; (*g*) assistants or assistant professors; and (*h*) instructors (*prepodavateli*).

Distributions of scientific workers by type of work are generally not published for the U.S.S.R. as a whole. Some data on supervisory personnel are available, however. The proportion of scientific supervisory personnel to total scientific workers was reported as 20.5 percent in 1960, which was a drop from the 28.6 percent level of 1950.[37] According to a distribution of scientific workers by position published for the

[35] The list of official types of scientific workers is taken from Bekleshov et al. *Ekonomika*, 1973, pp. 69–70; Serov. "Classification," 1973, pp. 141–142; and Varshavskiy and Kugel' "Structure," 1973, pp. 88–94.

[36] Campbell, "Notes," 1978, p. 3, and Feshbach, "Notes," 1978, p. 13.

[37] Varshavskiy and Kugel', "Structure," 1973, p. 88.

Ukraine in 1973, the proportion of supervisors was 17.4 percent, indicating a continuing decline for the U.S.S.R. as a whole.[38]

D. Distribution of Scientific Workers by Place of Work

1. GENERAL DISTRIBUTION

The published distribution of scientific workers by major place of work covers the following broad categories: (1) Scientific institutions of branch ministries and other state agencies (branch scientific institutions); (2) scientific institutions under the academy system; (3) VUZy; and (4) a residual category, consisting of industrial enterprises, nonresearch project and design organizations, state administrative staffs, and others. Table 11 shows the distribution of scientific workers among these categories from 1950 to 1977, table 12 presents the same distribution for scientific workers with advanced degrees only, and table 13 shows the percentage changes in the distribution of both groups since the change in the series in 1962.

TABLE 11.—NUMBER OF SCIENTIFIC WORKERS, BY PLACE OF WORK, U.S.S.R., 1950–77

[In thousands at end of year]

Year	Total scientific workers (1)	Branch scientific institutions (2)	Academy system (3)	VUZy (higher educational institutions) (4)	Industrial enterprises, nonresearch project and design organizations, central administrative departments, and others (5)
1950	162.5		70.5	86.5	5.5
1951	170.2	NA	NA	NA	NA
1952	179.1		75.3	97.3	NA
1953	191.9		80.0	105.4	6.5
1954	210.1		88.7	114.2	7.3
1955	223.9	75.5	[2] 21.0	119.1	8.3
1956	239.9	84.3	[2] 22.1	125.0	8.5
1957	261.6		121.5	132.3	7.8
1958	284.0		141.0	135.7	7.3
1959	310.0	106.7	58.1	137.8	7.4
1960	354.2	137.2	62.9	146.9	7.2
1961	404.1	184.6	53.9	158.4	7.2
1962	524.5	244.1	54.9	179.5	46.0
1963	566.0	273.1	53.7	196.8	[3] 42.4
1964	612.0	300.1	56.6	206.3	49.0
1965	664.6	329.1	61.3	221.8	52.4
1966	712.4	330.6	65.5	263.6	52.7
1967	770.0	355.9	69.9	285.7	58.5
1968	822.9	377.3	75.3	307.8	62.5
1969	883.4	407.1	81.4	327.2	67.7
1970	927.7	419.1	85.9	348.8	73.9
1971	1,002.9	463.0	90.4	366.7	82.8
1972	1,056.0	490.6	94.6	378.8	92.0
1973	1,108.5	516.8	97.0	394.4	100.3
1974	1,169.7	NA	100.4	410.8	NA
1975	1,223.4	NA	105.5	427.8	NA
1976	1,253.5	NA	107.7	441.5	NA
1977	1,279.6	NA	111.7	NA	NA

[1] These groups are combined in the statistical breakdown given in Soviet sources. One source gives the distribution in these categories as of year end 1970 as follows (in percentages of the total of scientific workers in the U.S.S.R.): all residual groups—7.97 percent; including industrial enterprises—3.27 percent; project, project-design, and project technological organizations—3.16 percent; central administrative departments and others—1.54 percent (Vladimirov, "Potential," 1976, p. 168). This accords with another source which indicates that roughly 35 to 40 percent of the workers in col. 5 have been employed in industrial enterprises (Shcherbakov, Sotsial'no-, 1975, p. 48). Another breakdown of col. 5, for 1973 places 71.7 percent of the residual in industrial enterprises and project and design organizations and 28.3 percent in central administrative departments and other organizations ("Scientific," 1974, p. 8).

[2] Excludes scientific workers in the specialized branch academies.

[3] The large increase in this column in 1962 and after was accounted for by the addition of persons without advanced scientific degrees employed in industrial enterprises and project organizations engaged in R. & D.

NA—Not available.

Source: See source note to table 1.

[38] Klimenyuk, *Upravleniye*, 1974, p. 44.

TABLE 12.—NUMBER OF SCIENTIFIC WORKERS WITH ADVANCED DEGREES, BY PLACE OF WORK, U.S.S.R., 1950–77

[In thousands at end of year]

Year	Total scientific workers with advanced degrees (1)	Branch scientific institutions (2)	Academy system (3)	VUZy (higher educational institutions) (4)	Industrial enterprises nonresearch project and design organizations, central administrative departments, and others (5)
1950	53.8	20.8		28.9	4.1
1951	57.7	NA	NA	NA	NA
1952	62.2	NA	NA	NA	NA
1953	68.0	NA	NA	NA	NA
1954	78.2	NA	NA	NA	NA
1955	87.5	20.6	10.6	49.0	7.3
1956	95.5	NA	NA	NA	NA
1957	97.2	NA	NA	NA	NA
1958	100.3	NA	NA	NA	NA
1959	104.5	41.8		55.9	6.8
1960	109.2	44.8		57.9	6.5
1961	113.8	NA	NA	NA	NA
1962	120.6	NA	NA	NA	NA
1963	127.9	NA	NA	NA	NA
1964	137.6	NA	NA	NA	NA
1965	149.2	NA	NA	73.4	NA
1966	169.0	NA	NA	NA	NA
1967	187.6	NA	NA	NA	NA
1968	206.4	NA	32.6	NA	NA
1969	227.2	NA	NA	NA	NA
1970	248.1	67.1	39.8	122.7	18.5
1971	275.3	NA	42.9	133.2	NA
1972	297.6	83.9	45.6	143.0	25.1
1973	318.1	NA	47.9	NA	NA
1974	341.2	NA	50.4	148.8	NA
1975	359.1	NA	53.4	168.9	NA
1976	380.0	NA	55.5	179.0	NA
1977	394.4	NA	58.1	NA	NA

NA—Not available.

Source: See source note to table 1.

TABLE 13.—PROPORTION OF SCIENTIFIC WORKERS, BY PLACE OF WORK, U.S.S.R., 1962–77

[In percent at end of year]

Year	Total scientific workers					Scientific workers with advanced degrees				
	Total	Branch ministries and other state agencies	Academy system	VUZy	Industrial enterprises, etc.[1]	Total	Branch ministries and other state agencies	Academy system	VUZy	Industrial enterprises, etc.[1]
1962	100	46.5	10.5	34.2	8.8	100	NA	NA	NA	NA
1963	100	48.2	9.5	34.8	7.5	100	NA	NA	NA	NA
1964	100	49.0	9.3	33.7	8.0	100	NA	NA	NA	NA
1965	100	49.5	9.2	33.4	7.9	100	NA	NA	49.2	NA
1966	100	46.4	9.2	37.0	7.4	100	NA	NA	NA	NA
1967	100	46.2	9.1	37.1	7.6	100	NA	NA	NA	NA
1968	100	45.8	9.2	37.4	7.6	100	NA	15.8	NA	NA
1969	100	46.1	9.2	37.0	7.7	100	NA	NA	NA	NA
1970	100	45.2	9.2	37.6	8.0	100	27.0	16.0	49.5	7.5
1971	100	46.2	9.0	36.6	8.2	100	NA	15.6	48.4	NA
1972	100	46.4	9.0	35.9	8.7	100	28.2	15.3	48.1	8.4
1973	100	46.6	8.8	35.6	9.0	100	NA	15.1	NA	NA
1974	100	NA	8.6	35.1	NA	100	NA	14.8	43.6	NA
1975	100	NA	8.6	35.0	NA	100	NA	14.9	47.0	NA
1976	100	NA	8.6	35.2	NA	100	NA	14.6	47.1	NA
1977	100	NA	8.7	NA	NA	100	NA	14.7	NA	NA

[1] Industrial enterprises, nonresearch project and design organizations, central administrative departments, and others.

NA—Not available.

Source: Calculated from preceding tables.

The tables show that, with only minor fluctuations since 1962, branch scientific institutions have employed nearly half of all scientific workers, and the VUZy have employed over a third. The proportion of

scientific workers in the academy system dropped slightly after 1962 because many of that system's scientific research institutes engaged in technical and industrial research were transferred to agencies in charge of branches of industry between 1961 and 1963. (Also see table 1 on number of academy institutions.) There has been a small rise in the share of scientific employment in the residual category, because industrial enterprises, project organizations, and central administrative science and technology departments have tended to increase their share of employment of scientific workers. VUZy account for nearly half of all scientific workers with advanced degrees, though their share has declined slightly since 1971. The academy system also has a disproportionate share of scientific employees with advanced degrees—nearly double its share of total scientific workers. The proportion of scientific workers with advanced degrees employed in the residual category is nearly as high as its share of total scientific workers in spite of the sparsity of advanced degree holders in industrial enterprises and project-design organizations.[39] This is due to the high proportion of persons with advanced degrees in the administrative apparatus of state agencies.

2. EMPLOYMENT OF SCIENTIFIC WORKERS IN BRANCH SCIENTIFIC INSTITUTIONS

Most branch scientific institutions are subordinate to ministries in charge of industry, but some fall under ministries for other branches of the economy, such as construction and social services.[40] Nearly half of all scientific workers (46.6 percent in 1973) are employed in branch scientific institutions. If one adds to this the approximately 3.2 percent of scientific workers employed in nonresearch project and design organizations,[41] which are also subordinate to the appropriate branch ministries, the proportion of scientific workers employed in all branch "scientific organizations" more closely approximates one-half.[42] The economic significance of the branch sector of science employment is even greater than the employment figures indicate, because about 85 percent of official science expenditures are made by this sector.[43]

There are no regularly published statistical series on the distribution of branch scientific workers by separate ministry or even by broad economic sector, such as for industry as a whole; only scattered data are available in works by individual authors that occasionally reveal the number of scientific workers in specific branch ministries or branches of the national economy.[44]

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[39] In the Ukrainian S.S.R. in 1968, for instance, while the proportions of scientific workers in industrial enterprises and in project-design organizations were 5.5 and 4 percent, respectively, the corresponding percentages for scientific workers with advanced degrees were only 1.1 and 0.7 (Bogayev et al., "Problems," 1971, p. 55).

[40] Most agriculture research, however, does not fall under the standard branch pattern of organizing economic sector R. & D., but is carried out either by agricultural VUZy subordinate to the U.S.S.R. Ministry of Agriculture or by one of the specialized branch academies, the V. I. Lenin All-Union Academy of Agricultural Sciences (*Vsesoyuznaya ordena Lenina Akademiya sel'skokhozyaystvennykh nauk imeni V. I. Lenina*—VASKhNIL). See Nolting, *The Financing*, 1976, pp. 12–14.

[41] Vladimirov, "Potential," 1976, p. 168. The given percentage is for the year 1970.

[42] Branch scientific workers apparently also include those employed in scientific research institutes under the central planning and regulatory agencies for the entire economy, such as the U.S.S.R. State Planning Committee (*Gosudarstvennyy planovyy komitet SSSR*—Gosplan U.S.S.R.) and the State Committee for Science and Technology (*Gosudarstvennyy komitet po nauke i tekhnike*—GKNT). Most of these scientific research institutes perform economic or cybernetic research rather than research in specific areas of branch technology.

[43] Nolting, *The Financing*, 1976, p. 9.

[44] See Kugel', "Changes," 1973, p. 114.

In 1968 about 85 percent of scientific workers in industry were concentrated in the machine-building and metalworking and the chemical and petrochemical branches (about 71 percent in machine-building and metalworking alone).[45] One Soviet source lists the individual branches of industry in rank order according to the proportion of scientific workers to total employment without giving the actual proportions. The order is as follows: machine-building and metalworking, chemical and petrochemical industry, nonferrous metallurgy, ferrous metallurgy, the glass and chinaware industry, the fuel industry, light industry, the food industry, the timber, woodworking, and pulp and paper industry, and the construction materials industry.[46] Industry as a whole in 1968 employed 51.8 percent of total scientific workers. This figure probably includes scientific workers in industrial enterprises as well as those in industrial branch scientific organizations.[47] In the early 1970's about 5 percent of all scientific workers were reported to be employed in the construction branch, 5.5 percent in agriculture, and 6 percent in health services and medicine.[48]

Although no regular statistical series are available showing the trends in the distribution of scientific personnel by branch, V. Pokrovskiy, a staff member of the State Committee for Science and Technology, provides an estimated distribution. His estimates show that during the period between 1960 and 1975 the percentage of scientific workers in industry, forestry, communications, trade and agricultural procurement, and municipal economy remained relatively constant, while the percentage in construction, agriculture, transportation, material-technical supply, education, and culture rose slightly.[49] The percentage of scientific workers in geological prospecting, health services, and the academy of sciences system declined during the same period.[50]

3. EMPLOYMENT OF SCIENTIFIC WORKERS IN THE ACADEMY SYSTEM

The scientific institutions under the academy system are engaged primarily in fundamental research; approximately 60 to 85 percent of the Soviet Union's fundamental research during the 1970's has been conducted by these institutions. Applied research and development on broad technological topics of interbranch significance is the second focus of academy scientific institutions. The academy system is composed of three general sectors, each with its own research institutions: (1) The U.S.S.R. Academy of Sciences, which conducts planning and coordination for the entire academy system; (2) the academies of sciences of the separate republics (except the R.S.F.S.R., which is covered by the U.S.S.R. Academy and its regional divisions); and (3) the specialized branch academies subordinate to separate ministries but supervised by the U.S.S.R. Academy.[51]

The academy system employed 111,730 scientific workers in 1977, or 8.7 percent of all scientific workers, including 58,057 scientific workers with advanced degrees, or 14.7 percent of the total with advanced degrees.[52] In 1977 scientific workers of the U.S.S.R. Academy, the re-

[45] Lebedev et al., *Ekonomicheskiye,* 1971, pp. 77, 79.
[46] Siderova, "Scientific," 1973, pp. 122–123.
[47] Lebedev et al., *Ekonomicheskiye,* 1971, pp. 77 and 79.
[48] Udovenko et al., *Vnedreniye,* 1975, p. 4; Grigo'yev, *Povysheniye,* 1974 p. 12; and Petrovskiy, *Sovetskoye,* 1973, p. 95.
[49] The highest proportional rise was in material-technical supply.
[50] Pokrovskiy, "Enhanced," 1977, p. 49.
[51] See Nolting, *The Financing,* 1976, pp. 12–13, 45–47.
[52] *Nar. khoz.* 77, p. 95.

public academies, and the specialized branch academies comprised 39.5, 41.1, and 19.4 percent, respectively, of all scientific workers in the academy system. The distribution of scientific workers within the academy system from 1956 to 1977 is shown in table 14.

TABLE 14.—DISTRIBUTION OF SCIENTIFIC WORKERS WITHIN THE ACADEMY OF SCIENCES SYSTEM, U.S.S.R., 1956–77

[At end of year]

Academies	1956	1960	1965	1968	1970	1972	1975	1977
Total academy system	32,150	62,905	61,250	75,349	85,911	94,638	105,540	111,730
U.S.S.R. Academy of Sciences	15,716	23,771	25,471	32,445	35,115	38,355	41,836	44,168
Republic academies of sciences	8,673	19,057	26,360	33,133	36,175	40,753	45,361	45,899
Ukrainian S.S.R.	1,664	4,199	7,020	9,119	10,141	11,281	12,102	12,158
Belorussian S.S.R.	595	1,455	1,957	2,815	3,115	4,012	4,640	4,892
Uzbek S.S.R.	788	2,388	2,592	3,112	3,256	3,527	3,699	3,637
Kazakh S.S.R.	1,054	1,697	2,404	2,837	3,102	3,349	3,731	3,579
Georgian S.S.R.	1,027	2,255	3,055	3,744	4,157	4,543	5,493	5,390
Azerbaydzhan S.S.R.	830	1,823	2,578	3,469	3,334	3,734	4,222	4,276
Lithuanian S.S.R.	268	569	765	943	1,143	1,398	1,534	1,624
Moldavian S.S.R.[1]	NA	NA	523	656	688	759	883	910
Latvian S.S.R.	497	859	1,163	1,352	1,475	1,681	1,760	1,746
Kirgiz S.S.R.	537	632	831	1,027	1,137	1,286	1,434	1,475
Tadzhik S.S.R.	271	802	703	888	966	1,065	1,213	1,267
Armenian S.S.R.	603	1,227	1,541	1,830	2,203	2,509	2,835	2,970
Turkmen S.S.R.	204	592	628	654	688	774	866	1,011
Estonian S.S.R.	335	559	600	687	770	835	949	964
Branch academies	7,761	20,077	9,419	9,771	14,621	15,530	18,343	21,663
V. I. Lenin All-Union Academy of Agricultural Sciences	3,719	5,103	3,474	4,210	8,330	8,558	10,339	13,576
U.S.S.R. Academy of Medical Sciences	1,910	2,794	4,579	3,747	4,155	4,665	5,480	5,598
U.S.S.R. Academy of Pedagogical Sciences[2]	504	635	744	1,139	1,353	1,504	1,711	1,696
U.S.S.R. Academy of the Arts	103	91	139	235	362	369	386	350
R.S.F.S.R. Academy of Municipal Economy	300	362	483	440	421	434	427	443
Other branch academies[3]	1,225	11,092	NA	NA	NA	NA	NA	NA

[1] The Moldavian Academy of Sciences was not founded until 1961. Before that date it had existed as an affiliate of the U.S.S.R. Academy (Nar. khoz. 60, p. 787).

[2] Before 1966 this academy was designated the R.S.F.S.R. Academy of Pedagogical Sciences (Nar. khoz. 65, p. 714).

[3] The other branch academies included (a) several republic academies of agricultural sciences, which were abolished in 1961 and 1962; and (b) the U.S.S.R. Academy of Construction and Architecture and the Ukrainian Academy of Construction and Architecture, which were abolished in 1963 (Nar. khoz. 63, p. 594; Nar. khoz. 62, p. 585; Nar. khoz. 61, p. 706; and Nar. khoz. 60, p. 787).

NA—Not applicable.

Source: See source note to table 1.

4. EMPLOYMENT OF SCIENTIFIC WORKERS IN THE VUZY

Scientific workers employed in the VUZy include both research and teaching personnel, whose time is divided between teaching, preparation of lectures, research, and administrative duties, and full-time research workers in the institutes and laboratories subordinate to the VUZy. The proportion of full-time researchers in the VUZy has grown since 1965 from 7.7 to 17.9 percent, reflecting a rapid growth in the number of research laboratories and an effort to utilize more extensively VUZy scientists for practical economic purposes. The growth in the number and proportion of full-time workers is demonstrated in table 15.[53]

[53] Where the full-time VUZy scientific workers are employed is not reported. One source states that in 1970 in VUZy under the system of the U.S.S.R. Ministry of Higher and Specialized Secondary Education, 5,100 scientific workers were employed in branch laboratories and 16,500 in problem laboratories, scientific research institutes, design bureaus, computer centers, botanical gardens, and observatories. Presumably, many of these 21,600 are full-time R. & D. workers, but this number accounts for only 47 percent of the 45,617 full-time R. & D. workers in all VUZy for that year. (Remennikov, *Vysshaya*, 1973, p. 97.)

TABLE 15.—VUZy SCIENTIFIC WORKERS ENGAGED FULL-TIME AND PART-TIME IN R. & D., U.S.S.R., 1950–76

[At end of year]

Year	Total VUZy scientific workers (1)	Workers engaged full time in R. & D. (2)	Workers engaged part time in R. & D. (research and teaching personnel) (3)
1950	86,542	2,070	84,472
1955	119,059	2,678	116,381
1960	146,915	5,777	141,138
1965	221,800	17,000	204,800
1966	263,600	NA	NA
1967	285,700	NA	NA
1968	307,800	NA	NA
1969	327,200	40,300	286,900
1970	348,872	45,617	303,255
1971	366,703	53,580	313,123
1972	378,800	NA	NA
1973	394,400	NA	NA
1974	410,818	70,496	340,322
1975	427,800	NA	NA
1976	441,500	79,200	362,300

NA—Not available.

Source: See source note to table 1.

The distribution of VUZy scientific workers in the U.S.S.R. by type of position has been published only for the years prior to 1961. The data are shown in table 16.

TABLE 16.—DISTRIBUTION OF SCIENTIFIC WORKERS IN VUZy, BY TYPE OF POSITION, U.S.S.R., 1950–60

[At end of year]

Type of position	1950	1955	1960
Total	86,542	119,059	146,915
Directors and assistant directors of teaching and research	1,995	1,877	2,057
Deans	2,148	2,262	2,876
Heads of departments	13,692	15,414	16,901
Professors	1,300	1,437	1,547
Docents	11,571	19,036	25,940
Assistant professors	20,660	33,417	41,397
Instructors	33,106	42,938	50,420
Scientific workers not engaged in instruction	2,070	2,678	5,777

Source: TsSU, Vyssheye obrazovaniye, 1961, pp. 208–209.

In order to determine the extent of participation by research and teaching personnel in R. & D. in actual work-hours, the amount of working time spent on research must be converted into full-time equivalence figures. Soviet statistics do not record systematic data on the full-time equivalent hours of R. & D. work by VUZy research and teaching personnel.[54] However, there have been a number of sociological surveys and estimates of full-time equivalents, which show varying proportions of time spent on R. & D. but indicate an average well under one-half of all working time.[55]

The "scientific research" of research and teaching personnel covers a wide range of writing, editorial, supervisory, and research preparation tasks.[56] Consequently, the time spent on direct research is not

[54] Feshbach, "Notes," 1978, p. 8.
[55] For example, Palkin, "A Scientist's," 1975, p. 2, and Yudelevich, "The Economic," 1966, p. 81.
[56] "Improving," 1977, pp. 4–5.

likely to be higher than the minimal Soviet estimate of one-third of total working time, and it may in fact be lower. For this reason, and because all VUZy scientific workers engaged full time in R. & D. will be included in the estimate of the total number of scientific workers in this report, the proportion of one-fourth, originally suggested by Robert Campbell,[57] will be used to calculate the full-time research equivalents of VUZy research and teaching personnel.[58]

Additional R&D work is performed by graduate students (*aspiranty*, or students working for the degree of candidate of sciences). Graduate students are not included in the standard scientific worker category, either by actual numbers or on a full-time equivalence basis. The Soviet science labor analyst M. A. Yudelevich maintains that all full-time graduate students—that is, those on full leave from production—should be counted as scientific workers, and that part-time students—that is, those who study after working hours and are given a month's special leave each year for study—should be counted in full-time equivalents as equal to 42 percent of their actual number.[59] This approach, however, seems to be too generous, because not all the study time of graduate students consists of original research or research assistance. Furthermore, at least some part-time students are likely to be already registered as scientific workers at their place of work, and many of those who are not are counted as auxiliary workers and therefore included as support personnel in the science and science services branch.[60] Another Soviet commentator indicated that one-fourth of the study time of a graduate student may be said to be devoted to research.[61] Hence, it seems reasonable to establish a full-time equivalence of one-fourth for full-time graduate students and one-fourth of 42 percent for part-time graduate students.

Table 17 shows the number of graduate students from 1950 to 1977, including both full-time and part-time students at VUZy and other scientific institutions. Since the mid-1960's the total number of graduate students has remained roughly stable, although there was a sharp relative as well as absolute decline in the number of full-time students, which results in a reduction of the estimated number of graduate students participating in R&D in terms of full-time equivalents.

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[57] Campbell, *Reference*, 1976, p. 46. Campbell has since adopted a proportion of 15.2 percent, based on the NSF estimates of the full-time R. & D. equivalents of U.S. college teachers (Campbell. Robert W. *Reference Source on Soviet R. & D. Statistics 1950–1978*, National Science Foundation, in press, pp. 37, 41). The proportion of 25 percent is retained here as a compromise between Campbell's estimate and the somewhat higher Soviet estimates.

[58] This lower proportion is also more in accord with the estimate that VUZy account for only about 5 to 6 percent of total R. & D. expenditure in the Soviet Union (Nolting. *The Financing*, 1976, p. 44).

[59] Yudelevich, "The Economic," 1966, p. 81. He justified this argument on the grounds that the study time of graduate students was spent in "scientific work" and improvement of scientific capacity and that the study time of part-time students made up 42 percent of combined working and study time.

[60] For instance, one of the Soviet participants at the April 1978 conference of the U.S./U.S.S.R subgroup on Scientific and Technical Manpower felt that so much of a graduate student's time was consumed in attending courses and seminars that very little was left for research (Campbell, "Notes," 1978, p. 2). See also Kugel' and Siderova, "The Scientific," 1973, p. 14.

[61] Feshbach, "Notes," 1978, p. 9.

TABLE 17.—NUMBER OF GRADUATE STUDENTS (ASPIRANTY) BY FULL- AND PART-TIME STUDY AND BY PLACE OF STUDY, U.S.S.R., 1950–77

[At end of year]

Year	Total	By participation		By place of study	
		Full-time students	Part-time students	Students in higher educational institutions (VUZy)	Students in other scientific institutions
1950	21,905	18,143	3,762	12,487	9,418
1951	24,845	20,031	4,814	14,592	10,253
1952	26,704	21,157	5,547	15,700	11,004
1953	29,162	22,372	6,790	17,216	11,946
1954	30,841	23,129	7,712	18,068	12,773
1955	29,362	21,357	8,005	16,774	12,588
1956	25,495	17,752	7,743	14,087	11,408
1957	22,236	14,772	7,464	12,081	10,155
1958	23,084	15,532	7,552	12,328	10,756
1959	28,644	18,613	10,031	15,596	13,048
1960	36,754	22,978	13,776	20,406	16,348
1961	47,560	28,675	18,885	27,066	20,494
1962	61,809	36,714	25,095	36,334	25,475
1963	73,105	42,895	30,210	43,297	29,808
1964	83,271	47,928	35,343	49,522	33,749
1965	90,294	51,109	39,185	53,412	36,882
1966	93,755	52,936	40,819	55,026	38,729
1967	96,779	54,248	42,531	56,243	40,536
1968	98,139	55,018	43,121	56,545	41,594
1969	99,532	55,603	43,929	57,010	42,522
1970	99,427	55,024	44,403	56,909	42,518
1971	99,308	53,839	45,469	56,997	42,311
1972	98,945	52,501	46,444	57,252	41,693
1973	98,860	49,702	49,158	57,640	41,220
1974	96,939	45,357	51,582	56,570	40,369
1975	95,675	41,857	53,818	55,706	39,969
1976	95,657	39,794	55,863	55,937	39,720
1977	96,668	39,626	57,042	57,417	39,251

Note: This table omits soiskateli (nonmatriculated graduate students) and foreign students.

Source: See source note to table 1.

Another category of graduate students (*soiskateli*) is excluded from the scientific worker category.[62] *Soiskateli* study part-time, but are not officially enrolled in graduate studies because they have passed the maximum age for admission as regular *aspiranty*. The number of *soiskateli* is not regularly reported, but one Soviet source indicated that there were approximately 60,000 in 1976.[63] *Soiskateli* will not be included in this report as additional increments to scientific workers because the suggested figure of 60,000 is uncertain, and because some *soiskateli* may already be counted as scientific workers on account of their age or may be employed as support personnel in R. & D.[64]

Some undergraduate students also engage in scientific research, particularly those in senior courses.[65] Estimates of undergraduate student participation in total scientific work (both research and development) in all VUZy in the U.S.S.R. vary from 25 percent of all students enrolled in full-time study to 35 to 40 percent.[66] These estimates indicate a range of 697,000 to 1,116,000 undergraduate students participating in R. & D. during the 1977/78 academic year.[67] None of the

[62] *Ibid.*, p. 18, and Puchkov and Popov, *Sotsial'no-*, 1976, p. 24.
[63] Feshbach in "Preliminary," 1978, unpaginated.
[64] A large proportion of *soiskateli* are employed in scientific organizations and VUZy, supporting the assumption that many are already counted as scientific workers (Zverev, "Graduate," 1968, p. 59).
[65] See Shostakovskiy, "Problems," 1976, p. 335, and Petrov, "Measures," 1975, p. 266.
[66] Mikhaylichenko, "Training," 1975, p. 277; Krutov, "An Important," 1974, p. 37; "All-Union Conference," 1973, p. 18; and Petrov, *VUZy*, 1973, p. 48.
[67] Nar. khoz. 77, p. 495.

estimates, however, give the full-time equivalents of the students engaged in R. & D. work.

Because the research work of undergraduate students is less likely to involve original, creative R. & D. than that of graduate students, and because the actual participation of undergraduate students in research projects is likely to consist of support activities, auxiliary work, and training, no calculation will be made here to add undergraduate students to the scientific worker category.

5. EMPLOYMENT OF SCIENTIFIC WORKERS IN INDUSTRIAL ENTERPRISE SCIENTIFIC AND TECHNICAL SUBDIVISIONS, NONRESEARCH DESIGN AND PROJECT ORGANIZATIONS, CENTRAL ADMINISTRATIVE SCIENTIFIC AND TECHNICAL DEPARTMENTS, AND OTHER ORGANIZATIONS

Soviet data on employment of scientific workers in this category are usually derived as a residual from the statistics. The most detailed breakdown of the residual was published for 1970, in which the proportion of the residual to total scientific workers was given as 7.97 percent, of which industrial enterprises employed 3.27 percent, nonresearch design and project organizations 3.16 percent, and central administrative departments and other organizations 1.54 percent.[68] The residual proportion was highly stable at around 8 percent between 1963 and 1970, but increased to 8.6 percent in 1972 and to 9 percent in 1973 (see table 13). The main reason for the increase in recent years is that the proportion of scientific workers employed in central administrative departments and other organizations increased from 1.54 percent in 1970 to 2 percent in 1972 and to 2.5 percent in 1973.[69] Another reason may have been the drive to augment the number of scientific workers in industrial enterprises during the recent effort to improve the application of science to production.

The numbers of scientific workers in industrial enterprise scientific and technical subdivisions, either by branch of industry or by type of scientific and technical subdivision, are not regularly published in Soviet statistics. At the end of 1972, total employment in industrial scientific and technical subdivisions (excluding mechanization and automation departments) was 1,345,000 or 4.1 percent of total industrial employment. Fifty-three percent, or 712,850, consisted of engineering-technical workers and scientific workers.[70] An estimated 37,000 of these were scientific workers, a 20-percent increase from 30,330 in 1970.[71] Since this 37,000 includes all scientific workers in industrial enterprises, it covers those employed in mechanization and automation departments. Most scientific workers apparently are employed in enterprise laboratories, which do the bulk of industrial research within enterprises.[72]

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[68] Vladimirov, "Potential," 1976, p. 168.
[69] Kostin, *Proizvoditel'nost'*, 1974, p. 86, and "Scientific," 1974, p. 8.
[70] Kostin, *Proizvoditel'nost'*, 1973, p. 83. Employment in scientific and technical subdivisions increased slightly since January 1971, when it constituted 3.9 percent of all industrial workers. Engineering-technical workers and scientific workers at that time comprised 51.2 percent of the total employment in scientific and technical subdivisions.
[71] This estimate was made as follows: In 1970 scientific workers in administrative staffs and other organizations comprised 1.54 percent of all scientific workers (Vladimirov, "Potential," 1976, p. 168). In 1973 this proportion increased to 2.5 percent ("Scientific," 1974, p. 8). After subtraction of this 2.5 percent from the residual, the remaining 71,900 workers in this residual category in 1973 were distibuted between industrial enterprises and nonresearch design organizations in the same proportion as that reported for 1970.
[72] Nolting, *The Financing*, 1976, p. 44.

It should be mentioned that the proportion of scientific workers in industrial enterprises, only 3.7 percent in 1970, is misleading when compared with the much higher proportion in Western countries. First, most industrial R. & D. in the U.S.S.R. is conducted in industrial branch scientific research institutes and design bureaus, and the results are then transferred to enterprises. Second, a number of central plant laboratories, especially those of major enterprises, have been officially designated as scientific institutions by the State Committee for Science and Technology of the U.S.S.R. Council of Ministers (*Gosudarstvennyy komitet po nauke i tekhnike*—GKNT), in which case their scientific workers are statistically entered as employees of branch scientific research institutes, and their entire employment falls under the science and science services branch rather than under industry.[73]

Scientific workers employed in nonresearch project and design organizations numbered about 29,300 in 1970 and an estimated 34,900 in 1973. This category includes design and project-design organizations, which design new products and machines, and project-technological or design-technological organizations, which develop process designs. Project organizations under the construction branch, which primarily plan and design new buildings, and project organizations in forestry are excluded from this category, as well as from the science and science services branch.[74]

Scientific workers in central administrative scientific and technical departments and in other institutions and organizations have greatly increased during the early 1970's, nearly doubling in number from 14,300 in 1970 to 27,700 in 1973. The reason for this increase probably lies in the heavy emphasis since 1968 on integrated planning of science and technology and more systematic coordination of this planning with general economic planning. This policy has evidently led to increased employment of scientific workers in the central administrative and consultative departments dealing with decisionmaking and planning in science and technology.[75]

Additional weight is lent to this assumption by the fact that all scientific workers in this subcategory have advanced scientific degrees,[76] and it is such employees who would be most likely to be involved in planning and in advising on science policy.

E. Distribution of Scientific Workers by Branch of Science

The official list of 21 brances (*otrasli*) of sciences, under which scientific workers are distributed, is derived from the "Nomenclature of Specialties of Scientific Workers," which is periodically revised by the GKNT together with the U.S.S.R. Academy of Sciences, the U.S.S.R. Ministry of Higher and Specialized Secondary Education, the Higher

[73] Feshbach, "Notes," 1978, p. 18. This source also indicated that in a plant laboratory with an approved science plan all those working on the plan are included under science and science services, and its scientific workers are presumably counted under branch institutions. See also, Davinidze, "Management," 1973, p. 236.

[74] Nolting, *The Financing*, 1976, pp. 8–9; Gosplan SSSR, *Metodicheskiye*, 1974, p. 769; and Kostin, *Proizvoditel'nost'*, 1973, p. 86. All project and design organizations that also engage in scientific research work are, of course, excluded from this category, since they are classified under branch scientific institutions.

[75] There may be other reasons for the spurt in the number of scientific workers in this subcategory, inasmuch as the "other institutions and organizations" included with administrative staffs have not been identified.

[76] Kostin, *Proizvoditel'nost'*, 1974, p. 86.

(degree) Certification Commission (*Vysshaya attestatsionaya komissiya*—VAK) attached to the U.S.S.R. Council of Ministers, the TsSU U.S.S.R., and various other interested ministries. This list has been revised in 1963, 1969, 1972, and 1977.[77] The 1977 nomenclature contains 21 branches, 33 subbranches, and 486 specialties, of which 214 are in the technical or engineering sciences.[78] (See appendix B.)

Table 18 shows the distribution of scientific workers by branch of science from 1950 to 1974 and table 19 shows the same distribution for scientific workers with advanced degrees.[79] In these tables the branches of science are divided into the natural sciences or physical and life sciences, the technical or engineering sciences, the social sciences and humanities, architecture, and "other" sciences. With the exception of the technical sciences, which are consolidated in Soviet statistical publications, these categories are rearranged here to indicate the trends in employment by broad areas of science.[80]

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[77] "Nomenclature," 1977, p. 7, and Serov, "Classification," 1973, p. 135.

[78] "Nomenclature," 1977, passim. In Soviet literature the specialities are sometimes referred to as "fields" (*oblasti*).

[79] The U.S.S.R. has not published these distributions since 1974.

[80] More detailed breakdowns of scientific workers by branch of science have occasionally been published. In 1971 workers in mathematics comprised 3.5 percent of all scientific workers and about 30 percent in physics and mathematics (Mikulinskiy, "The Problem," 1973, p. 80). From these ratios it is possible to determine that in 1971 mathematicians constituted approximately 30,000 of the combined physics/mathematics category. In 1963, of the 28,810 scientific workers in chemistry, 5,217 were in organic chemistry and 5,222 in analytical chemistry. Of the 245,441 in the technical sciences, 26,502 were in chemical technology, 4,249 in technology of foodstuffs, 2,868 in machine-building for the chemical industry, and 1,129 in machine-building for the food industry. Of the 27,993 in agriculture and veterinary sciences, 1,898 were in agrochemistry (Torochesnikov, "Problems," 1965, p. 20).

TABLE 18.—NUMBER OF SCIENTIFIC WORKERS, BY BRANCH OF SCIENCE, U.S.S.R., 1950–74

[Absolute numbers in thousands at end of year]

Branch of science	1950		1955		1960		1965		1970		1974	
	Number	Percent of total	Number	Percent of total	Number	Percent of total	Number	Percent of total	Number	Percent of total	Number	Percent of total
Total	162.5	100.0	223.9	100.0	354.2	100.0	664.6	100.0	927.7	100.0	1,169.7	100.0
Physical and life sciences	70.8	43.7	93.6	41.8	134.4	38.0	208.2	31.3	284.2	30.6	341.3	29.1
Physics/mathematics	10.2	6.3	20.1	9.0	29.0	8.2	63.9	9.6	95.3	10.3	116.9	10.0
Chemistry	12.9	8.0	16.4	7.4	26.2	7.4	33.5	5.0	45.8	4.9	53.7	4.6
Biology	8.6	5.3	11.0	4.9	15.1	4.3	27.1	4.1	37.3	4.0	45.5	3.9
Geology/mineralogy	3.6	2.2	5.7	2.5	10.7	3.0	16.4	2.5	20.3	2.2	24.5	2.1
Medicine	21.0	13.0	24.8	11.1	31.4	8.9	35.8	5.4	48.8	5.3	57.6	4.9
Pharmaceutics	.4	.3	.5	.2	.8	.2	.9	.1	1.2	.1	1.4	.1
Agriculture	11.9	7.3	12.8	5.7	18.0	5.1	27.1	4.1	31.2	3.4	36.5	3.1
Veterinary sciences	2.2	1.3	2.3	1.0	3.2	.9	3.5	.5	4.3	.4	5.2	.4
Technical (engineering) sciences	41.5	25.5	61.1	27.3	129.8	36.7	298.8	45.0	409.5	44.1	548.0	46.9
Social sciences and humanities	45.8	28.1	61.8	27.6	81.2	22.8	135.8	20.4	200.7	21.7	237.6	20.3
History	8.5	5.2	13.4	6.0	16.5	4.6	20.6	3.1	25.1	2.7	28.7	2.5
Economics	4.6	2.8	8.3	3.7	13.9	3.9	30.7	4.6	57.5	6.2	80.1	6.9
Philosophy	2.7	1.7	1.9	.8	3.4	1.0	7.4	1.1	12.0	1.3	15.1	1.3
Language and literature	13.6	8.4	17.7	7.9	21.2	6.0	37.2	5.6	48.7	5.3	51.6	4.4
Geography	2.6	1.6	3.4	1.5	4.3	1.2	5.9	.9	7.2	.8	8.3	.7
Law	1.1	.6	1.6	.7	2.2	.6	3.3	.5	4.8	.5	6.3	.5
Education	8.8	5.4	11.5	5.2	14.1	3.9	22.4	3.4	31.3	3.4	30.2	2.6
Psychology [1]									1.9	.2	2.8	.2
Art	3.9	2.4	4.0	1.8	5.6	1.6	8.3	1.2	12.2	1.3	14.5	1.2
Architecture	.8	.5	.9	.4	1.4	.4	2.0	.3	2.6	.3	3.3	.3
Other sciences (military and military-related)	3.6	2.2	6.5	2.9	7.4	2.1	19.8	3.0	30.7	3.3	39.5	3.4

[1] Employees under psychology were not reported separately until 1968. Before that date they were grouped with employees in education studies "pedagogical sciences."

Note: Architecture is not included with the technical sciences in this table, as this branch covers only history and theory, building design, city planning, and landscape architecture, whereas architectural engineering falls under construction engineering in the technical sciences. Psychology is placed under the social sciences especially since it excludes psychiatry, which is under medicine in the Soviet classification. Geography is placed under the social sciences since there are no available statistics separating physical geography and socioeconomic geography ("Nomenclature," 1977, pp. 16–17).

Source: See source note to table 1.

TABLE 19.—NUMBER OF SCIENTIFIC WORKERS WITH ADVANCED DEGREES, BY BRANCH OF SCIENCE, U.S.S.R., 1950–74

[Absolute numbers in thousands at end of year]

Branch of science	1950		1955		1960		1965		1970		1974	
	Number	Percent of total	Number	Percent of total	Number	Percent of total	Number	Percent of total	Number	Percent of total	Number	Percent of total
Total	53.8	100.0	87.4	100.0	109.2	100.0	149.2	100.0	248.1	100.0	341.2	100.0
Physical and life sciences	29.0	54.0	42.7	48.8	52.4	48.1	71.5	47.9	117.5	47.3	156.4	45.9
Physics/mathematics	3.1	5.7	6.2	7.1	7.8	7.1	13.8	9.2	25.1	10.1	36.5	10.7
Chemistry	3.6	6.7	5.3	6.0	6.3	5.8	8.5	5.7	14.6	5.9	19.5	5.7
Biology	4.3	8.1	6.5	7.4	7.9	7.3	12.2	8.2	19.6	7.9	25.3	7.4
Geology/mineralogy	1.9	3.5	2.7	3.1	3.6	3.3	5.2	3.5	8.8	3.5	11.6	3.4
Medicine	11.1	20.6	15.0	17.2	18.2	16.7	21.2	14.2	33.1	13.3	42.3	12.4
Pharmaceutics	.1	.2	.2	.2	.2	.2	.3	.2	.4	.2	.7	.2
Agriculture	3.9	7.3	5.3	6.1	6.6	6.0	8.4	5.6	13.2	5.3	17.1	5.0
Veterinary sciences	1.0	1.9	1.5	1.7	1.8	1.7	1.9	1.3	2.7	1.1	3.4	1.1
Technical (engineering) sciences	14.2	26.4	22.5	25.7	28.7	26.3	37.9	25.4	68.3	27.5	102.9	30.1
Social sciences and humanities	10.0	18.6	20.9	23.9	26.4	24.1	35.6	23.8	55.5	22.4	73.7	21.6
History	2.4	4.4	6.0	6.9	7.2	6.6	8.4	5.6	10.9	4.4	13.4	3.9
Economics	1.9	3.5	4.0	4.5	5.2	4.8	8.3	5.6	15.9	6.4	23.3	6.8
Philosophy	.6	1.1	1.3	1.5	2.0	1.8	3.4	2.3	5.8	2.3	8.0	2.3
Language and literature	2.1	3.9	4.3	4.9	5.5	5.1	7.3	4.8	10.2	4.1	12.6	3.7
Geography	.8	1.5	1.5	1.7	1.8	1.6	2.2	1.5	3.0	1.2	3.6	1.1
Law	.5	1.0	1.1	1.3	1.5	1.3	1.8	1.2	2.7	1.1	3.6	1.1
Education	1.2	2.2	2.0	2.3	2.4	2.2	3.3	2.2	4.7	1.9	6.2	1.8
Psychology									.9	.4	1.3	.4
Art	.5	1.0	.7	.8	.8	.7	.9	.6	1.4	.6	1.7	.5
Architecture	.3	.5	.4	.5	.5	.5	.6	.4	.9	.4	1.1	.3
Other sciences (military and military-related)	.3	.5	.9	1.1	1.2	1.0	3.6	2.5	5.9	2.4	7.1	2.1

Source: See source note to table 1.

The undesignated residual category of employment in branches of science given in Soviet statistics (labeled "other branches" in Soviet sources) apparently consists entirely or mainly of military or military-related sciences not included in the technical sciences. This can be assumed because the only remaining branches of science in the official nomenclature of specialties of scientific workers that are not listed in the breakdowns of scientific workers are military sciences and naval sciences—numbers 20 and 21, respectively.

Some information has come to light on the nature of the "other" branches. One Soviet economist has estimated that half of the scientific workers in these branches are employed in "production R. & D."—that is, in R. & D. directly promoting production of material goods.[81] This might indicate that the military and naval sciences are not limited to theoretical military studies, but include some military hardware R. & D., though most military and military-related technology undoubtedly falls under appropriate subbranches of the technical sciences, such as aviation engineering and space technology and shipbuilding. Military hardware R. & D. personnel possibly classified under "other sciences" might refer to such groups as military representatives (*voyenpredy*) of the Ministry of Defense who monitor the fulfillment of orders at defense plants, persons who study and draw up weapons requirements, and persons engaged in field testing of military equipment.

Another source has revealed that nearly 57 percent of the "other" scientific workers in 1970 were employed in VUZy.[82] Thus, a large proportion of such workers presumably are teachers in military academies and military faculties of civilian VUZy, perhaps in both theoretical military science and in military technology.[83]

The largest growth in the number of scientific workers since 1950 has taken place in the technical sciences, which nearly doubled in relative size (from 25.5 percent of scientific workers in 1950 to 46.9 percent in 1974), physics/mathematics (from 6.3 to 10 percent), economics (2.8 to 6.9 percent), and "other" sciences (from 2.2 to 3.4 percent). Some fields have decreased in relative size. For example, physical and life sciences as a whole dropped from 43.7 to 29.1 percent and social sciences and humanities from 28.1 to 20.3 percent. Significant proportional declines occurred in specific branches of science, including chemistry, biology, medicine, agriculture, veterinary sciences, history, language and literature, geography, education, and art. These changes are somewhat magnified by the statistical addition in 1962 of R. & D. employees without advanced degrees in industrial enterprises and design organizations, most of whom were technical scientists. Since 1965 the proportions among branches of science have remained very stable, though the trend in favor of the technical sciences, physics/mathematics, economics, and the "other sciences" has continued.

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[81] Glyazer, "Science," 1974, pp. 68–69. Another source indicates that "production R&D" consists mainly of the technical sciences and excludes the social sciences, humanities, and fundamental research in the natural sciences. (Fedorenko, *Problemy*, 1972, p. 143.)

[82] Remennikov, *Vysshaya*, 1973, p. 155 (see table 20).

[83] Although the assumption in this report is that the "other" branches of science are primarily military in nature, additional possibilities cannot be ruled out. The residual could also serve as a catch-all for scientific workers whose work or specialties span more than one branch of science. One Soviet commentator, for instance, refers to the absence of "rigid boundaries" among the branches of science and mentions a "broad spectrum of interdisciplinary research." (Mikulinskiy et al., *Podgotovka*, 1976, p. 34.)

The physical and life sciences have by far the largest share of scientific workers with advanced degrees. The percentage of advanced degree holders in the technical sciences is much lower than the percentage of total scientific workers in these sciences. The percentage of all advanced degree holders employed in the social sciences, in humanities, and in architecture is approximately the same as the proportion of the total number of scientific workers in these fields. The proportion of advanced degree holders in "other sciences" is quite low (18 percent compared to 31.2 percent for all scientific workers in 1974).

Table 20 shows the distribution of scientific workers by branch of science in the U.S.S.R. Academy of Sciences, the VUZy, and the U.S.S.R. as a whole in 1970. The concentration of scientists in the physical and life sciences is much higher in the Academy and slightly higher in the VUZy than in the U.S.S.R. as a whole.[84] The proportion of scientific workers in the technical sciences is very low in the Academy, while the proportion in the VUZy falls between that in the Academy and that in the entire country. The percentage of scientific workers in the social sciences and humanities is highest in the VUZy, except in history, economics, and geography, in which fields the proportion in the Academy is higher. In 1970, 87 percent of scientific workers in industrial enterprises scientific and technical subdivisions were classified in the technical sciences.[85] Many of the remaining 13 percent were in the physics/mathematics group and in chemistry.[86] By a rough calculation based on the figures in table 20 it can be determined that approximately 70 percent of technical scientists and about 40 percent of physical and life scientists are employed in branch scientific organizations, where the great majority of scientific workers in the "all other" column of table 20 are employed.

[84] The concentration of physical and life scientists is presumably even higher in the entire academy system, inasmuch as a large number of scientists in medicine and agriculture are employed in the specialized branch academies, and few are employed in the U.S.S.R. Academy.
[85] Gvishiani and Mikulinskiy, "The Scientific," 1971, p. 25.
[86] Puchkov and Popov, *Sotsial'no-*, 1976, p. 27.

TABLE 20.—NUMBERS OF SCIENTIFIC WORKERS IN THE U.S.S.R., THE U.S.S.R. ACADEMY OF SCIENCES, THE VUZy, AND ALL OTHER PLACES OF WORK, BY BRANCH OF SCIENCE, 1970

[At end of year]

Branch of science	U.S.S.R. total		U.S.S.R. Academy of Sciences		VUZy		All other places of work[1]	
	Number	Percent	Number[2]	Percent	Number	Percent	Number	Percent
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Total	927,709	100.0	35,115	100.0	348,872	100.0	543,722	100.0
Physical and life sciences	284,174	30.6	22,545	64.2	113,160	32.4	148,469	27.3
Physics/mathematics	95,272	10.3	8,850	25.2	46,499	13.3	39,923	7.3
Chemistry	45,815	4.9	5,655	16.1	15,222	4.4	24,938	4.6
Biology	37,342	4.0	4,775	13.6	11,196	3.2	21,371	3.9
Geology/mineralogy	20,342	2.2	2,495	7.1	3,779	1.1	14,068	2.6
Medicine	48,750	5.3	175	.5	25,865	7.4	22,710	4.2
Pharmaceutics	1,207	.1	(3)	(3)	737	.2	470	.1
Agriculture	31,146	3.4	595	1.7	7,582	2.2	22,969	4.2
Veterinary sciences	4,300	.4	(3)	(3)	2,280	.6	2,020	.4
Technical (engineering) sciences	409,470	44.1	4,075	11.6	92,058	26.4	313,337	57.6
Social sciences and humanities	200,812	21.7	8,470	24.1	124,976	35.8	67,366	12.4
History	25,138	2.7	2,530	7.2	12,604	3.6	10,004	1.8
Economics	57,518	6.2	2,495	7.1	22,012	6.3	33,011	6.1
Philosophy	12,039	1.3	490	1.4	10,574	3.0	975	.2
Language and literature	48,721	5.3	1,475	4.2	41,476	11.9	5,770	1.1
Geography	7,242	.8	845	2.4	2,871	.8	3,526	.6
Law	4,765	.5	245	.7	2,748	.8	1,772	.3
Education	31,283	3.4	320	.9	22,507	6.5	8,456	1.6
Psychology	1,924	.2	35	.1	1,228	.4	661	.1
Art	12,182	1.3	35	.1	8,956	2.5	3,191	.6
Architecture	2,590	.3	(3)	(3)	1,320	.4	1,270	.2
Other sciences (military and military-related)	30,663	3.3	[2] 25	.1	17,358	5.0	13,280	2.5

[1] Scientific workers employed in branch scientific organizations, the republic and specialized branch academies of sciences, industrial enterprises, nonresearch project organizations, central administrative scientific and technical subdivisions, and other organizations. The great majority in this residual are in branch scientific organizations.

[2] The numbers of scientific workers in the Academy were calculated from percentages and rounded to the nearest 5. Because of rounding a residual of 25 was derived. This number was arbitrarily assigned to "other" sciences.

[3] Not available.

Source: See source note to table 1.

IV. Adjustment of Soviet Data and Comparison of Soviet and U.S. R. & D. Employment Figures

In order to draw meaningful comparisons between Soviet and U.S. data on R. & D. employment, the numbers of persons conducting and supporting R. & D. in the U.S.S.R. in 1970 as given in this section are adjusted to include R. & D. personnel not in the official series and to exclude from the series personnel not engaged full-time in R. & D. In addition, the adjusted data are presented in variants including and excluding the social sciences and humanities. The year 1970 is selected to demonstrate the adjustment methodology because the published information for that year is more comprehensive than that for most other years. Table 21 illustrates the results of the adjustment of the original Soviet R. & D. personnel data. The calculations used to derive the adjusted figures are presented in appendix C.

A comparison follows of U.S. and Soviet statistics on personnel directly conducting R. & D. The basis for the Soviet figures is the adjusted series of "scientific workers." The U.S. statistical series that most closely approach the scientific workers series are the Bureau of Labor Statistics (BLS) series on scientists and engineers engaged in research and development and the National Science Foundation (NSF) regular series on full-time equivalent scientists and engineers employed in re-

search and development. The former series was discontinued after 1970. Significant differences in the methods of compiling the U.S. and Soviet series are discussed below:

TABLE 21.—ADJUSTMENT OF SOVIET DATA ON R. & D. PERSONNEL, 1970

Employment category	Personnel	
	Reported figures	Adjusted figures
Personnel conducting R. & D., total	927, 709	713, 434
Personnel conducting R. & D., excluding the social sciences and humanities	726, 897	590, 760
Personnel conducting R. & D., excluding the humanities	829, 629	661, 929
Personnel conducting and supporting R. & D., total	2, 999, 000	3, 021, 268
Personnel conducting and supporting R. & D., excluding the social sciences and humanities	(1)	2, 826, 547

[1] Not available.

Source: See app. C.

(1) The Bureau of Labor Statistics series records the number of scientists and engineers who spend the greater portion of their working time in R. & D. or in related work such as management, which requires knowledge of the appropriate field of science or engineering. The National Science Foundation series is based upon the number of employees working principally or part-time in R. & D. and R. & D. management, but these numbers are reduced to full-time equivalents. The Soviet series includes all specialists defined as scientific workers with no reduction to full-time equivalents.

(2) The Bureau of Labor Statistics series excludes all humanities specialists, psychologists and social scientists. The National Science Foundation series excludes all humanities specialists and social scientists and psychologists employed in industry. The Soviet data cover all specialists doing research; however, for comparison purposes, scientific workers in the social sciences and humanities can be disaggregated as required, except in geography, which combines physical geographers and socioeconomic geographers.

(3) The Bureau of Labor Statistics series includes salaried graduate students and the National Science Foundation series incorporates graduate students engaged in R. & D. on a full-time equivalent basis. The Soviet series excludes graduate students, but in this paper an estimate of the full-time equivalents of graduate students is added to the Soviet series.

(4) Inclusion in either U.S. series requires a bachelor's degree in science or engineering or the equivalent in experience and training. At first glance, the Soviet educational criterion appears to be more stringent, as it calls for the possession of a VUZ diploma for all those not having an advanced degree or title. In practice, however, scientists and engineers without diplomas have been counted as scientific workers if they work in units which have an approved scientific research plan.

(5) The Bureau of Labor Statistics data refer to January or an "early-in-year" date. The components of the National Science Foundation series apply to different times of the year, but overall the series approximates an annual average measure. The Soviet data are based on the end of the year.

The most serious obstacle to comparing the U.S. and Soviet series lies in the first difference, i.e., the scope of participation in R. & D. The Soviet definition of participation includes so many qualifications that a precise comparison of Soviet and U.S. figures is out of the question. Nevertheless, it is assumed that the two sets of series, after adjustment of the Soviet series, fall within a range which offers a valid comparison of Soviet and U.S. R. & D. employment. Both the U.S. and Soviet series reduce the actual number of scientific and engineering specialists, the Bureau of Labor Statistics series by eliminating persons not working primarily in R. & D., the National Science Foundation series by converting persons into full-time equivalents in R. & D., and the Soviet scientific worker series by excluding persons not engaged mainly in R. & D. (except for VUZy teachers) and those engaged only in development and innovation not related to major science projects. The Soviet data by definition exclude development and prototype design specialists engaged in local R. & D. projects conducted by separate scientific organizations and industrial enterprises and not a part of ministerial or state science plans. In the adjustments made in this section, the largest group of Soviet scientific workers not employed primarily in R. & D.—VUZy teachers—is reduced to R. & D. full-time equivalents. Two other adjustments are made to the Soviet series to bring it conceptually closer to the U.S. series: first, full-time equivalents of graduate students are added, and second, the estimated number of persons with advanced degrees and titles not engaged in R. & D. (a small proportion at any rate) is eliminated.

No comparison is made in this paper of personnel conducting and supporting R. & D., because there are significant differences in the identification and utilization of support personnel in the United States and the U.S.S.R.; therefore, a comparison would give a misleading indication of the relative size of R. & D. employment in the two countries. One Western authority estimated that in 1970 the ratio of scientists and engineers engaged in R. & D. to auxiliary employees was 1:5 in the U.S.S.R. and only 1:1.3 in the United States.[87] This striking difference in the employment of auxiliary personnel reflects a lower level of efficiency of R. & D. support in the U.S.S.R. rather than a larger pool of effective scientific personnel.[88] It also reflects statistical differences between the U.S. and the U.S.S.R. data in recording persons as R. & D.-support labor.

Table 22 shows the number of scientists and engineers in R. & D. in the United States and the U.S.S.R. from 1950 to 1979. The U.S. data are given as published; the U.S.S.R. data are adjusted from the official scientific worker series, with columns 3 and 4 adjusted to correspond to the Bureau of Labor Statistics and National Science Foundation series, respectively.

[87] Bronson, "Scientific," 1973, p. 577. The ratio for the U.S.S.R. is derived from an adjusted number of scientific workers to adjusted number of persons employed in science and science services.

[88] The ratio of technicians to scientific workers, however, has generally been lower than in the West (Zavlin et al., *Trud*, 1971, pp. 303–304), attesting to a relatively wasteful use of unskilled labor and management in scientific organizations.

TABLE 22.—SCIENTISTS AND ENGINEERS EMPLOYED IN RESEARCH AND DEVELOPMENT IN THE UNITED STATES AND THE U.S.S.R., 1950–79

[In thousands; BLS—beginning of year; NSF—annual average; U.S.S.R.—end of year]

Year	United States		U.S.S.R., adjusted scientific workers series, less specialists in the—	
	Bureau of Labor Statistics (BLS) estimates [1]	National Science Foundation (NSF) estimates [2]	Social sciences and humanities	Humanities alone
	(1)	(2)	(3)	(4)
1950	157.9	158.7	111.7	125.2
1951	175.4	(3)	117.0	131.2
1952	204.9	(3)	123.1	138.0
1953	227.8	(3)	131.9	147.9
1954	243.5	237.1	144.5	162.0
1955	248.8	254.3	153.9	172.6
1956	271.0	(3)	164.9	184.9
1957	308.8	(3)	179.9	201.6
1958	329.7	354.1	195.3	218.9
1959	362.1	(3)	213.2	238.9
1960	386.1	380.9	243.5	273.0
1961	409.5	425.7	277.9	311.5
1962	441.9	(3)	334.1	374.5
1963	475.7	(3)	360.5	404.1
1964	497.9	(3)	389.8	436.9
1965	513.2	494.5	423.3	474.5
1966	526.3	(3)	453.8	508.7
1967	554.0	(3)	490.5	549.8
1968	552.8	(3)	524.2	587.6
1969	549.0	556.6	562.7	630.8
1970	535.4	546.5	590.8	661.9
1971	(4)	526.4	638.9	716.1
1972	(4)	518.5	672.7	754.0
1973	(4)	517.5	706.1	791.5
1974	(4)	525.4	745.1	835.2
1975	(4)	534.8	779.3	873.5
1976	(4)	549.9	798.5	895.0
1977	(4)	571.1	815.1	913.6
1978	(4)	595.0	828.1	928.2
1979	(4)	610.0	(3)	(3)

[1] Excludes social scientists, psychologists, and humanities specialists.

[2] Excludes humanities specialists in all sectors and social scientists and psychologists in industry. (It is estimated that in the U.S. social scientists performing R. & D. in industry would add only about 5 percent or less to the industry figures—this estimate is based on information supplied by John R. Chirichiello, National Science Foundation.) It also excludes scientists and engineers in R. & D. employed in States and local governments. The proportion of the latter, however, is very small, and amounts to only 0.8 percent of total R. & D. scientists and engineers in the Bureau of Labor Statistics data for 1970.

[3] Not available.

[4] Not applicable.

Note: Col. 3 is derived for all years by multiplying the published total number of scientific workers by the estimated percentage of scientific workers outside the social sciences and humanities as adjusted for 1970 (63.7 percent). Similarly, col. 4 is derived by applying the estimated percentage outside the humanities as adjusted for 1970 (71.4 percent). The 1970 percentages are used for all years because the data needed to calculate percentages for most other years are insufficient or unavailable. For the years 1950 to 1961 inclusive, the Soviet official series is multiplied by a factor of 1.107942 in order to adjust for the change in the series in 1962 (derived as a percentage to total number of scientific workers in 1962 of the number of persons employed in industrial enterprises and project organizations who were added to the series that year).

Source: Col. 1: U.S. Bureau of Labor Statistics, Employment, 1973, pp. 24–25. Col. 2: 1950, 1955, 1960: Bronson. "Scientific," 1973, pp. 586–587. 1954, 1961, 1965, 1969, 1972–1979: National Science Foundation, National, 1978, p. 45. 1958, 1970–71: National Science Foundation, National, 1977, p. 34. Col. 3: Soviet scientific worker series multiplied by 1970 estimate of proportion outside social sciences and humanities (63.7 percent). Col. 4: Soviet scientific worker series multiplied by 1970 estimate of proportion outside humanities (71.4 percent).

According to the estimates in table 22, during the early 1950's the United States was well ahead of the Soviet Union both in the number of scientists and engineers employed in R. & D. and in the rate of employment growth. By the end of the decade, however, the Soviet rate of growth rose above the U.S. rate and remained far ahead during the 1960's. The crossover point in number of employees was reached toward the end of the 1960's. From 1969 to 1975 the Soviet total continued to increase more rapidly than the U.S. total, although the rate of growth declined. The U.S. growth rate surpassed the Soviet rate by a small margin during the period from 1975 to 1978. The number of R. & D.

scientists and engineers in the United States, however, declined during the first half of the 1970's and regained the 1969 level only in 1977. As a result, the Soviet number in 1978 was nearly 60 percent greater than the U.S. (comparing the National Science Foundation figure with the estimate for the Soviet Union in column 4). The approximate U.S. and Soviet rates of growth during 5-year periods since 1950 and for 1975–1978 are shown in table 23.

TABLE 23.—AVERAGE ANNUAL RATES OF GROWTH IN THE NUMBER OF SCIENTISTS AND ENGINEERS EMPLOYED IN R. & D. IN THE UNITED STATES AND THE U.S.S.R., 1950–78

[In percent]

Year	United States	U.S.S.R.
1950–55	9.9	6.6
1955–60	8.4	9.6
1960–65	5.4	11.7
1965–70	2.0	6.9
1970–75	−.4	5.7
1975–78	3.6	2.1

Source: Table 22, cols. 2 and 4.

Both the Bureau of Labor Statistics and the National Science Foundation series also include distributions of R. & D. scientists and engineers by economic sector, such as industry, government, universities and colleges, and nonprofit institutions. However, due to the great institutional differences between the U.S. and Soviet systems, the only sector for which a reasonable comparison can be made is U.S. universities and colleges versus Soviet VUZy. Table 24 shows R. & D. employment in this sector in the two countries. As the table indicates, U.S. and Soviet R. & D. employment in higher education was remarkably close in the 1950's and quite comparable from 1960 to 1965. After 1965, however, the Soviet numbers moved considerably ahead, rising to nearly twice the U.S. figure by 1976. The Soviet increase obviously reflects the rapid growth in full-time R. & D. employees in VUZy during this period. Since these employees are not reduced to full-time equivalents in the table, the Soviet figures after 1965 are somewhat overstated.

TABLE 24.—SCIENTISTS AND ENGINEERS EMPLOYED IN R. & D. AT HIGHER EDUCATIONAL INSTITUTIONS IN THE U.S. AND THE U.S.S.R. IN FULL-TIME EQUIVALENTS, 1950–76

[In thousands]

Year	United States (National Science Foundation series)	U.S.S.R.
1950	[1] 18.3	18.3
1955	[2] 25.2	25.1
1960	[3] 37.1	32.4
1965	51.1	53.9
1970	61.3	95.9
1976	68.5	134.1

[1] Excluding an estimate of graduate students included in the original source.
[2] 1954.
[3] 1961.

Note: Both series exclude graduate students. The U.S. figures include university-associated federally funded research and development centers, which are equivalent to problem and branch laboratories in the U.S.S.R. The U.S.S.R. figures are derived from the reported number of scientific workers in VUZy, adjusted as follows: For all years the numbers of research and teaching personnel and full-time R. & D. employees are multiplied by 79 percent, the reported proportion of VUZy scientific workers not in the humanities in 1970, the numbers of research and teaching personnel are reduced to full-time equivalents by multiplying by 25 percent, and full-time equivalents are added to full-time R. & D. employees.

Source: United States: 1950: Adapted from Bronson, "Scientific," 1973, p. 586. 1955–76: National Science Foundation, National, 1978, p. 45, and National Science Foundation, National, 1977, p. 34. U.S.S.R.: Adapted from table 20.

Table 25 shows the distribution of scientists and engineers in R&D by branch of science and engineering in 1974. The Soviet proportions are calculated from the standard official distribution by branch of science, less the humanities. The U.S. proportions are based on a national sample survey of scientists and engineers conducted by the Bureau of the Census for the National Science Foundation. In order to make the Soviet and U.S. distributions more comparable, only U.S. scientists and engineers in R. & D., R. & D. management, and college teaching as reported in the survey are included; their distribution is then juxtaposed with that of Soviet scientific workers. The distributions in the table are presented in percentages alone because the U.S. survey data represent only a portion of the total numbers. As of 1974, the distribution of personnel in the two countries in the physical and life sciences was nearly the same, although the relative distribution among subgroups of the physical and life sciences differed. For example, the U.S.S.R. had a somewhat larger percentage in physics/astronomy/mathematics, agriculture, and medicine, even after national differences in the classification of fields are accounted for. The U.S. share of personnel in chemistry was more than double the Soviet percentage. The proportions in biology were approximately the same with the U.S. share slightly higher when differences in classification are considered. The U.S. proportion in engineering was higher and is judged to remain so even if differences in the classification of engineering fields are taken into account. The Soviet percentage of social scientists was higher than the United States, despite the fact that some Soviet psychology specialists are included under medicine and some anthropologists under biology. The Soviet proportion in economics is much greater than the U.S. figure, but it is somewhat exaggerated by the inclusion in Soviet data of fields which are classified under other branches of the social sciences or humanities in the United States, such as demography and economic history, which are included with sociology and history, respectively.[89]

[89] See National Science Foundation, *Manpower*, 1977, pp. 57–58, and "Nomenclature," 1977, pp. 7–17.

TABLE 25.—DISTRIBUTION OF SCIENTISTS AND ENGINEERS IN RESEARCH AND DEVELOPMENT, BY BRANCH OF SCIENCE AND ENGINEERING IN THE UNITED STATES AND THE U.S.S.R., 1974

[In percent]

Branch of science and engineering	United States	U.S.S.R
Total	100.0	100.0
Physical and life sciences	32.4	32.9
Physics/astronomy/mathematics	7.4	11.0
Computer sciences [1]	1.3	([2])
Environmental sciences (geology/mineralogy/geography) [3]	2.7	3.1
Chemistry	11.5	5.1
Biology [4]	5.1	4.3
Medicine	1.5	5.4
Pharmaceutics [5]	([2])	.1
Veterinary sciences [6]	([2])	.5
Agriculture	1.9	3.4
Other physical and life sciences	1.0	([7])
Technical (engineering) sciences [8]	60.2	51.7
Social sciences	7.4	11.3
Economics	1.9	7.6
Law (political science)	([2])	.6
Education	([2])	2.9
Psychology [9]	2.6	.2
Sociology/anthropology	1.5	([2])
Other social sciences	1.4	([7])
Architecture [10]	([2])	.3
Other sciences (military and military related) [10]	([2])	3.8

[1] Computer sciences in the U.S.S.R. is divided between mathematics and engineering.
[2] Not available.
[3] The Soviet data include socio-economic geography, which is not shown separately from physical geography.
[4] In the U.S. classification, biology includes anatomy, immunology, nutrition, pathology, and pharmacology, which are in medicine in the Soviet classification.
[5] In the U.S. classification, pharmaceutics is divided between chemistry and medicine.
[6] In the U.S. classification, veterinary sciences are under medicine.
[7] Not applicable.
[8] Several fields of science included under the technical sciences in the Soviet classification, such as geodesy, cartography, control systems and information processing, and food technology, are under the physical and life sciences in the U.S. classification.
[9] It is probable that some scientists in psychology in the Soviet Union are classified under medicine (such as psychiatrists) and under education, accounting in part for the disparity between the United States and Soviet proportions. Psychology became a separate branch of science only recently in the U.S.S.R. See table 18.
[10] Part of these groups is probably under engineering in the U.S. classification.

Source: United States: National Science Foundation, Characteristics, 1976, pp. 40–45, 53–60. U.S.S.R.: Adapted from table 18.

The distribution by scientific field of specialists with advanced degrees (i.e., doctorates in the United States and candidate or doctor of sciences in the U.S.S.R.) diverges from the distribution of total scientists and engineers in R. & D. Table 26 shows the distribution of these specialists during the period from 1974 to 1977. The proportion of specialists in the physical and life (i.e., natural) sciences is roughly 45 percent for both countries, whereas approximately 32 percent of the total number of R. & D. scientists and engineers were in these sciences in 1974. Employment in the individual natural sciences in the two countries has almost the same distribution as employment of total scientists and engineers in R. & D. The United States share in biology, however, is much higher than the Soviet share, probably reflecting the years in which biology was a controversial field in the U.S.S.R. In engineering, the Soviet percentage of specialists with advanced degrees is more than twice that of the United States. Except in economics, the Soviet proportion in the social sciences and humanities is lower than the U.S. With respect to the overall figure of specialists with advanced degrees, if one discounts the number of U.S. doctorates not included in table 26 (those not in the labor force, not employed, or not reporting) the Soviet and U.S. totals for the mid-1970's are remarkably similar.

TABLE 26.—UNITED STATES AND U.S.S.R. SPECIALISTS WITH ADVANCED DEGREES, BY BRANCH OF SCIENCE AND ENGINEERING, 1974–77

[Actual figures for United States; Soviet figures rounded to nearest hundred]

Branches of science in which employed	United States, beginning of 1977 [1]		United States, beginning of 1975, [2] number	U.S.S.R., end of 1974	
	Number	Percent of total		Number	Percent of total
Total	[3] 339,167	100.0	(4)	341,200	100.0
Physical and life sciences	147,607	43.6	143,976	160,000	47.0
Physics/mathematics	34,778	10.3	34,631	36,500	10.7
Physics and astronomy	17,911	5.3	16,793	(4,5)	(4)
Mathematics	16,867	5.0	17,838	(4)	(4)
Chemistry	29,640	8.7	29,548	19,500	5.7
Environmental sciences	14,170	4.2	13,842	15,200	4.5
Geology/mineralogy	4,081	1.2	4,023	11,600	3.4
Geography [6]	7,103	2.1	6,140	3,600	1.1
Other earth sciences [7]	2,986	.9	3,679	(4)	(4)
Biology	39,324	11.6	38,463	25,300	7.4
Agriculture	10,641	3.1	10,070	17,100	5.0
Medicine/pharmaceutics	18,164	5.4	16,678	43,000	12.6
Veterinary sciences	890	.3	744	3,400	1.1
Engineering (technical sciences)	49,481	14.6	44,113	102,900	30.1
Social sciences	72,526	21.4	(4)	34,400	10.1
Economics	16,376	4.8	14,408	23,300	6.8
Law (political science)	17,735	5.2	(4)	3,600	1.1
Education	10,467	3.1	(4)	6,200	1.8
Psychology [8]	27,948	8.3	27,596	1,300	.4
Humanities	55,355	16.3	(4)	35,700	10.4
Philosophy/sociology	10,070	2.9	(4)	8,000	2.3
Language and literature	26,040	7.7	(4)	12,600	3.7
History	14,237	4.2	(4)	13,400	3.9
Art	5,008	1.5	(4)	1,700	.5
Architecture [9]	923	.3	(4)	1,100	.3
Other (U.S.S.R.) [10]	(11)	(11)	(11)	7,100	2.1
Other (United States) [12]	13,275	3.9	(4)	(11)	(11)

[1] Based on those receiving their doctorates between 1934 and 1976.
[2] Based on those receiving their doctorates between 1932 and 1974. Humanities doctorates were not included in this survey.
[3] The U.S. total of 339,167 excludes 35,834 doctorates who were outside the labor force or unemployed (27,154) or who did not report their field of employment (8,680).
[4] Not available.
[5] Scientific workers in physics and astronomy comprised about ⅔ of those in physics/mathematics in 1971.
[6] Includes socioecomonic geography, in which there were 1,807 persons in the United States in 1977.
[7] Includes branches of geology, physical geography, and geodesy. The latter, however, is classified as an engineering field in the U.S.S.R. classification.
[8] Psychology totals may be misleading, as the U.S. figures include clinical psychology (12,397 persons in 1977). Some of the Soviet equivalents may be classified under psychiatry, which is in medicine.
[9] The U.S. figure is incomplete, including only urban and regional planning, which is classified under architecture in the U.S.S.R.
[10] The U.S.S.R. "other," as previously indicated, is believed to be primarily military or military-related sciences.
[11] Not applicable.
[12] The U.S. "other" includes area studies, social work, speech and hearing, religion and theology, general social sciences, general humanities, and unspecified fields.

Note: The original U.S. data were adjusted as follows to conform to the Soviet categorization of branches of science: (1) mathematics: computer theory and software systems were added; (2) chemistry: biochemistry was removed to biology and pharmaceutical chemistry to pharmaceutics; (3) environmental sciences: fuel technology and petroleum engineering were removed to engineering, and socioeconomic geography was added; (4) biology: anatomy, immunology, and nutrition and dietetics were removed to medicine; food science and technology was removed to engineering; anthropology was added from the social sciences; and behavior/ethology was removed to psychology; (5) agriculture: agricultural economics was removed to economics and food science and technology to engineering; (6) medicine: veterinary medicine was separated and hospital administration was removed to economics; (7) engineering: communications, computer hardware, and library and archival sciences were added; (8) economics: social statistics, business administration, and home economics were added; (9) law: political science, public administration, international relations, and jurisprudence were combined; (10) psychology: education was removed to general education; (11) language and literature: linguistics and journalism were included; and (12) history: archeology was added.

Source: United States, 1977: Adapted from National Research Council, Science, 1977 Profile, pp. 84–85. United States, 1975: Adapted from National Research Council, "Control," 1976, unpaginated. U.S.S.R.: Table 19.

Appendix A

Types of Scientific Organizations (Nauchnyye Organizatsii) and Other Scientific and Technical Organizations in the U.S.S.R.

I. Organizations Under "Science and Science Services" Branch

A. Scientific institutions (*nauchnyye uchrezhdeniya*):

1. Scientific research institutes (*nauchno-issledovatel'skiye instituty*—NII's) and their affiliates and divisions.
2. Independent (not a part of scientific research institutes or industrial enterprises) scientific research laboratories (*nauchno-issledovatel'skiye laboratorii*).
3. Independent design organizations (*konstruktorskiye organizatssi*) or design bureaus (*konstruktorskiye byuro*) conducting research as well as design work.
4. Scientific and experimental stations (*nauchnyye i opytnyye stantsii*) in agriculture, fishing, forestry, fur-raising, biology, volcanology, permafrost research, and organizations conducting mining and oil drilling research (scientific research industrial stations—*nauchno-issledovatel'skiye promyshlennyye stantsii*).
5. Testing fields, supporting stations (*opornyye punkty*) for scientific projects, and experimental bases, all three groups mainly in agriculture.
6. The U.S.S.R. Academy of Sciences, the republic academies of sciencies, the specialized branch academies, and the affiliates and divisions of the academies (exclusive of academy system scientific research institutes, which are under A–1).
7. Organizations for preservation and study of fauna and flora (such as zoos and botanical gardens), observatories, and museums.
8. Computer centers.
9. State archives, libraries, book centers, and institutes of scientific and technical information.

B. Scientific organizations which conduct development and prototype work and provide survey and experimental data, but do not engage in scientific research work:

1. Independent nonresearch design organizations and project organizations (*proyektnyye organizatsii*), excluding project organizations in construction and forestry.
2. Independent experimental plants (*opytnyye zavody*) not producing industrial output for sale to other organizations.[1]
3. Independent organizations for servicing (*obsluzhivaniye*) scientific institutions, that is, conducting surveys, gathering data, or operating testing facilities: maritime and fishery prospecting organizations, agricultural experimental stations,[2] laboratories for testing equipment and materials, technical information bureaus, and computer centers.
4. Organizations under the hydrometeorological service and geological survey and prospecting organizations.

II. Organizations Not Included Under "Science and Science Services" Branch

A. Scientific institutions:

1. Higher educational institutions (VUZy) and problem and branch laboratories and scientific sectors under VUZy.[3]
2. Central administrative scientific and technical departments, such as scientific and technical councils and technical administrations of branch ministries.

B. Industrial enterprise scientific and technical subdivisions—laboratories, design divisions, test-experimental departments, and departments of mechanization and automation.

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[1] Experimental plants that do sell industrial output are classified under "industry."

[2] In 1976 most, if not all, of these agricultural experimental stations were transferred from "science and science services" to the agriculture branch of the economy.

[3] Scientific research institutes under VUZy are listed under "science and science services" in the 1976 All-Union classification of branches of the economy (TsSU et al., *Obshchesoyuznyy*, 1976, p. 42), but it is not certain whether the personnel working in these scientific research institutes are included with employment in "science and science services."

Source: TsSU et al., *Obshchesoyuznyy*, 1976, pp. 42–43; Taksir, *Integratsiya*, 1975, p. 15; Gosplan SSSR, *Metodicheskiye*, 1974, pp. 768–770; Kostin, *Proizvoditel'nost'*, 1974, p. 83; and Serov, "Classification," 1973, pp. 132 and 140.

Appendix B

Branches of science and subbranches used in classifying scientific workers, U.S.S.R.

Branches and subbranches	*Code*
1. Physics/mathematics	01. 00. 00
a. Mathematics	01. 01. 00
b. Mechanics	01. 02. 00
c. Astronomy	01. 03. 00
d. Physics	01. 04. 00
2. Chemistry	02. 00. 00
3. Biology	03. 00. 00
4. Geology/mineralogy	04. 00. 00
5. Technical sciences	05. 00. 00
a. Machine-building and mechanical engineering	05. 02. 00
b. Processing of metals and other mechanical materials	05. 03. 00
c. Electric power, metallurgical, and chemical machine-building	05. 04. 00
d. Transportation, mining, and construction machine-building	05. 05. 00
e. Agricultural and forestry machine-building	05. 06. 00
f. Aviation engineering and space technology	05. 07. 00
g. Shipbuilding	05. 08. 00
h. Electrical engineering	05. 09. 00
i. Precision instrument building, metrology, and measuring systems	05. 11. 00
j. Radiotechnology, electronics, and communications	05. 12. 00
k. Control systems, automatics, and computer technology	05. 13. 00
l. Power engineering	05. 14. 00
m. Mining engineering	05. 15. 00
n. Metallurgy	05. 16. 00
o. Chemical technology	05. 17. 00
p. Technology of foodstuffs	05. 18. 00
q. Technology of textiles and clothing	05. 19. 00
r. Mechanization and electrification of agriculture	05. 20. 00
s. Technology of the timber industry, paper-cellulose manufacture, and woodworking	05. 21. 00
t. Transportation engineering	05. 22. 00
u. Construction engineering	05. 23. 00
v. Geodesy	05. 24. 00
w. Scientific and technical information processing	05. 25. 00
x. Safety and fire control technlogy	05. 26. 00
6. Agriculture	06. 00. 00
a. Agronomy	06. 01. 00
b. Livestock husbandry	06. 02. 00
c. Forestry	06. 03. 00
7. History	07. 00. 00
8. Economics	08. 00. 00
9. Philosophy	09. 00. 00
10. Language and literature	10. 00. 00
a. Literature	10. 01. 00
b. Languages and linguistics	10. 02. 00
11. Geography	11. 00. 00
12. Law	12. 00. 00
13. Education	13. 00. 00
14. Medicine	14. 00. 00
15. Pharmaceutics	15. 00. 00
16. Veterinary sciences	16. 00. 00
17. Art	17. 00. 00
18. Architecture	18. 00. 00
19. Psychology	19. 00. 00
20. Military sciences [1]	20. 00. 00
21. Naval sciences [1]	21. 00. 00

[1] These are listed in the 1972, but not the 1977, nomenclature.

Source: "Nomenclature," 1977, pp. 7–17, and "Nomenclature," 1972, pp. 1–16.

APPENDIX C

METHODOLOGY OF ADJUSTING SOVIET R. & D. EMPLOYMENT DATA FOR THE PURPOSE OF COMPARISON WITH THE UNITED STATES DATA

	Number
A. Adjustment of data on personnel conducting R. & D.:	
Starting point: Reported number of scientific workers, 1970	927,709
Step 1:	
Reduce number of VUZy research and teaching personnel to full-time equivalents in R. & D. by multiplying by 25 percent (303,255×0.25) [1]	75,814
Subtract full-time equivalents from VUZy research and teaching personnel (303,255−75,814)	227,441
Deduct the remainder from total scientific workers (927,709−227,441)	700,268
Step 2:	
Calculate number of scientific workers with advanced degrees and titles not actually employed in R. & D. by multiplying the remainder in step 1 by 0.75 percent, which is the midpoint of the estimated range of 0.5 to 1 percent not employed in R. & D. (700,268×0.0075) [2]	5,252
Deduct result from remainder in step 1 (700,268−5,252)	695,016
Step 3:	
Calculate full-time R. & D. equivalents of full-time graduate students by multiplying number of latter by 25 percent (55,024×0.25)	13,756
Calculate full-time R. & D. equivalents of part-time graduate students by multiplying number of latter by 42 percent, which is their estimated proportion of study time (44,403×0.42=18,649), and multiply result by 25 percent (18,649×0.25)	4,662
Add full-time R. & D. equivalents of full-time and part-time graduate students to remainder in step 2 (695,016+13,756+4,662)	713,434

	Less social sciences and humanities (1)	Less humanities (2)
B. Adjustment of data on personnel conducting R. & D., excluding (1) the social sciences and humanities and (2) the humanities:		
Starting point: Reported number of scientific workers, 1970	927,709	927,709
Step 1:		
(1) Deduct number of scientific workers in social sciences and humanities (927,709−200,812)	726,897	
(2) Deduct number of scientific workers in humanities (927,709−98,080)		829,629
Step 2:		
(1) Calculate number of VUZy research and teaching personnel outside social sciences and humanities (303,255×0.642) [3]	194,690	
Convert to full-time R. & D. equivalents (194,690×0.25)	48,673	
Deduct full-time equivalents (194,690−48,673)	146,017	
Subtract remainder from result in step 1 (726,897−146,017)	580,880	
(2) Calculate number of VUZy research and teaching personnel outside humanities (303,255×0.790) [4]		239,571
Convert to full-time R. & D. equivalents (239,571×0.25)		59,893
Deduct full-time equivalents (239,571−59,893)		179,678
(3) Subtract remainder from result in step 1 (829,629−179,678)		649,951
Step 3:		
(1) Deduct scientific workers with advanced degrees and titles not employed in R. & D. ((580,880)−(580,880×0.0075))	576,523	
(2) Deduct scientific workers with advanced degrees and titles not employed in R. & D. ((649,951)−(649,951×0.0075))		645,076
Step 4: [5]		
(1) Add full-time R. & D. equivalents of full-time graduate students outside social sciences and humanities (576,523)+((55,024)×(0.773)×(0.25))	587,156	
(2) Add full-time R. & D. equivalents of full-time graduate students outside humanities (645,076)+((55,024)×(0.915)×(0.25))		657,663
Step 5: [6]		
(1) Add full-time R. & D. equivalents of part-time graduate students outside social sciences and humanities (587,156)+((44,403)×(0.773)×(0.43)×(0.25))	590,760	
(2) Add full-time R. & D. equivalents of part-time graduate students outside humanities (657,663)+((44,403)×(0.915)×(0.42)×(0.25))		661,929

	Number
C. Adjustment of data on personnel conducting and supporting R. & D.:	
Starting point: Reported employment in science and science services branch of the national economy, 1970 (new series)	2,999,000
Step 1: Deduct persons employed in the hydrometeorological service and geological survey organizations in science and science services, on the assumption that these organizations do not perform R. & D., but only basic data gathering and geological exploration [7] (2,999,000−475,000) [8]	2,524,000
Step 2:	

METHODOLOGY OF ADJUSTING SOVIET R. & D. EMPLOYMENT DATA FOR THE PURPOSE OF COMPARISON WITH THE UNITED STATES DATA—Continued

	Number
Add VUZy personnel:	
(a) VUZy full-time scientific workers [9]	45,617
(b) Research and teaching personnel in full-time R. & D. equivalents	75,814
(c) Graduate students in full-time R. & D. equivalents	18,418
(d) VUZy R. & D. support personnel in full-time equivalents (estimated by analogy with reported proportion of support personnel in the U.S.S.R. Academy of Sciences for 1970—37 percent in the section of social sciences and roughly ½ in the sections of natural and technical sciences [10]	181,683
Total after adding VUZy personnel	2,845,532
Step 3: Add personnel in industrial enterprise scientific and technical subdivisions:	
(a) Scientific workers	30,330
(b) Support personnel in industrial enterprise scientific and technical subdivisions (estimated by analogy with proportion of support personnel in scientific organizations of the precision instrument-building industry—about 70 percent) [11]	70,770
Total after adding personnel in industrial enterprise scientific and technical subdivisions	2,946,632
Step 4: Add personnel in central administrative scientific and technical departments:	
(a) Scientific workers	14,300
(b) Support personnel in central administrative scientific and technical departments (estimated by analogy with proportion of support personnel in the Presidium and Presidium administrative apparatus of the U.S.S.R. Academy of Sciences in 1970, or 82.1 percent) [12]	65,588
Total after adding personnel in industrial enterprise scientific and technical subdivisions	3,026,520
Step 5: Deduct advanced scientific degree and title holders not employed in R. & D. (5,252) [13]	3,021,268
D. Adjustment of data on personnel conducting and supporting R. & D. outside the social sciences and humanities:	
Starting point: Adjusted total number conducting and supporting R. & D., 1970	3,021,268
Step 1: Deduct adjusted number of scientific workers in social sciences and humanities (713,434−590,760=122,674)	2,898,594
Step 2: Deduct support workers of scientific workers in social sciences and humanities (estimated by applying 63 percent, the reported proportion of scientific workers to total employment in the section of social sciences of the U.S.S.R. Academy of Sciences (122,674÷0.63)−(122,674)=72,047)	2,826,547

[1] Inasmuch as the number of VUZy scientific workers employed full time in R. & D. is not included in the number of research and teaching personnel, the number of full time R. & D. workers is therefore unaltered.

[2] Multiplying this proportion by 700,268 instead of by the reported number of scientific workers (927,709) takes into account the full-time R. & D. equivalents of teachers presumably included in the proportion.

[3] Calculated from table 20.

[4] Calculated from table 20.

[5] The proportion of total graduate students outside the social sciences and humanities in 1970 is derived as 77.3 percent and the proportion outside the humanities is derived as 91.5 percent from Nar. khoz. 70, p. 662. These percentages are postulated here for both full-time and part-time students.

[6] The results of these calculations show that the adjusted number of personnel conducting R. & D. in 1970 comprised 76.9 percent of the reported total number of scientific workers. The adjusted number conducting R. & D. outside the social sciences and humanities comprised 63.7 percent of the total number, and the adjusted number conducting R. & D. outside the humanities alone made up 71.4 percent. These percentages are used in section IV for all years as rough indices in comparing Soviet and United States R. & D. personnel (table 22).

[7] This assumption is also made by various Western scholars estimating Soviet R. & D. employment (for example, Cambell, Reference, 1976, p. 37, and Davies and Berry, "The Research," 1969, pp. 504–506). Also excluded from the new Soviet series of science and science services are agricultural experiment stations not performing R. & D. Employment in these stations constituted 7.4 percent of the old series in 1970.

[8] Derived by extrapolation of the trend in employment between 1965 and 1967. The number employed has not been reported since 1967.

[9] A flaw in adding these personnel is that some of the 45,617 are already counted under science and science services, at least those employed in VUZy scientific research institutes. However, the great majority are believed to be employed in the branch and problem laboratories and scientific sectors of VUZy, which are not placed under science and science services. Any double-counting entailed is assumed to be negligible.

[10] Graduate students are excluded in this calculation because they presumably have no support workers. The calculation is as follows: 45,617 (VUZy full-time R. & D. workers)+75,814 (research and teaching personnel in full-time R. & D. equivalents)=121,431; 121,431×0.358 (proportion in social sciences and humanities)=43,472; number outside social sciences and humanities=77,959 (121,431−43,472); (43,472÷0.63)+(77,959÷0.333)=303,114−121,431=181,683 support workers.

[11] Glagoleva has reported that about 62,000 were engaged in scientific research in industrial enterprises in the early 1970's (Glagoleva, "Problems," 1973, p. 17), but this figure probably refers to scientific workers plus R. & D. assistants, excluding administrative and other auxiliary employees.

[12] Kugel's, "Changes," 1973, p. 32. The proportion of scientific workers to total employees is given as 17.9 percent in this source. Of the support workers, 68.2 percent were in office work and economic services.

[13] The number of support workers calculated above is not reduced to compensate for this deduction since most support workers are reported under science and science services, and the calculation of support workers in other sectors is only a very rough approximation.

Appendix D

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SOVIET CONSUMER POLICY: TRENDS AND PROSPECTS

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I. Summary

The Soviet consumer entered the 1970's with raised expectations. Consumption goals for the Eighth Five-Year Plan (1966–70) had been met for the first time in Soviet planning history, boosted by improved performance in agriculture and unprecedented imports of Western soft goods. The average annual rate of growth in per capita consumption during 1966–70 was above that for either of the previous two 5-year periods. Moreover, the Soviet leadership seemed to commit itself more seriously to consumer-oriented programs, symbolized by the pledge to raise the output of quality foods.

In general, the 1970's have been a disappointment. Although substantial resources have been devoted to some consumer programs, a clearcut boost in priority for the consumer has not been forthcoming. Growth in per capita consumption has been slow and erratic compared with the late 1960's. The main obstacle to steady consumer progress has been the poor performance of the agricultural sector, which seriously disrupted the program to improve the Soviet diet.

In the decade to come, the Soviet consumer is likely to find it difficult to even maintain his current rate of progress. Less favorable weather may disrupt long-term trends in farm output. Also, a general decline in growth is projected for the Soviet economy through the mid-1980's, a result of old problems as well as new difficulties, especially in the areas of manpower and energy. Moreover, the easy quantitative gains in consumer output have been made, and qualitative improvements will be harder to achieve. Foreseeable changes in demand will only add to these pressures.

Policy options in the consumer area seem to narrow down to ameliorative measures, ones that have the potential for providing short-term gain with a minimum of material support from the state. Permission to expand the private sector, for example, could provide a safety valve for consumer discontent.

The relative mood of the Soviet consumer is not inconsequential to the leadership. If the Soviet worker cannot see a potential for improving his lot, he will not respond with alacrity to increased incentives at the farm or factory. Yet a substantial boost in labor productivity is essential if the economy's sliding growth rates are to be reversed. Leadership decisions in the consumer area also are of increasing significance to the rest of the world. Consumer-related imports excluding machinery and equipment have constituted about a third of total Soviet imports since 1965. The decision to import grain in recent years is a good example of the potential impact on world trade of a change in Soviet consumer policy.

This paper will examine: (1) the main features and consequences of consumer policy during the 1970's; (2) trends in per capita consumption and disposable money income during 1965–78; (3) changes in supply and demand that will restrict consumption growth through the mid-1980's; and (4) some policy options open to the leadership. A comparison of the Brezhnev years with former periods was fully covered in the 1976 JEC volume.[1] A comparison of consumption in the U.S.

[1] See Gertrude E. Schroeder and Barbara S. Severin, "Soviet Consumption and Income Policies in Perspective" in *Soviet Economy in a New Perspective*, JEC, Oct. 14, 1976, pp. 620–660.

and U.S.S.R. from 1955 through various benchmark years is contained in another article in this JEC volume.[2]

II. Consumer Policies of the 1970's

The rhetoric of the Brezhnev leadership during the 1970's has been laced with promises to improve the lot of the consumer. The draft directives for the 1971–75 plan declared for the first time that the "chief task" was the "increase in the people's material and cultural standard of living." For only the second time since the beginning of Soviet power, the 1971–75 industrial targets for consumer goods were set higher than for producers goods.[3] Although more symbolic than real, Brezhnev apparently felt it necessary to defend this turnabout at the 24th Party Congress in March 1971. He cited two reasons for paying more attention to consumer demands: (1) The level of growth already achieved allowed the U.S.S.R. to redress the "imbalances of the past"; and (2) the greater satisfaction of consumer demands, because of its effect on worker morale and productivity, was "one of the important economic prerequisites for the rapid growth of production."

However good the intentions, they apparently were not backed by a relative increase in resource allocations; nor is any planned through 1980:

- Consumer-oriented investment[4] as a share of total investment during 1971–77 was somewhat smaller than during 1966–70 and even smaller than in the previous ten years under Khrushchev.
- Total inputs into the agricultural sector during 1971–77 increased at an average annual rate of 1.6 percent, only marginally better than the 1.3 percent achieved in 1966–70 and substantially under the 2.8 percent registered during 1961–65.[5]
- The consumer goals for the Tenth Five-Year Plan (1976–80) are modest; growth in per capita consumption is estimated at 3.2 percent, only slightly more than achieved in 1971–75 after two disappointing harvests.
- Income growth during 1976–80 will be restrained to match the modest consumer output goals.
- After a decade of a rising share of total investment committed to the farm sector, the planned share in 1976–80 will remain the same (albeit at the high level of about one-fourth).

The leadership can argue, however, that it has attempted to focus on the most pressing consumer demands. These include policies to expand the livestock sector, to increase the output of consumer durables, and to raise the quality of both durables and soft goods. Moreover, large and increasing budget subsidies have been allocated to maintain stable prices on basic consumer goods despite rising costs of production. At the same time, growth in income is being held down in an attempt to narrow the gap of unfulfilled consumer demand.

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[2] See Imogene Edwards et al., "U.S. and U.S.S.R.: Comparison of Trends in GNP," in this JEC volume.

[3] In Soviet parlance, goods are relegated to "Group A" (consumer goods) or "Group B" (producers goods) according to their final use. Prior to 1955, these categories were not so clearly defined as enterprises were assigned to Groups A and B depending on the "predominant function" of their output.

[4] Includes investment in Group B industry, agriculture, housing, and services, found in *Narodnoye khozyaystvo* 1977, pp. 352–353.

[5] See Douglas B. Diamond and W. Lee Davis, "Comparative Output and Productivity of U.S. and U.S.S.R. Agriculture," in this JEC volume.

A. Expand Meat Output

A primary plank of the consumer program has been the promise to improve diets, especially by way of expanding meat output. To attain meat goals quickly, livestock herds were expanded rapidly without first ensuring adequate supplies of feed grains. When shortfalls in grain output in 1972 and 1975 threatened the livestock program, the leadership committed itself to importing record amounts of grain and other feedstuffs to minimize distress slaughtering and maintain food supplies. This was in direct contrast to Khrushchev's actions following the harvest disaster of 1963. Grain imports then were belated and small, requiring consumers to tighten their belts and forcing a major reduction in livestock herds.

Largely as a result of this grain import policy, consumer-related imports [6] have become relatively more costly in terms of hard currency. Imports from the Developed West as a share of total consumer imports rose from an average of 15 percent in 1965–69 to 19 percent in 1970–74 and 22½ percent in 1975–77 (Table 1). The size of the Soviet deficit in agricultural commodity trade with the hard currency countries grew from $525.5 million in 1965 to a high of $3.4 billion in 1976.[7] Although grain imports fluctuated widely, the share of consumer-related imports in the total each year remained relatively stable, within a range of 31 to 36 percent,[8] suggesting that grain was imported at the expense of other consumer imports.

TABLE 1.—U.S.S.R.: CONSUMER-RELATED TRADE, 1965–77 [1]

[Percent based on value terms]

	Imports			Exports	
	Consumer-related imports as share of total imports	Grain imports as share of total imports	Consumer-related imports from developed West as share of total consumer-related imports	Consumer-related exports as share of total exports	Grain exports as share of total exports
1965	34.04	4.94	18.03	10.52	3.31
1966	35.79	6.21	20.37	11.26	2.62
1967	35.20	1.75	13.50	13.87	4.67
1968	33.22	1.16	13.74	12.22	3.60
1969	31.52	.31	10.85	12.47	4.27
1970	33.88	1.15	14.34	10.56	3.12
1971	35.03	1.72	13.95	11.57	4.37
1972	36.05	5.51	21.10	8.28	2.14
1973	35.24	7.37	26.26	7.81	2.28
1974	31.39	2.84	16.47	9.41	3.00
1975	35.40	7.21	22.77	7.18	1.52
1976	34.06	7.77	26.21	5.39	.57
1977	32.53	3.42	18.55	5.14	1.14

[1] This category includes all identifiable intermediate and finished consumer-related goods. It does not include equipment for the manufacture of consumer goods.

Source: CIA's Project TRADER, a computerized data base that uses statistics from Soviet foreign trade handbooks (Vneshnaya torgovlya).

[6] This category includes identifiable finished and intermediate consumer-related goods. It does not include imports of machinery and equipment to make consumer goods. Imports of equipment for the food and light industries and agriculture averaged 12 percent of total machinery imports in 1965–77. Trade in consumer-related equipment cannot be broken down further using Soviet trade statistics. The inclusion of heavy industrial equipment for producing consumer goods, such as the Tol'yatti automobile plant, would increase this share substantially.

[7] See CIA ER 78–10516, "Soviet Agricultural Commodity Trade, 1960–76: A Statistical Survey," September 1978.

[8] The coefficient of variation around the mean was 7.3 percent for nongrain consumer-related imports compared with 4.6 percent for all consumer-related imports.

A policy shift in support of the private farm sector[9] has been underway since 1976 to encourage additional livestock product output. The current campaign is only the latest swing in a long history of such policy fluctuations but this one seems more serious, backed by an unprecedented number of new regulations with apparent clout. These include directives to encourage a reliable supply of feed and pasture, the fattening of private livestock at state and collective facilities, the production of small portable tools and mechanized implements suitable for private plots, and the establishment of better procurement facilities for the purchase of surplus production from the private sector. A new decree, issued in September 1977, ordered the republic Councils of Ministers to review the ban on keeping livestock in small towns and to consider raising the limits on private livestock.

Overall livestock targets for 1976–80 apparently had to be reduced as a result of distress slaughtering in 1975 but even so, the reduced plans remain tied to an ambitious herd rebuilding program. An increasing share of productive investment is being directed to livestock complexes.[10] The livestock program will need continued support from imported grain. The Soviets have committed themselves under the terms of the U.S.–U.S.S.R. long-term grain agreement to import a minimum of six million tons of U.S. grain each year during 1976–80.

B. Increase Output of Consumer Durables

The leadership has attached great importance to the continued high growth of consumer durables. One of the most highly publicized and expensive consumer projects was completed during 1971–75—the Fiat-designed Volga Motor Vehicle Plant at Tol'yatti. The output from this plant in addition to that from other new and expanded facilities increased the output of passenger cars to about 1.2 million units by 1975 compared with only 200,000 units in 1965.

During 1976–80, the consumption of durable goods is planned to grow again at a high rate, although somewhat more slowly than in 1971–75. This category is scheduled to include goods that the Soviet consumer has never seen before, such as self-defrosting refrigerators, air conditioners, and video tape recorders. In contrast to the previous five-year plan period, rapidly increasing sales of automobiles will not play an important role in boosting growth rates of consumer durables. Because automobile production is planned to increase only slightly—about 1 percent per year—annual sales to the population are expected to remain at roughly the 1975 level.[11]

C. Improve the Quality of Soft Goods and Durables

At the opening session of the 24th Party Congress in March 1971 Brezhnev indicated that past attitudes toward consumer goods output

[9] The private agricultural sector supplies more than 25 percent of the U.S.S.R.'s total farm output, including more than 30 percent of its livestock products. It is almost exclusively composed of individual holdings of one-half hectare or less, frequently combined with the ownership of one or two head of livestock and small flocks of poultry.

[10] Complexes are large, standardized, highly automated facilities developed to concentrate the breeding, raising, and feeding of livestock, including poultry. In 1975, they supplied 12 percent of the beef, 13 percent of the pork and 20 percent of the poultry produced, and the share of output from these organizations is to almost double by 1980. See Barbara S. Severin and David W. Carey, "The Outlook for Soviet Agriculture," in *The Future of the Soviet Economy*: 1978–1985, Boulder, 1978, p. 121.

[11] See Toli Welihozkiy, "Automobiles and the Soviet Consumer," in this JEC volume.

would have to be changed. He recognized that the privations of the past had had a deleterious effect on "the production of consumer goods, their quality and range" but declared this to be no longer acceptable. Inventories of unwanted goods were growing again, after being drawn down in the late 1960s by increased effective demand in the countryside. Now the rural population was also experiencing a rising level of expectations and greater consumer sophistication. During 1971–75, discounts of nearly 5 billion rubles were needed to reduce inventories,[12] an amount equivalent to nearly 5 percent of retail sales of nonfood products in 1975.

To confront these problems, a quality campaign in the consumer goods area was launched, a complement to the general effort to raise quality throughout the economy. Mainly hortative in nature, the campaign has failed to attack the basic deficiencies in the producer price and incentive system that stymie innovation and quality output.[13] Some piecemeal measures have been taken including:

Permission for a temporary rise in wholesale prices for new and improved consumer goods;[14]

Reduction of 3% in an enterprise's material incentive fund for each percent of output returned for finishing or correcting;[15]

Measurement of plan fulfillment for consumer durables in retail prices instead of physical indicators;[16]

Increase in bonus funds depending on the share of total production receiving the "Seal of Quality";[17] and

Assignment of five-year plan goals for the output of consumer goods to 14 branches of heavy industry, including defense-related industries.

D. Subsidize Retail Prices

The current leadership has continued the long-term Soviet policy of maintaining stable prices on basic consumer goods. True to this policy, official price increases have been concentrated on luxury goods or those purchased by only a small portion of the population, and prices on other products have been cut to reduce excessive inventories. In March 1978, for example, prices were raised sharply for gasoline, gold and platinum jewelry, coffee, cocoa and chocolate but reduced for black and white television sets, refrigerators, and some clothing.[18]

In the face of increasing costs of production, the decision to hold the price line on basic consumer goods has created a growing gap between costs and revenues, the difference financed by budget subsidies. In 1975, for example, holding retail meat prices unchanged since 1962 resulted in an estimated 12 billion rubles in subsidies, equivalent to a 40 percent markdown in retail prices. During the present five-year plan 100 billion rubles[19] have been allocated from the state budget to cover the difference between state purchase prices for meat and milk and the retail prices fixed by the state—roughly equivalent to four times total agricultural investment in 1975.[20]

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[12] *Voprosy ekonomiki*, No. 12, 1977, p. 26.
[13] See Gertrude E. Schroeder, "The Soviet Economy on a Treadmill of Reform," in this JEC volume.
[14] *Sotsialisticheskiy trud*, No. 10, 1978, pp. 39–40.
[15] *Ibid.*
[16] *Finansy, SSSR*, No. 8, 1978, p. 11.
[17] *Sotsialisticheskiy trud.*, loc. cit.
[18] *Pravda*, Mar. 1, 1978, p. 1.
[19] *Planovoye khozyaystvo*, No. 7, 1977, p. 17.
[20] See "Agricultural Subsidies in the Soviet Union," U.S. Bureau of the Census, Foreign Economic Report, No. 15, December 1978.

E. Restrain Income Growth

The leadership has increasingly emphasized the importance of matching the pace of consumer goods output with income growth. During 1971–75 this policy was particularly difficult to implement. Supplies of consumer goods were much smaller than expected and income supplement programs such as higher minimum wages coupled with normal wage creep led to high rates of growth in disposable money income. Income goals for 1976–80 indicate a more serious effort to stifle inflationary pressures. The growth planned for average annual money wages per wage and salary worker—3.2 percent—is the lowest rate in the Brezhnev period and roughly equals the estimated growth planned for consumption. Also, the welfare package planned for 1976–80 is more modest than in the past. Per capita growth of the "socialized fund" of consumption—transfer payments such as pensions as well as state expenditures on health and education—is planned to grow at 4.3 percent, down from the 6.1 percent attained in the previous period.

The leadership has good cause to be concerned about unfulfilled consumer demand. This so-called "postponed demand" not only complicates planning but has the potential for dampening incentives and hence, achievement of productivity goals. Many Soviet economists see the gap between supply and demand reflected in the large lump of highly liquid demand embodied in savings deposits. Such deposits grew more than seven-fold from 1965 to 1978, reaching 131 billion rubles, a sum equal to 55 percent of the value of retail sales in that year. A large part of this growth no doubt reflects consumer savings for major cash purchases such as a car or co-op apartment since credit is not available as in the West. However, recent Soviet research indicates that there is also a substantial amount that can be labeled "unsatisfied demand." One economist estimates that this portion has increased by almost 30 percent compared with 1968.[21]

A calculation of the marginal propensity to save (increase in savings compared with increase in incomes) substantiates a growing gap between incomes and available goods. If an "alternative" price index [22] is used to deflate growth in income and savings, an upward trend in the marginal propensity to save is indicated particularly since 1970 (Table 3). The rise in the average propensity to save (share of savings out of income) has been fairly steady since 1965.

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[21] *Voprosy ekonomiki*, No. 10, 1978, p. 75. *Izvestiya akademii nauk SSSR, Seriya ekonomicheskaya*, No. 5, 1976, pp. 90–100.

[22] Developed by Gertrude E. Schroeder and Barbara S. Severin, this is the price index implicit in a comparison of indexes of goods sold in the retail trade network in constant and in current prices. It is believed to be a more accurate measure of real price changes of goods actually purchased than is the official index. See discussion in their article in the 1976 JEC volume, *Soviet Economy in a New Perspective*, *op. cit.*, pp. 631–632. See Table 2 in this article for the calculation of the "alternative" price index for 1950 and 1955–78.

TABLE 2.—U.S.S.R.: CALCULATION OF "ALTERNATIVE" PRICE INDEX, 1950, 1955–78

	Total consumption of consumer goods	Consumption in-kind	Consumer goods in retail trade (col. 1—col. 2)	State and co-op retail trade	Collective farm market sales	Total (col. 4+5)	Implicit retail price index (col. 6÷col. 3)	Implicit retail price index, 1970=100
1950	53.984	15.483	38.501	35.958	4.919	40.877	106.2	100.1
1955	74.811	15.299	59.512	50.194	4.780	54.974	92.4	87.1
1956	79.977	15.508	64.469	54.743	4.210	58.953	91.4	86.2
1957	86.975	16.125	70.850	62.501	3.960	66.461	93.8	88.4
1958	94.306	16.188	78.118	67.720	4.050	71.770	91.9	86.6
1959	97.971	16.496	81.475	71.923	3.830	75.753	93.0	87.6
1960	104.136	16.290	87.846	78.555	3.702	82.257	93.6	88.2
1961	106.469	16.067	90.402	81.076	3.930	85.006	94.0	88.6
1962	111.634	15.783	95.851	87.296	3.873	91.169	95.1	89.6
1963	113.467	15.939	97.528	91.685	3.788	95.473	97.9	92.3
1964	116.466	15.815	100.651	96.361	3.861	100.222	99.6	93.9
1965	122.797	16.332	106.465	104.762	3.589	108.351	101.8	96.0
1966	130.795	16.526	114.269	113.015	3.666	116.681	102.1	96.2
1967	139.959	16.748	123.211	123.579	3.788	127.367	103.4	97.5
1968	149.123	16.655	132.468	134.190	3.811	138.001	104.2	98.2
1969	158.620	16.617	142.003	144.399	4.100	148.499	104.6	98.6
1970	166.618	16.375	150.243	155.208	4.200	159.408	106.1	100.0
1971	173.283	16.377	156.906	165.577	4.100	169.677	108.1	101.9
1972	176.948	15.618	161.330	176.422	4.600	181.022	112.2	105.8
1973	184.113	15.857	168.256	185.665	4.600	190.265	113.1	106.6
1974	191.944	15.605	176.339	196.560	4.800	201.360	114.2	107.6
1975	201.108	15.370	185.738	210.389	5.200	215.589	116.1	109.4
1976	206.440	15.437	191.003	220.139	5.800	225.939	118.3	111.5
1977	213.271	15.341	197.930	230.641	5.800	236.441	119.5	112.6
1978	219.603	15.322	204.281	241.2	6.200	247.400	121.1	114.1

Source: Total consumer goods consumption is from CIA's index of Soviet consumption. Consumption in-kind is based on bench mark years estimated by Constance Krueger. State and co-op retail trade as well as collective farm market sales are from Narodnoye Khozyaystvo for the appropriate years.

TABLE 3.—U.S.S.R. MARGINAL AND AVERAGE PROPENSITIES TO SAVE, 1955–77

	Real per capita savings (1970 rubles)		Real per capita disposable money income (million 1970 rubles)		Average propensity to save $\Delta s/y$	Marginal propensity to save $\Delta\Delta s/\Delta y$
	Total	Annual change	Total	Annual change		
1955	4.454		328.84		0.014	
1956	6.729	2.276	337.24	8.40	.020	0.271
1957	9.983	3.253	364.48	27.24	.027	.119
1958	5.534	—4.449	393.42	28.94	.014	—.154
1959	7.576	2.042	402.17	8.75	.019	.233
1960	4.725	—2.851	413.63	11.46	.011	—.249
1961	4.564	—1.603	453.72	40.09	.010	—.040
1962	6.262	1.698	477.68	23.96	.013	.071
1963	7.205	.943	475.41	—2.27	.015	—.415
1964	8.848	1.642	487.01	11.60	.018	.142
1965	14.030	5.183	511.81	24.80	.027	.209
1966	19.535	5.504	549.04	37.23	.036	.148
1967	17.923	—1.612	576.14	27.10	.031	—.059
1968	24.918	6.995	624.54	48.40	.040	.145
1969	27.134	2.216	652.11	27.57	.042	.080
1970	35.844	8.710	682.74	30.63	.052	.284
1971	27.927	—7.917	704.08	21.34	.040	—.371
1972	30.043	2.116	711.23	7.15	.042	.296
1973	31.325	1.281	740.29	29.06	.042	.044
1974	39.464	8.139	776.56	36.27	.051	.224
1975	45.524	6.060	802.08	25.52	.057	.237
1976	44.144	—1.380	826.42	24.34	.053	—.057
1977	48.984	4.840	845.98	19.56	.058	.247

Source: Total savings are savings deposits plus bond purchases minus net borrowing. Savings deposits are from the appropriate Narodnoye khozyaystvo. Bond purchases (state loans) and net borrowing are from tables 9 and 10 in this paper and table 11 in "New Directions in the Soviet Economy," part II–B, JEC, Washington, 1966, p. 526. Per capita savings are obtained by dividing total savings by mid-year population from U.S. Department of Commerce, Bureau of Economic Analysis, Foreign Demographic Division; per capita savings is deflated by the "alternative" price index from table 1 in this paper. Real per capita disposable money income is from table 8 in this paper and table 11 in a previous JEC volume cited above.

III. Trends in Consumption and Income, 1965–78

Growth in per capita consumption [23] has differed substantially between the earlier and later periods of the Brezhnev era—from an average annual rate of 5 percent in 1966–70 to 2.6 percent in 1971–78 (Table 4). The former period was aided by favorable weather for the agricultural sector, but all consumption components experienced healthy growth. In contrast, since 1971, growth has fallen in several sectors but most precipitously in the food sector as a result of two disappointing harvests. Reflecting this slowdown, consumption has declined somewhat as a share of gross national product since 1970 but has not fallen sharply because of the general slowdown in economic growth (Table 5).

[23] The methodology used to derive CIA's index of consumption has been revised somewhat, resulting largely in differences in the growth rates of the food and communal services categories. A complete methodology will be published in a forthcoming JEC volume along with other GNP components.

TABLE 4.—U.S.S.R.: GROWTH IN PER CAPITA CONSUMPTION, 1961–78

[Average annual rates of growth]

	1961–65	1966	1967	1968	1969	1970	1966–70	1971	1972	1973	1974	1975	1971–75	1976	1977	1978
Total consumption	2.3	5.1	5.5	5.4	5.0	4.1	5.0	3.1	1.4	3.2	3.2	3.8	2.9	1.9	2.4	2.2
Food	1.6	3.9	5.2	4.4	4.6	2.9	4.2	1.6	−1.3	2.9	2.8	2.4	1.7	0	.8	.6
Soft goods	1.7	7.6	6.9	7.3	6.2	5.3	6.6	3.6	2.0	2.3	2.5	5.0	3.1	3.8	3.0	2.6
Durables	4.2	10.8	7.8	10.2	7.0	11.0	9.3	12.5	14.5	7.4	7.4	8.9	10.1	6.1	8.6	7.0
Personal services	4.3	6.0	6.5	6.2	5.0	5.5	5.8	4.8	4.8	4.6	5.0	4.9	4.7	4.0	3.1	4.1
Communal services	3.9	3.4	2.5	3.3	2.8	2.8	2.9	1.8	.7	1.4	1.9	1.6	1.4	1.1	1.5	.9

Source: CIA Index of Soviet Consumption.

TABLE 5.—U.S.S.R.: COMPONENTS OF CONSUMPTION AS SHARES OF GNP (FACTOR COST)

[In percent]

	1960	1965	1970	1975	1978
Total consumption	60.1	57.0	57.3	56.6	55.5
Food	27.0	24.4	24.3	22.7	21.4
Soft Goods	7.5	7.0	7.8	8.2	8.3
Durables	1.9	1.9	2.5	3.5	4.0
Services	23.7	23.7	22.7	22.3	21.8

Source: CIA Index of Soviet Gross National Product.

A. Food

Growth in overall per capita consumption is heavily influenced by the record of the food sector since food constitutes about half of total consumption. The growth in food consumption was relatively high and stable in 1966–70, but average annual growth during 1971–78 was less than half the former period and extremely erratic. Per capita food consumption declined absolutely in 1972 and failed to grow at all in 1976. Growth has been higher since then, and the record grain harvest of 1978 should give a much needed boost to the food processing sector in 1979.

The leadership's pledge to increase meat output has proved to be its most expensive and elusive goal. After distress slaughtering boosted meat output temporarily in 1975, production fell sharply in 1976, recovering in 1977–78 but still failing to surpass the per capita output of 1975. Despite massive grain imports (37 million tons in 1975–76) meat shortages were frequent and widespread, occurring in rural areas as well as in towns and major cities.[24]

Despite frustrated demand, quality foods have been the growth leaders since 1965 (Table 6). Per capita consumption of meat and meat products by 1978 was 137 percent of the 1965 level compared with 85 percent for potatoes and 90 percent for grain products. This has resulted in a substantial improvement in diet for the average citizen. Starchy staples (grain and potatoes) at last constitute less than half of the total calories supplied per person per day, with more meat taking up some of this slack. Nevertheless, the Soviet diet is still a long way from matching that in the West. In 1977, starchy staples supplied 22 percent of the calories in the average U.S. diet compared with 46 percent in the U.S.S.R., while meat and fish accounted for 20 percent of the U.S. diet, compared with only 8 percent in the U.S.S.R. (Figure 1). Per capita meat consumption in the U.S.S.R. in 1977 is estimated to have been only about 60 percent of that of Poland and about 75 percent of that of France.[25]

[24] Grain imports reached a record high of $3.3 billion in 1976. Nearly all of the grain was used to minimize reduction in livestock herds by maintaining earlier levels of grain feeding.

[25] "Foreign Agriculture Circular: Livestock and Meat," U.S. Department of Agriculture, FLM 7–78, August, 1978.

TABLE 6.—U.S.S.R.: PER CAPITA CONSUMPTION OF MAJOR FOODS, 1965, 1970, 1975, AND 1978

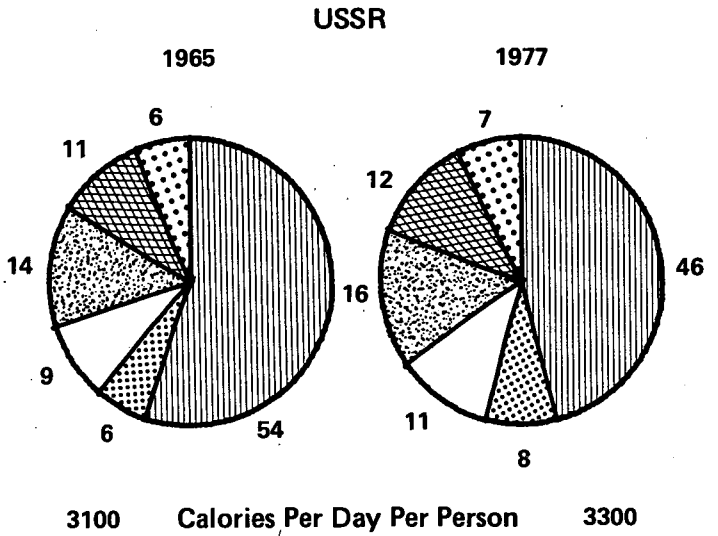
[In kilograms per year]

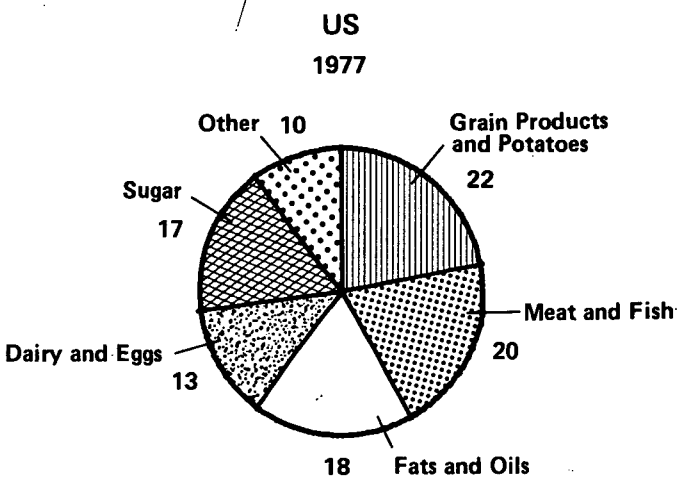
	1965	1970	1975	1978	1978 as percent of 1965
Eggs (units)	124	159	216	230	185
Fruit and grapes	28.0	35.0	39.0	41.0	146
Fish and fish products	12.6	15.4	16.8	16.9	134
Meat and meat products	41.0	48.0	57.0	56.0	137
Milk and milk products	251.0	307.0	316.0	320.0	127
Vegetables	72.0	82.0	89.0	90.1	125
Sugar	34.2	38.8	40.9	43.0	126
Vegetable oil	7.1	6.8	7.6	8.2	115
Grain products	156.0	149.0	141.0	140.0	90
Potatoes	142.0	130.0	120.0	120.0	85

Source: SSSR v tsifrakh v 1978, p. 204.

Figure 1

Composition of Diets





B. Soft Goods

Average annual growth in per capita consumption of soft goods in 1971–78 was about half that achieved in 1966–70. The rate in the earlier period was unusually high, stimulated by rapidly rising farm incomes combined with increased transfers of goods from urban to rural areas. As indicated above, by the 1970's the backlog of unsatisfied rural demand for soft goods had been largely met, and the increasingly sophisticated rural resident joined his urban counterpart in demanding higher quality shoes and clothing. Soft goods inventories, which had dropped sharply from 55 percent of retail sales in 1965 to 45 percent in 1970, turned up again by 1975 to 47 percent, with unsold quantities of certain goods such as knitwear registering much higher figures.

Despite real improvements in quality, style and assortment over the years, shoddiness still pervades those industries producing soft goods. The campaign to make a dramatic leap ahead in quality in the 1970's has not borne fruit as evidenced by numerous complaints in the Soviet press. One source reports that it is not uncommon for the State Inspectorate for the Quality of Goods to reject from 20 percent to 25 percent of checked sewn articles, 30 percent to 50 percent of the leather footwear, 20 percent to 30 percent of all fabrics and over 20 percent of the knitwear.[26] Another Soviet source notes that in 1977, 10.7 percent more woolen fabrics, 14.2 percent more dresses and 5.4 percent more leather shoes were rejected than in 1976.[27] Moreover, imports of higher-quality soft goods have declined as a share of total imports in 1971–77 compared with 1965–70.

C. Durables

The durables sector has consistently been the fastest growing category of consumption. The growth in stocks of basic consumer durables from 1965–77 shows that they are becoming an increasingly common fixture in most Soviet households (Table 7). A notable exception is the inventory of privately owned automobiles, which by the end of 1977 came to an estimated 5 million units, or one car for every 52 people.[28] Nevertheless, during 1971–77, there was an eight-fold increase in the number of cars sold to individuals.

TABLE 7.—U.S.S.R.: HOUSEHOLD STOCKS OF CONSUMER DURABLES, 1965 AND 1978

[In numbers per 100 persons]

	1965	1978	1978 as percent of 1965
Radios	16.5	24.3	147
Televisions	6.8	24.0	353
Washing machines	5.9	20.3	344
Refrigerators	2.9	22.6	779
Bicycles	13.4	14.8	110
Vacuum cleaners	1.8	7.1	394
Motorcycles	1.7	2.7	159

Source: SSSR v tsifrakh v 1978, p. 206.

Growth in output of major durables is slowing as consumers fulfill their basic needs and industry fails to respond to changes in demand.

[26] *Finansy SSSR*, No. 6, 1977, p. 15.
[27] *Finansy SSSR*, No. 8, 1978, p. 8.
[28] Wellhozkiy, *op. cit.*

In 1978, for example, the output in physical units of radios, TV's and washing machines was only 1 percent greater than the previous year. As with soft goods, Soviet consumers now are demanding an increase in quality and assortment but industry has not responded accordingly. In mid-1977, for example, the trade network reportedly carried an inventory of 1.6 million TV sets, a number ordinarily sold in 118 business days.[29] These were largely 24-inch, black and white models, indicating a lack of response to current consumer demands for small color TV's. The average changeover period for a major appliance model reportedly is still 6–10 years, compared with 3–4 years in the West.[30] The "Seal of Quality", awarded only to those items considered equivalent to international standards, has been assigned to only 5 of 42 refrigerator models, 3 of 40 washing machine models and 2 of 32 tape recorder models.[31]

D. Services

The growth in the supply of communal services (health and education) on a per capita basis has declined over the Brezhnev years as these sectors mature and a smaller school age population reduces the need for large annual increases in outlays for education. Resource allocations for health care and education are impressive, accounting for about 7 percent of gross national product. Great strides have been made in education, with an emphasis on achieving universal secondary education (10 years) and increasing the share of students with a higher education. The share of the population 16 years of age and over with a general secondary education grew from less than 8 percent in 1965 to nearly 20 percent in 1977, while the share with higher education increased from about 3½ percent in 1965 to over 6½ percent in 1977.[32] The gains in health services have been less dramatic in the Brezhnev years, having already attained by 1965 reductions in general and infant mortality rates close to those in the West.[33] Major emphasis now is being placed on improving the quality of personnel and facilities, still poor by Western standards.

The supply of personal services [34] has grown at relatively high rates since 1965, but none of the breakthroughs has been made that are necessary to radically improve this chronically deficit sector. Among services, housing continues to be the greatest source of consumer dissatisfaction although the supply has grown steadily in recent years. The majority of urban families now have their own apartments, a great improvement over earlier years when most urban families lived in communal apartments, sharing kitchen and bathroom facilities. Per capita housing space increased from 6.8 square meters in 1965 to 8.4 in

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[29] *Voprosy ekonomiki*, No. 7, 1978, p. 57.
[30] *Planovoye khozyaystvo*, No. 10, 1978, p. 23.
[31] *Ibid.*
[32] See CIA ER 79–10344, "U.S.S.R.: Trends and Prospects in Educational Attainment, 1959–85," June 1979.
[33] However, the Soviet Union appears to have experienced a rise in infant mortality and a fall in life expectancy in recent years. These changes seem not to be caused primarily by deficiencies in the health care system but by a variety of demographic, health and social factors. See "Life Expectancy in the Soviet Union," *Wall Street Journal*, Jan. 20, 1978, p. 20.
[34] Includes housing, utilities, personal transport and communication, repair and personal care, and some recreational and cultural activities.

1977.[35] Even so, living space is still cramped, and the nine square meters established by the Soviet government in 1928 as the minimum norm for health and decency will not be reached until at least 1980.[36] The number of units constructed annually has leveled off at 2.2–2.3 million. Moreover, the quality of construction is poor, and housing maintenance and repair is a sometime thing.

State-provided everyday services (such as barber shops, public baths, and shoe and clothing repair) have been another long-neglected area which the current leadership pledged to tackle. Plans to double the volume available during 1966–70 were achieved, but the goal of again doubling the volume in 1971–75 in urban areas and tripling it in rural areas fell far short of plan. In 1978, the total value of such services amounted to 6.8 billion rubles or about 26 rubles per capita [37]—an equivalent outlay for a woman to have her hair washed and set once a month. As a result, a large network of semi-legal private services has developed to fill the gap. A revealing study of consumer services in Belorussia during 1971–73 found that 45 percent of the demand for apartment repair, 25 percent of the demand for furniture repair and 16 percent of the demand for vehicle repair were provided by the private sector.[38]

E. Disposable Income

During 1966–70 there was a surge in the growth of per capita disposable money income (Table 8), which largely reflected a major wage reform in the industrial sector and an increase in the monthly minimum wage from 40 to 60 rubles. Rising labor productivity and higher skill and education levels also played a role. Since that time the Soviets have managed to reduce the rates of growth somewhat in order to stifle inflationary pressures. During 1971–77, per capita disposable money income grew at an average annual rate of 4.9 percent compared with 6.8 percent during 1966–70.

The gross earnings of wage and salary workers at state enterprises and wages of collective farmers form roughly 80 percent of total money income (Appendix, Table 1). Prior to 1970, there was a spectacular rise in incomes of agricultural workers because of various wage reforms and higher procurement prices for farm products. During 1966–70 the average annual money wage of a collective farmer rose over 11 percent compared with about 4½ percent for a nonagricultural worker. By the 1970s these reforms had almost run their course, and several disappointing harvests took their toll on farm income. As a result, during 1971–77 the gap between the growth in the average annual money wage of a collective farmer (5½ percent) and that of a nonagricultural worker (3½ percent) closed somewhat.

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[35] CIA's Index of Consumption. The index used to measure housing services is an index of total living space, computed as the sum of separate estimates for midyear stocks of urban and rural housing.

[36] By way of comparison, in mid-1978, the average space per person was 23 square meters in East Germany and 31 square meters in West Germany. The U.S. average is at least 25 square meters.

[37] *SSSR v tsifrakh v 1978*, p. 217.

[38] A. I. Goranin, *Voprosy kachestva bytovykh uslug*, 1975, p. 25. Such services usually are provided by moonlighting but often make use of state-owned tools and materials.

TABLE 8.—U.S.S.R.: PERSONAL DISPOSABLE MONEY INCOME

[Billion rubles]

	1950	1955	1960	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
1. Total personal money income	46.52	64.90	85.08	123.34	134.28	144.60	159.84	169.96	182.74	194.30	206.46	219.13	234.84	249.50	264.85	276.80
2. Deductions from personal money income	6.92	8.77	6.90	9.89	10.95	12.03	13.69	15.26	16.97	18.45	20.22	22.08	24.19	26.27	28.31	30.18
3. Personal disposable money income	39.60	56.13	78.18	113.45	123.33	132.57	146.15	154.70	165.77	175.85	186.24	197.05	210.65	223.23	236.54	246.62
4. Per capita personal disposable money income (rubles)	219.88	286.09	364.82	491.34	528.18	561.74	613.30	642.98	682.74	717.46	752.48	789.15	835.58	877.48	921.46	952.57
5. Real per capita disposable money income (rubles) deflated by (1970=100):																
(a) Soviet official price index	165.82	289.56	366.65	488.90	529.77	563.43	615.15	643.62	682.74	718.18	753.99	789.94	838.09	876.60	919.62	947.83
(b) "Alternative" implicit price index	219.66	328.84	413.63	511.81	549.04	576.14	624.54	652.11	682.74	704.08	711.23	740.29	776.56	802.08	826.42	845.98

SOURCE AND METHODOLOGY

1. Total personal money income: (a) All years—Table 1 in Appendix.
2. Deductions from personal money income: (a) All years—table 2 in Appendix.
3. Personal disposable money income: (a) All years—line 1 less line 2.
4. Per capita personal disposable money income: (a) All years—line 3, divided by mid-year population from U.S. Department of Commerce, Bureau of Economic Analysis, Foreign Demographic Division.
5. Real per capita disposable money income:
   (a) Soviet Official Price Index:
      1. All years—line 4, deflated by an index of prices paid by consumers for goods. The deflator is a weighted index based on the official retail price index (e.g., N.kh. 1977, p. 469) and a collective farm market price index derived from N.kh. 1977, 452. For a complete methodology of the latter, see "The ACES Bulletin," spring 1979. The weights are the respective shares of total sales in 1970 from N.kh. 1976, p. 531.
   (b) "Alternative" implicit price index:
      1. All years—line 4, deflated by the "alternative" implicit price index, which is calculated by dividing Soviet-reported retail sales plus CFM sales in current rubles by the value of total estimated food consumption less the value of consumption in-kind, both in constant 1970 prices. Consumption in-kind was calculated by Constance Krueger for benchmark years 1950, 1955, 1960, 1966, 1970, 1974 and 1976. Other years were interpolated geometrically on the basis of the trend in the share of consumption in-kind in total consumption of food, 1975–77 extended at the 1974 level. Total food consumption is from CIA's Soviet Consumption Index.

Transfer payments, the other major source of money income, almost tripled in 1966–67 compared with the doubling of gross earnings of wage and salary workers and collective farmers, thus providing a larger share of total income. The rising share reflects the implementation of programs to bring collective farmers under social insurance coverage and the periodic liberalization of pension and welfare grants. Other notable changes in money income during 1965–77 included a 70-percent increase in the net incomes of households from the sale of farm products, and a sixfold increase in interest earned on savings accounts.

IV. Outlook for Consumption in the 1980's

The Soviet consumer has made admirable strides during the Brezhnev years even though progress has been uneven and the pace of improvement has slowed in recent years. As the 1980's approach, the leadership will find that substantial gains in consumer welfare will be even harder to achieve:

A change in basic weather patterns could frustrate Soviet plans for a large rise in farm output, particularly in the livestock sector, and increase dependence on grain imports.

The easy gains—large quantitative gains from a low base—have been made, and future achievements will depend largely on qualitative improvements. The Soviets traditionally are weak in this area because the present incentive system is not geared to rewarding innovation and improved quality.

Stringent projections for the economy as a whole in the early 1980's will increase competition among resource claimants for investment, labor, and foreign exchange. If the past is repeated, the consumer will lose this battle.

At the same time, changes in demand will maintain pressures for increased consumption. Although population growth will remain low, those in the 25–34 year age group will increase proportionately more, and these are prime consumption years. One mitigating factor is the fact that population growth will be greatest in those republics with the lowest relative per capita consumption. Growth in money incomes, even restrained, will put the greatest pressure on those consumer items with the poorest near-term prospects for growth—meat, high-quality durables, and personal services. Moreover, the traditional emphasis on mass satisfaction of basic consumer wants will make it difficult and costly to satisfy the more sophisticated and individualistic demands of the future.

A. Changes in Supply

1. AGRICULTURE [39]

At a party plenum devoted to agriculture in July 1978, Brezhnev announced a 1985 meat output target of 19.5 million tons. If the 1980 meat output goal is reached, this implies an average annual per capita growth of only 1.5 percent in 1981–85, substantially below the 2.2 percent planned for 1976–80. To achieve even this slower growth rate, very large imports of grain for feeding livestock would be required.

[39] See CIA ER 79-10057, "U.S.S.R.: Long-Term Outlook for Grain Imports," January 1979.

Achievement of the 1985 grain target of roughly 260 million tons would require a continuation of the relatively favorable weather conditions of the past decade or a more rapid growth in yields based exclusively on accelerated growth in the use of fertilizer. Recent Western studies indicate that neither of these conditions probably will be met.[40] As a result, Soviet grain output probably will fall in the range of 190–212 million tons in 1980 and 212–236 million tons in 1985. Comparing this likely range in output with estimated demand and assuming that the gap will be covered with imports, the maximum quantity of imports required would be 27 million tons in 1980, declining to a maximum of 16 million tons in 1985. The 1980 amount is valued at an estimated $3.4 billion,[41] compared with the all-time high of $3.3 billion worth of grain imports in 1976. Although a heavy burden, imports of this size appear to be feasible.

Raising the meat output goal for 1985, however, would be severely constrained by hard currency availabilities. A doubling of the planned average annual rate of increase in per capita meat output to 3 percent, for example, would lead to a 1985 import requirement of roughly 25 million tons, costing almost $4 billion. This would run directly into a hard currency crunch caused by the expected decline in Soviet oil exports beginning about 1980.[42]

2. QUALITY OUTPUT

The unwillingness of the present regime to launch a fundamental economic reform will continue to hamper the campaign for the production of consumer goods of higher quality and greater assortment. Reforms in the price and incentive structure are needed to reward those who improve product quality or introduce new products. The existing incentive system still emphasizes quantity, not quality, and the price structure fails to make it consistently profitable to produce those items demanded by the public.[43]

The Soviet press abounds with reports of the consequences of these perverse incentives. It has become "unprofitable" to produce cotton children's clothing, clothing in small sizes and items that are labor intensive such as teapots and small saucepans.[44] Meanwhile, stores become overstocked with woolen children's clothing, clothing in large sizes, and large saucepans and buckets. Fines for the nondelivery of goods are set as a percent of ruble value, making it more profitable, for example, to fill orders on clothing for adults rather than children. Enterprises report that it is not always worth striving for the "Seal of Quality" because the additional expenditures necessary are only poorly reflected in prices. At one firm, a jacket that costs 2.2 times more to manufacture than its lower quality counterpart sells for only 13 percent more.[45]

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[40] See CIA ER 76–10577, "USSR: The Impact of Recent Climate Change on Grain Production," October 1976, and CIA ER 77–10556, "The Impact of Fertilizer on Soviet Grain Output, 1960–80, November 1977.

[41] World market prices for grain (measured in 1978 dollars) are estimated to rise by an average of 5 percent annually in 1978–85. A 1977 base price for grain of $109 per ton was used.

[42] Even allowing for an optimistic estimate of crude oil production and for domestic conservation measures, by 1985 the USSR is expected to become a substantial net importer on the hard currency account. Thus, nonoil import capacity in 1985 will be reduced well below current levels.

[43] See Gertrude E. Schroeder, *op. cit.*, in this volume.

[44] *Voprosy ekonomiki*, No. 7, 1978, pp. 54–64.

[45] *Finansy* SSR, No. 8, 1978, p. 10.

A major problem is that there is no single ministry for consumer goods output. Three-quarters of the production volume of the so-called cultural and everyday goods category (containing almost all durables with the exception of automobiles) is scattered throughout heavy industry. One result has been a plethora of brands and models—e.g., 89 bicycle models—fragmenting the effort and complicating the supply of parts and service. In most cases, the output of consumer goods is only a sideline of a producer's goods enterprise and is easily sacrificed if materials are short.

3. GENERAL GROWTH CONSTRAINTS

Soviet economic growth has been slowing for some time, largely because of a drying up of rural sources of urban labor force growth, a slowdown in the growth of capital productivity, and a limited capacity for the purchase of foreign technology and materials. In the 1980's not only will these problems intensify but they will be joined by two additional constraints—a decline in the growth of the labor force and, as indicated above, a looming oil shortage that will severely limit earnings of foreign exchange.[46]

The expected decline in GNP growth will inevitably cut deeply into consumer gains. Simulations of Soviet growth to 1985 using a large scale macroeconomic model show that, depending on the choice of possible policy options open to the Soviets and possible contingent events, average annual GNP growth during 1981–85 could vary between 2.3 percent and 3.1 percent.[47] Average annual growth in consumption would fall in the range of 2 to 2.6 percent (per capita consumption in the range of 1 to 1.6 percent). Such growth represents a distinct slowdown compared with previous periods. The projected decline in aggregate consumption growth is due largely to an assumed growth in defense expenditures of 4 percent annually—about one percentage point greater than GNP growth. Therefore, consumption, as the residual claimant, is squeezed not only by reduced growth but also by having to settle for a smaller share of the GNP pie.

The constraints of the 1980's will impact more heavily on some consumer programs than others. We have already seen that the anticipated shortage of hard currency combined with probable weather-related problems could cause per capita consumption of meat to increase at a substantially slower rate in 1981–85 than planned in 1976–80. Consumer-related imports other than grain also may be cut because of reduced growth in overall import capacity. Assuming a continuation of a moderate level of imports of Western plant and equipment—especially for energy conservation and production—little capacity for consumer imports will remain, with the exception of grain and livestock-related equipment.

Potential shortfalls in the output of petroleum and high-quality steel in the early 1980's might force a rethinking of Soviet plans to increase automobile production. In any case, it is doubtful that the foreign exchange will be available to purchase the Western equipment necessary for further significant expansion and modernization of auto-

[46] See CIA ER 77–104360, "Soviet Economic Problems and Prospects," July 1977.
[47] See CIA ER 79–10131, "Simulations of Soviet Growth Options to 1985," March 1979.

mobile plants. Moreover, the general investment squeeze will make it more difficult to improve the currently lagging service facilities and road network.

The service sector is another consumer area badly in need of major expansion but likely to be pushed aside by the more pressing needs of other sectors. Some services are highly labor-intensive such as retail trade and everyday (repair and personal care) services. With the looming labor shortage it is hard to imagine that adequate resources will be allocated to redress the relative neglect of the past much less provide for a sizeable expansion. Housing, on the other hand, is relatively capital-intensive, receiving about 15% of total annual investment. In keeping with a marked slowdown in overall investment growth during the current 5-year plan, unusual emphasis has been placed on reducing the backlog of uncompleted construction. So far this program has not resulted in a more rapid completion of new housing; less housing has been added each year during 1976–78 than was built in 1975 (in terms of square meters). More importantly for the future, a restraint on new housing starts during this five-year plan period would result in a downturn in completions in the early 1980's.[48]

B. Changes in Demand

Assuming a continuation of the official policy of maintaining state retail prices at current levels, demographic change and income growth will be the major determinants of consumer demand in the early 1980's.

1. DEMOGRAPHIC CHANGE [49]

Population growth in the early 1980's will remain at the relatively low rates of the 1970's—about 1 percent per year compared with 1.7 percent during the 1950's. The continuation of this low growth should slow demand for consumer goods and services. Also, regional differences in population growth should help restrain growth in demand. Partially offsetting these factors, however, will be a projected change in the structure of population growth during the 1980's.

Because of a decline in fertility the share of the population under 16 years of age will fall from 27.9 percent in 1975 to 26.6 percent in 1985. At the same time, the share of population in the pension ages (60 for men and 55 for women) is expected to rise—from 15.3 percent in 1975 to 16.5 percent in 1985. While the share in the able-bodied ages (16 to 59/54) will remain about the same—56.8 percent in 1975 compared with 58.4 percent in 1980 and 56.9 percent in 1985—there will be significant change within this age group. The population bulge created by those born during the 1950's and early 1960's will be in the 25–34-year-old age group by the early 1980's.

The bulge of 25–34-year-olds in the early 1980's (the major family and household formation years) will increase pressures on most categories of consumption, particularly food, soft goods and durables. The effect on services will be mixed. Housing and everyday services will be more in demand while there will be a decline in demand for education,

[48] Nearly all new Soviet urban housing is comprised of large high-rise apartment buildings requiring 4 or 5 years from initial construction to completion.

[49] Taken from unpublished manuscript by Ann Goodman that uses unpublished projections from Foreign Demographic Analysis Division, U.S. Bureau of the Census, March 1977.

already reflected in lower enrollment figures in the primary and middle grades. A substantially larger share of people in the pension ages by 1985 should increase the need for health services.

The increased pressure on consumption may be eased somewhat by regional differences in population growth, which show that growth will be largest in those republics that consume the least on a per capita basis. Birth rates in the Transcaucasian and Central Asian republics are still double the rate for the USSR as a whole. By 1985 the share of total population in the Transcaucasus and Central Asia will be 16.6 percent compared with 11.2 percent in 1960. Although per capita consumption by republic is not available, the following selected indicators [50] show that these republics, for whatever reason,[51] consume relatively less than their Slavic and Baltic counterparts. In 1975, per capita payments and benefits from the social consumption fund (principally transfer payments and public outlays on education and health), on a scale of 100 for the USSR, were an average of 77 for the Transcaucasus and 76 for Central Asia compared with 110 for the RSFSR and 126 for Estonia. Retail sales per capita in 1975, again with the USSR equal to 100, were 71 for the Transcaucasus and Central Asia combined compared with 110 for the RSFSR and 142 for Estonia.

2. INCOME GROWTH

Growth in money income even if restrained will expand the demand for the very consumer items that will be most vulnerable to supply difficulties in the early 1980's. Changes in the structure of household expenditures for Soviet industrial workers and collective farmers since 1940 illustrate the predictable changes in patterns of expenditures with rising incomes (Table 9). The shares of durables and services in total expenditures rise as incomes rise and unless contrained by rationing or higher relative prices probably will continue to do so in the future as the share of food drops.

TABLE 9.—U.S.S.R.: STRUCTURE OF HOUSEHOLD EXPENDITURES, 1940, 1965, AND 1977

[In percent]

	Household of industrial workers			Household of collective farmers		
	1940	1965	1977	1940	1965	1977
Total income	100.0	100.0	100.0	100.0	100.0	100.0
Food	53.8	37.9	32.4	67.3	45.2	34.7
Clothing	11.1	13.9	15.6	10.9	13.7	15.8
Durables	1.7	6.1	6.8	1.2	4.2	5.9
Services	17.5	24.2	22.6	4.4	12.5	15.0
Communal	9.0	13.8	13.4	3 4	10.0	11.9
All other	15.9	17.9	22.6	16.2	24.4	28.6

Source: Narodnoye khozyaystvo 1977, pp. 409–410.

The declining share of total expenditures on food, however, will give little relief to Soviet planners because the income elasticity (the response of demand to changes in income) for quality foods is higher than for other foods. These are the very foods that the Soviets are

[50] Taken from Tables 5 and 6, Gertrude E. Schroeder, "Soviet Regional Development Policies in Perspective", NATO Colloquium 1978.

[51] These include a larger share of children in the population, socio-cultural factors, lack of urbanization, and more moderate climate than in the rest of the USSR.

relatively least efficient in producing. The evidence suggests a Soviet income elasticity of demand for unprocessed meat at or above 1.0, considerably above the income elasticity of demand estimated for other countries with comparable levels of economic development.[52] The relatively high Soviet elasticity reflects current meat consumption well below levels for countries with comparable levels of economic development, and few alternative outlets for rising income; quality consumer goods such as consumer durables, clothing, and shoes are in short supply, and housing space is rationed at heavily subsidized prices.

If meat and income goals are met, assuming an income elasticity of demand of 1.0, the implied gap between the supply and demand for domestically produced meat in 1980 is estimated to be 8 percent (roughly 1.5 million tons) greater than in 1975. Even if the 1985 meat target is met and per capita disposable income grows by an average annual rate of 3 percent, the gap between meat supply and demand is projected to widen by an additional 1.5 million tons.[53]

3. CHANGE IN THE CHARACTER OF DEMAND: INDIVIDUAL VS. COLLECTIVE

For the past 60 years, the Soviet planner on perfectly rational grounds has concentrated on satisfying basic, communal wants of the consumer. Vast sums have been spent on mass transport, uniform high-rise apartments, public health care, and a farm sector that could supply an adequate amount of cheap calories. The emphasis was on getting the job done with a minimum of choices or frills. Now the Soviet consumer is beginning to demand not only more and better goods and services but an assortment and type tailored to individual tastes. Soviet planners are ill-prepared to anticipate or satisfy this type of demand. Moreover, having created an infrastructure designed to satisfy "collective" demands, the regime will be reluctant to allocate the capital needed to satisfy the individual. As a result, the maturation of Soviet consumer wants will be frustrated.

The most obvious case is the emerging desire of the Soviet for his own means of transport. The regime has committed itself to a rapid expansion in the sale of cars to individuals in the 1970's yet it has not been willing to provide the requisite infrastructure. A lack of adequate repair garages, gas stations, and roadside accommodations restricts domestic tourism, and the existence of public transport plus the poor planning of parking facilities and traffic patterns discourage the use of the car for commuting. Thus far, car ownership can be regarded only as a rather impractical venture, a kind of conspicuous consumption. There is no evidence that private car ownership in the USSR will be allowed to perform the same function as in the West in the near future, particularly since prudence dictates the conservation of fuel, capital and foreign exchange.

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[52] Italy and Spain, for example, have estimated elasticities of demand with respect to income of 0.71 and 0.67, respectively, while Poland and Hungary register 0.70 and 0.65 respectively. See "USSR: Long-Term Outlook for Grain Imports," *op. cit.*, p. 5.

[53] *Ibid*, p. 6. The estimate of 3 percent was chosen because it is roughly the upper end of the range estimated for per capita GNP. Historically, disposable income has grown more rapidly than GNP.

V. Possible Policy Responses

Since additional resources cannot be allocated to stem the inevitable decline in the growth of consumer goods and services through the mid-1980's, the leadership must settle on policies that are ameliorative, ones that will cushion the impact. Such policies could boost output by encouraging the use of resources that would otherwise lie idle or could attempt to redistribute or reduce demand.

A. Encouragement of the Private Sector

Official encouragement of the private sector is one way to obtain extra output with a modicum of additional state resources. Private activity is allowed in the agricultural, housing and service sector. As noted earlier, a campaign is already underway to boost output from the private agricultural sector, particularly in livestock products. Beginning in 1977, the share of total livestock inventories held by private owners increased for the first time since 1965; the value of privately held livestock in 1977 increased by 5 percent over 1976, the first positive growth since 1970.

The private farm sector probably can provide a substantial boost in meat output in the short-run, but in the longer-run there are limits. Private farming is highly labor-intensive, and at present largely depends on pensioners, unemployed women, and the free time of state and collective farmers. Further expansion will be difficult as the rural population continues to decline. Also, growing farm incomes and the increasing availability of processed foods will make work in the private sector less attractive. Finally, the continued small size of the plot and livestock holdings will make it less amenable to major gains through adoption of labor saving technology or herd improvement.

Private housing construction seems to have little potential for making a noticeable dent in the housing shortage. Official encouragement has been given, largely by making it easier for individuals to invest in cooperative (technically in the state sector) and private housing, but keen competition from the state housing sector for land, labor, machines and materials will continue to restrict its growth.

Private activity in the service sector is already substantial and could continue to fill the gap between the growing demand for such services and the meagre state supply. Private services cover a broad range of activity including professional services such as those of doctors and teachers, repair services, personal services such as barbering and sewing, and handicrafts. Official sanction was given to these activities by the new Constitution of 1977 that states, "the law permits individual labor in handicrafts, farming, the provision of services for the public * * *" Brezhnev envisioned that labor that would otherwise be lost could be turned to this sector. He told the 24th Party Congress in 1971 that it was time to create the conditions for using "pensioners, housewives, and invalids * * * either at home, in an individual capacity, or forming themselves into cooperatives (to) take up some work in the field of services."

B. Price Increases

An obvious way to restrain consumer demand for quality foods and other goods is to raise prices. Not only would this reduce queues but

it would relieve the budget from having to absorb further rises in the differential between retail prices and agricultural production costs. However, the experiences of Khrushchev in 1962 and neighboring Poland in 1970 and 1976 indicate that a price rise must be handled with finesse. When Khrushchev raised retail prices of meat by an average of 30 percent in 1962, civil disturbances were so severe that the army had to be used to quell the rioters. In Poland, sharp hikes in food prices in 1970 led to Gomulka's ouster, and a 69 percent increase in meat prices in 1976 had to be rescinded the following day to prevent a nationwide strike.

Subsequent moves in Poland to raise food prices in more subtle ways promise to work better.[54] The ultimate success of the Polish experiment might give the Soviet leadership confidence to try price hikes of its own. This would mean reneging on the promise to hold the line on prices of basic foods, but this policy must be weighed against the wisdom of preserving a subsidy system for meat and milk that in 1976–80 will cost 1.4 times greater than agriculture's contribution to Soviet GNP in 1977.

C. Special Supply Systems

The Soviets have, to a great extent, institutionalized their consumer shortages. That is, special distribution systems have developed that give a portion of the populace more reliable access to deficit items. This includes the so-called second economy, "elite" stores, and enterprise rationing systems. The consumer squeeze of the next decade no doubt will result in greater refinements of these "marketing" systems, as has already occurred with respect to meat.

Soviets with high incomes or privileged status have always had access to a relatively steady supply of quality foods, including meat. The collective farm markets consistently offer higher quality and assortment than found in state stores but at premium prices. Over the years, key occupation groups have been rewarded by the so-called "Kremlin ration," the "academic ration," and several restricted distribution systems. Currently, the most common type of privilege is access to a closed shop or "distributor" with admission by work-pass. Other restricted outlets include "home delivery departments" or "order desks" attached to the larger stores or buffets, and eating facilities at party offices with carry-out service.[55]

In the aftermath of the meat shortages of the 1970's additional systems have evolved that in effect widen the circle of people with some access to meat beyond the traditionally privileged. Most of these efforts have originated with local governmental, trade or plant authorities. These practices include: (*a*) a limit on meat sales at state stores; (*b*) direct distribution of meat by state industrial enterprises to their workers; and (*c*) a ration card system which entitles each employee to a

[54] Although official meat prices have not risen as yet, Gierek announced in January 1978 that such prices would rise gradually. Meanwhile, the government has opened "commerical" shops offering a better selection of higher quality meat, but at prices nearly double the "frozen" prices.

[55] See Mervyn Matthews, "Privilege in the Soviet Union," 1978, pp. 48–52.

certain quantity of meat per month bought from state stores. The age-old system of bribes and barter has thrived in this atmosphere. Proliferation of the special distribution systems that rechannel meat supplies probably is a major reason for frequent reports of a complete absence of meat in state retail outlets despite some improvement in meat supplies since 1977.

In lieu of the use of prices to ration scarce consumer goods, these special distribution systems should help the economy function more smoothly during the next decade. The elite systems are basically an acknowledgment that additional "perks" are necessary to reward those officially deemed most valuable to Soviet society. If it becomes more common for enterprises to act as distribution points for consumer goods, the best supplies could be channeled to those industries whose rising productivity is most vital to economic growth. In any case, systems that reduce the need for queuing, which is often done on company time, would seem to improve productivity and reduce consumer discontent.

TABLE 1.—U.S.S.R.: PERSONAL MONEY INCOME

[In billion rubles]

	1950	1955	1960	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
1. Total personal money income	46.52	64.90	85.08	123.34	134.28	144.60	159.84	169.96	182.74	194.30	206.46	219.13	234.84	249.50	264.85	276.80
2. Gross earnings of wage and salary workers	32.00	44.51	59.97	89.05	95.83	103.40	115.09	123.31	132.05	140.02	148.74	157.83	168.98	178.81	189.37	198.15
3. Wage payments to collective farm members	1.18	3.06	4.94	9.13	10.96	12.66	13.40	13.66	14.04	14.38	14.82	15.77	16.24	15.86	16.62	17.47
4. Net incomes of households from sale of farm products	4.18	4.11	5.39	6.39	7.15	6.84	7.35	6.90	8.26	8.97	9.39	9.59	10.02	10.07	11.14	10.99
5. Profits distributed to cooperative members		.01	.02	.02	.02	.02	.02	.02	.03	.03	.04	.04	.03	.03	.03	.04
6. Military pay and money allowances	4.65	5.75	3.38	3.17	3.19	3.26	3.26	3.33	3.32	3.45	3.45	3.50	3.60	3.76	3.76	3.87
7. Transfer payments	3.87	6.00	10.39	15.01	16.55	17.71	19.93	21.80	24.04	26.28	28.70	30.90	33.27	38.03	40.62	42.64
8. Pensions and welfare payments	3.37	5.22	9.68	13.85	15.18	16.22	18.27	19.92	21.96	23.89	25.94	27.49	29.17	33.39	35.42	36.84
9. Pensions	2.40	3.20	7.20	10.60	11.80	12.60	14.00	15.00	16.20	18.00	19.80	20.80	22.10	24.40	25.70	27.10
10. Welfare payments	.97	2.02	2.48	3.25	3.38	3.62	4.27	4.92	5.76	5.89	6.14	6.69	7.07	8.99	9.72	9.74
11. Stipends to students	.46	.74	.60	.90	1.00	1.10	1.18	1.30	1.30	1.40	1.50	1.90	2.10	2.20	2.20	2.30
12. Insurance indemnities	.04	.04	.11	.26	.37	.39	.48	.58	.78	.99	1.26	1.51	2.00	2.44	3.00	3.50
13. Loan service	.51	1.43	.70	.10	.10	.20	.20	.20	.10	.10	.08	.11	1.10	1.10	1.20	1.20
14. Net borrowing	.07	.09	.06	.09	.02	−.04	−.06	−.04	−.03	−.03	−.01	−.03	−.02	−.03	−.02	.02
15. Interest on savings	.06	.12	.23	.38	.46	.55	.65	.78	.93	1.10	1.25	1.42	1.62	1.87	2.13	2.42

SOURCE AND METHODOLOGY

1. Total money income: (a) All years—sum of lines 2 through 7 and 13 through 15.
2. Gross earnings of wage and salary workers:
   (a) 1950, 1955—Narodnoye khozyaystvo SSSR v 1974 godu, Moscow, 1975, p. 549, 562 (hereafter, N. Kh. and the appropriate year). Includes gross earnings of cooperative artisans of 880,000,000 rubles in 1950 and 1,170,000,000 rubles in 1955 respectively. Cooperative artisans earned a wage equal to ⅔ that of industrial wage and salary workers according to U.S. Bureau of the Census, "Producers' Cooperatives in the Soviet Union," by Frederick A. Leedy, International Population Reports Series, P 95, No. 51, Washington, D.C., p. 14. The average annual number of artisans is reported in N. Kh. 1964, p. 545. The average annual industrial earnings are from Trud v SSSR, Moscow, 1968, p. 140. Producers' cooperatives were converted into state enterprises in 1960 and members were then classified as state workers.
   (b) 1960, 1965–74—N. Kh. 1975, p. 531, 546, 1975–77—N. Kh. 1977, p. 378, 385. Gross earnings are the product of the average annual number of wage and salary workers and average monthly earnings, adjusted to an annual basis.
3. Wage payments to collective farm members:
   (a) 1950, 1955, 1960—David W. Bronson and Constance B. Krueger, "The Revolution in Soviet Farm Household Income, 1953–1967," in James R. Millar (ed.), "The Soviet Rural Community," University of Illinois Press, Urbana, 1971, p. 250.
   (b) 1965–77—Derived for each year as the product of (1) official statistical handbook data regarding total wage payments (money plus in-kind) made by collective farms to collective farm members for their work in socialized activity of the farms and (2) the share constituting money payments only. Data for total wage payments (money plus in-kind) are available for 1965–70 in "Sel'skoye khozyaystvo SSSR," Moscow, 1971, p. 479; for 1971–74 in N. Kh. 1975, p. 414; for 1975–77—N. Kh. 1977, p. 271. Money payments accounted for 79.4 percent of total payments (money plus in-kind) in 1965 (V. N. Zhurikov and V. I. Solomakhin, compilers, "Spravochnik po oplate truda v kolkhozakh" Moscow, 1973, p. 10); 85.6 percent in 1966; 92.4 percent in 1967; 93.7 percent in 1968; 96.9 percent in 1969 (S. V. Rogachev, "Ekonomicheskiye zakony i razvitiye sel'skogo khozyaystva," Moscow, 1973, p. 217); and 93.6 percent in 1970 (Zhurikov and Solomakhin, op. cit.). Money payments are estimated to amount to 94 percent in 1971, in line with the 1970 share, and to 95 percent in 1972 through 1976, and 96 percent in 1977.

4. Net income of households from sales of farm products:
   (a) 1950, 1955, 1960, 1965–75—Net income of households from sales of farm products is derived as the difference between (1) total money income of households from sales of farm products—sales to state procurement and state and cooperative trade organizations, sales in collective farm ex-village markets and commissions trade, and sales of livestock to collective farms—and (2) money outlays—purchases from outside the sector of materials and services used in production of these agricultural products and indirect taxes. Included in indirect taxes are fees charged collective farm market traders and taxes levied on livestock holdings of households. A detailed methodology is given in "U.S.S.R.: Gross National Product Accounts, 1970," A(ER) 75–76, Nov. 1975.
   (b) 1976–77—The above series is extended by using the growth rates derived from adding the sales of farm products to consumer co-ops and the sales of farm products at collective farm markets found in N. Kh. 1977, p. 449.
5. Profits distributed to cooperative members:
   Consumers' cooperatives constitute a separate trade network, paralleling that of the state stores but designed primarily to service rural areas with stores and restaurants. A cooperative is usually composed of residents of a single village. Nominally, the cooperatives system is controlled by its members, but the government actually exercises strict control over profits, prices, and earnings. A small share of profits is distributed to members. During 1962–65, 68,400,000 rubles were distributed to cooperative members according to A.P. Ilyushin (ed.), 50 let sovetskoy potrebitel'skoy kooperatsii, Moscow, 1967, p. 142. Total cooperative profits for those years were 3,389,000,000 rubles. (N. Kh. 1963, p. 637 and N. Kh. 1964, p. 747.) Dividing distributions by profits results in a distribution rate of 2.02 percent. This rate is applied to reported profits for each year:
   (a) 1950, 1960, 1965–67—N. Kh. 1967, p. 857.
   (b) 1955—N. Kh. 1960, p. 843.
   (c) 1970–74—N. Kh. 1975, p. 725.
   (d) 1975–77—N. Kh. 1977, p. 541.
6. Military pay and monetary allowances:
   The U.S.S.R. publishes no data on aggregate military pay. An estimate of total pay for 1970 was recently published by CIA. This is used as a base weight and is moved from 1950 to the current year by an index based on military manpower, including paramilitary personnel such as border guards and security forces:
   (a) 1970—GNP 1970, p. 3.
   (b) All other years—Index based on military manpower estimates from the annual publication of the International Institute for Strategic Studies, "The Military Balance", London.
7. Transfer payments: (a) All years—Sum of lines 8, 11 and 12.
8. Pensions and welfare payments:
   The Soviet Union has established an extensive program of social services covering a wide range of contingencies. The state social security program—which includes benefits for sickness, maternity, and large families, and pensions for old-age and disability—covers workers in state enterprises. Since 1965, a similar but more limited program has existed for collective farmers. Pensions and welfare payments are derived as the difference between total outlays for social security and social insurance, including pensions, and the sum of outlays for health resorts and sanitoria, outlays for kindergartens and pioneer camps, and miscellaneous outlays:
   (a) 1950, 1968–69—N. Kh. 1969, p. 771, 774.
   (b) 1955—N. Kh. 1958, p. 905–906, adjusted, assuming relationship between expenditures in 1950 as reported in N. Kh. 1958, p. 905–906, and in N. Kh. 1969, p. 771, 774, applied in 1955.
   (c) 1960, 1966–67—N. Kh. 1968, p. 776, 779.
   (d) 1965, 1970–74—N. Kh. 1975, p. 744, 746.
   (e) 1975–77—N. Kh. 1977, p. 408, 563.
9. Pensions:
   State workers and collective farmers are given pensions for permanent disability, survivor. old-age, and long service:
   (a) 1950, 1968–69—N. Kh. 1969, p. 758.
   (b) 1955—Estimated to be 72 percent of pensions and welfare payments, based on the relationships existing in 1950 and 1960.
   (c) 1960, 1966–67—N. Kh. 1968, p. 776.
   (d) 1965, 1970–74—N. Kh. 1975, p. 744.
   (e) 1975–77—N. Kh. 1977, p. 561.
10. Welfare payments: (a) Total pension and welfare payments (line 8) less pensions (line 9).
11. Stipends to students:
   (a) 1950, 1955—"Raskhody na sotsial'no-kul'turnye meropriyatiya po gosudarstvennomu byudzhetu SSSR," Moscow, 1958, p. 46.
   (b) 1960, 1969–70—N. Kh. 1970, p. 537.
   (c) 1965, 1970–75—N. Kh. 1975, p. 568.
   (d) 1966–68—Estimates based on numbers of students in higher education (N. Kh. 1968, p. 682 and N. Kh. 1969, p. 675) and average stipend paid in 1965 and 1969.
   (e) 1976–77—N. Kh. 1977, p. 408.
12. Insurance indemnities:
   Sum of compensation received for personal property and life and accident insurance claims:
   (a) 1950, 1955, 1960, 1965–66—G. P. Kosyachenko, et al., "50 let sovetskikh finansov," Moscow 1967, p. 347–348
   (b) 1967–68—A. G. Zverev, "Natsional'nyy dokhod i finansy SSSR," Moscow, 1970, p. 282.
   (c) 1969—"Ekonomicheskaya gazeta," No. 41. 1971, p. 6.
   (d) 1970—"Finansy SSSR," No. 1, 1971, p. 10.
   (e) 1971–72—Based on "Ekonomicheskaya gazeta," No. 41, 1971, p. 6, and "Finansy SSSR," No. 4, 1973, p. 8.
   (f) 1973—"Finansy SSSR," No. 4, 1974, p. 14.
   (g) 1974—"Finansy SSSR," No. 6, 1975, p. 59.
   (h) 1975—"Finansy SSSR," No. 5, 1976, p. 17.
   (i) 1976–77—estimated.
13. Loan service:
   (a) 1950, 1955—N. Kh. 1958, p. 900.
   (b) 1960, 1965–68—N. Kh. 1968, p. 774.
   (c) 1969–70—N. Kh. 1970, p. 730.
   (d) 1971—N. Kh. 1922–72, p. 482.
   Since 1971, budget reporting has carried no item on loan service. Estimates for 1972 forward are based on the following:
   (e) 1972–73—Den'gi i kredit, No. 1, 1974, p. 4. In 1972 and 1973, 2,600,000,000 rubles and 3,600,000,000 rubles of 3 percent lottery bonds were sold respectively.

(f) 1974–75—Den'gi i kredit, No. 11, 1974, p. 90. The government resumed redemption of the subscription loans in December 1974. In 1974 and in 1975, 1,000,000,000 rubles were to be paid to the population. Total loan service for each year also includes an estimated 100,000,000 rubles of payment for 3 percent lottery loans. Finansy SSSR, No. 4, 1976, p. 24, confirms that in 1974–75, 2,000,000,000 rubles of loans were paid off.
(g) 1976—Loan repayments are estimated at 1,100,000,000 rubles. Finansy SSSR, No. 1, 1976, p. 6, confirms that loan repayments to the population are continuing. Finansy SSSR, No. 12, 1976, p. 7, states that the plan for 1977 loan repayments is 1,200,000,000 rubles; 3 percent lottery winnings are continued at 100,000,000 rubles, a reasonable estimate according to Den'gi i kredit, No. 1, 1975, p. 8, and No. 4, 1976, p. 5.
(h) 1977—estimated.

14. Net borrowing:
The difference between long-term loans to the population outstanding at the end of the given year and loans outstanding at the end of the previous year.
(a) 1950, 1955—Vestnik statistiki, No. 2, 1960, p. 89–92.
(b) 1960—N. Kh. 1962, p. 639.
(c) 1966–68—N. Kh. 1968, p. 779.
(d) 1969—N. Kh. 1969, p. 774.
(e) 1970—N. Kh. 1970, p. 735.
(f) 1971–75—N. Kh. 1975, p. 747.
(g) 1976–77—N. Kh. 1977, p. 564.

15. Interest on savings:
State savings banks offer the following major types of accounts for individuals:
(1) Demand (vklady do vostrebovaniya) paying 2 percent yearly interest.
(2) Time (srochnyye vklady) paying 3 percent yearly when held for more than 6 months.
(3) Lottery deposit (vyigryshnyye vklady) paying an average of 3 percent yearly in winnings. (A. P. Sakharov and V. K. Chirkov, "Operatsii sberegatel'nykh kass," Moscow, 1973, p. 21–23.)

For all years, except 1950, interest payments are assumed to be 2.2 percent of average annual reported deposits, based on "Vestnik statistiki", No. 1, 1967, p. 22, which stated that interest on savings amounted to 383,000,000 rubles in 1965—2.2 percent of average annual deposits in that year. Demand deposits make up the bulk of savings accounts, amounting to 73.1 percent in 1971 according to "Den'gi i kredit", No. 8, 1971, p. 68. The same article stated that no significant changes occurred in the distribution of deposits by category during 1965–70. In 1975, the proportions remained about the same; approximately 70 percent of savings deposits were in long-term accounts according to "Finansy SSSR," No. 4, 1976, p. 22. For 1950, however, interest payments are assumed to equal 3 percent of total deposits because, according to "Vestnik statistiki," No. 1, 1967, p. 22, interest payments were lowered from 3–5 percent to 2–3 percent in 1955.
(a) 1950, 1968–69—N. Kh. 1969, p. 585.
(b) 1955, 1960—N. Kh. 1960, p. 854.
(c) 1966–67—N. Kh. 1967, p. 699.
(d) 1965, 1970–75—N. Kh. 1975, p. 597.
(e) 1976–77—N. Kh. 1977, p. 434.

TABLE 2.—U.S.S.R.: DEDUCTIONS FROM PERSONAL MONEY INCOME

[In billion rubles]

	1950	1955	1960	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
1. Total deductions	6.92	8.77	6.90	9.89	10.95	12.03	13.69	15.26	16.97	18.45	20.22	22.08	24.19	26.27	28.31	30.18
2. Direct taxes	3.58	4.83	5.60	7.70	8.44	9.32	10.50	11.60	12.74	13.72	14.79	15.83	17.12	18.36	19.60	20.80
3. Personal income tax	2.04	3.55	4.64	6.77	7.50	8.36	9.50	10.54	11.61	12.54	13.57	14.57	15.81	16.99	18.27	19.44
4. Agricultural tax	.80	.44	.40	.36	.35	.35	.34	.33	.33	.32	.31	.30	.29	.29	.29	.29
5. Bachelor and small family tax	.74	.84	.56	.57	.59	.62	.66	.73	.80	.86	.91	.96	1.02	1.08	1.04	1.07
6. Local taxes	.28	.29	.14	.17	.19	.19	.20	.19	.18	.20	.22	.24	.24	.25	.26	.28
7. State loans	2.70	3.14	.06	.18	.22	.13	.28	.36	.47	.33	.34	.38	.44	.56	.60	.60
8. Trade union dues	.24	.36	.55	.86	.96	1.08	1.20	1.28	1.38	1.45	1.54	1.63	1.75	1.85	1.98	2.06
9. Party membership dues	.08	.11	.15	.24	.27	.29	.32	.35	.37	.40	.42	.44	.46	.49	.52	.54
10. Insurance premiums	.04	.04	.40	.74	.87	1.02	1.19	1.48	1.83	2.35	2.91	3.56	4.18	4.76	5.35	5.90

SOURCE AND METHODOLOGY

1. Total deductions: (a) All years—Sum of lines 2, 6, 7, 8, 9, 10.
2. Direct taxes:
   (a) 1950, 1955, 1960—Gosudarstvennyy byudzhet SSSR i byudzhety soyuznykh respublik, Moscow, 1966, (hereafter Gos. byud., 1966), p. 11.
   (b) 1965–70—Gosudarstvennyy buydzhet SSSR i byudzhety soyuznykh respublik, 1966–70 gg., (hereafter Gos. byud., 1972) Moscow, 1972, p. 12.
   (c) 1971–75—Gosudarstvennyy byudzhet SSSR i byudzhety soyuznykh respublik 1971–75, gg., (hereafter Gos. byud., 1976) Moscow, 1976, p. 9.
   (d) 1976–77—N.kh. 1977, p. 559.
3. Personal income tax:
   (a) 1950, 1955, 1960, 1965–70—Sources (a) and (b) of 2 above.
   (b) 1971–75—Source (c) of 2 above.
   (c) 1976–77—Estimated.
4. Agricultural tax:
   (a) 1950, 1955, 1960, 1965–70—Sources (a) and (b) of 2 above.
   (b) 1971–75—Source (c) of 2 above.
   (c) 1976–77—Estimated.
5. Bachelor and small family tax:
   (a) 1950, 1955, 1960, 1965–70—Sources (a) and (b) of 2 above.
   (b) 1971–75—Source (c) of 2 above.
   (c) 1976–77—Estimated.
6. Local taxes: It is assumed that half of local taxes paid for state fees, building taxes and land rents, and one-time collections at collective farm markets are paid by individuals. In addition, local taxes include an "admission tax" paid solely by institutions (U.S. Bureau of the Census, The Soviet Financial System: Structure, Operation, and Statistics, Washington, 1968, p. 127–28):
   (a) 1950, 1955, 1960—Gos. byud., 1966, p. 70, reduced by value of "admissions tax" from Gos. byud., 1966, p. 70, and half the value of taxes paid on the 3 categories listed below.
   (b) 1965–70—Gos. byud., 1972, p. 77, reduced by value of "admission tax" from Mestnyye byudzhety SSSR, Moscow, 1970, p. 11. "Admission taxes" assumed to grow by 3 percent in 1969. Since 1969, "admission taxes" are assumed to be the residual—total local taxes less the sum of state fees and building tax and land rent.
   (c) 1971–75—Gos. byud., 1976, p. 74.
   (d) 1976–77—Estimated.
7. State loans:
   (a) 1950, 1955, 1960—Gos. byud., 1966, p. 11. Includes compulsory bond purchases of 2,600,000,000 rubles in 1950 and 3,000,000,000 rubles in 1955.
   (b) 1965–70—Gos. byud., 1972, p. 12.
   (c) 1971–75—Gos. byud., 1976, p. 9.
   (d) 1976–77—N.kh. 1977, p. 559.
8. Trade union dues: Trade union dues are the product of trade union membership and 1 percent of the average annual wage. The rate is found in Spravochnik profsoyuznogo rabotnika, 1972, Moscow, 1972, p. 463. The average annual wage is derived by adjusting the average monthly wage, found in N.kh 1975, p. 546, and N.kh 1977, p. 385, to an annual basis. Data on trade union membership are scattered, but available for several years. Membership is established for 1949, 1954, 1959, and 1963 in Emily C. Brown, "Soviet Trade Unions and Labor Relations," Harvard, 1966, p. 48. Membership for 1967 and 1971 is given in Sovetskoye profsoyuzy. No. 5, 1972, p. 6. Membership for the remaining years is estimated on the basis of percentage of state labor force belonging to the trade unions or by percentage increases in the state labor force, State labor force data are found in N.kh 1974, p. 549. Membership for 1976 is given in Sovetskoye profsoyuzy, No. 22, 1976, p. 2. Membership for 1977 is given in Ekonomicheskaya gazyeta, No. 12, 1977, p. 24.

9. Party membership dues: Party membership dues are the product of average annual party membership (estimated as of July 1) and 1.5 percent of the estimated average annual wage of party members. Party membership is from Spravochnik partiinogo rabotnika, Moscow, 1978, p. 367. The average annual wage of party members is estimated to be 25 percent above the average for all state employees, which is derived by adjusting the average monthly wage, found in N.kh 1975, p. 546, and N.kh 1977, p. 385, to an annual basis. The dues rate of 1.5 percent of wages is found in Ustav kommunisticheskoy partiy sovetsvogo soyuza, Moscow, 1964, p. 385.
10. Insurance premiums:
    a. 1950, 1955—50 lyet sovetskikh finansov, 1967, pp. 347–348.
    b. 1960, 1965, 1970, 1975–76—Den'gi i kredit, No. 2, 1978, p. 41.
    c. 1966, 1969—Interpolated.
    d. 1967, 1968, 1972—Finansy SSSR, No. 4, 1973, p. 8.
    e. 1971—Finansy SSSR, No. 4, 1972, p. 4.
    f. 1973—Finansy SSSR, No. 4, 1974, p. 14.
    g. 1974—Finansy SSSR, No. 6, 1975, p. 59.
    h. 1977—Finansy SSSR, No. 9, 1978, p. 3 gives voluntary insurance payments. It is estimated that these payments constitute 92 percent of total insurance payments by the population.

THE SOVIET QUEST FOR BETTER HOUSING—AN IMPOSSIBLE DREAM?

(By Henry W. Morton*)

CONTENTS

> Citizens of the U.S.S.R. have the right to housing.
>
> This right is insured by the development and upkeep of state and socially owned housing; and by assistance for cooperative and individual house building; by fair distribution, under public control, of the housing that become available through fulfillments of the program of building well-appointed dwellings, and by low rents and low rent charges for utility services. Citizens of the U.S.S.R. shall take good care of the housing allocated to them.
>
> Article 44,
> Constitution of the U.S.S.R.

Does the U.S.S.R. provide satisfactory housing for its citizens? This depends upon whether the Soviet Union is viewed as an industralized or a developing nation. If we view it as the latter, the Soviet achievement in housing has been admirable; if as the former, then Soviet housing accommodations are still among the poorest of any industrialized society.

An estimated thirty percent of the urban population still either live communally, with unrelated families and singles sharing apartments, or in crowded factory dormitories. In the countryside conditions are worse. While most urban housing comes equipped with electricity, indoor plumbing, hot water, gas and central heating, in rural areas, although the typical privately owned one-story wooden home will have electric current, water is drawn from a well and an outhouse is used instead of a flush toilet.

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Soviet Achievement in Housing—The Official View

Soviet leaders, housing officials and publicists would sharply disagree with the preceding overview. They take great pride in Soviet accomplishments in housing and present it to the Soviet people and the world in a strong, positive light. In assessing the Soviet achievement it is important for us to understand by what standards they wish to be judged; what they emphasize and what they leave unsaid. In the official view the following are considered to be the most salient facts about Soviet housing:

> For the past 20 years at least 2 million flats have been built every year in the U.S.S.R.—more than in any other country in the world. The superiority is both absolute and relative—8.8 homes are built annually for every 1,000 inhabitants compared to 7 in West Germany, 6.6. in the U.S.A., 5.8 in Great Britain and 3.9 in Italy * * * . It is hard to imagine how long people would have to wait for good new housing if a powerful building industry had not been created. We now have more than 400 factories making large-panel components with a capacity to [* * * build] nearly a million apartments a year or the housing for a city of 3 million [* * * people].
>
> Housing is built mainly at the expense of the government and is allocated free to people on the waiting list without any key money or other downpayment * * *. In 1928 the lowest rent tariff in the world was fixed in the U.S.S.R.; it has not been raised since. In Moscow the average sum that a family pays for its dwelling plus communal services does not exceed 3 percent of its monthly budget. The rent itself covers only a third of state expenditure on the maintenance and upkeep of housing; the rest is subsidized from public funds.
>
> Eleven million Soviet citizens move into new dwellings or improve their housing standard yearly. Housing can, of course be built for profit, but in the U.S.S.R. it is built to meet the people's needs. Homes are therefore not an object of commerce with use, neither when being built nor when occupied * * * . More than 90 percent of families now receive a separate flat when housing is being allocated (in the 1950's it was 30 percent).
>
> When can we consider the housing problem solved? When every family, without exception, has a separate, self-contained, well-appointed flat that meets all its reasonable wants and provides optimum conditions for its harmonious developments * * * . Housing is not treated as a commodity. It is a more difficult, of course, to meet the demand when it is not limited by ability to pay, than to bring the volume of house building into line with demand. The housing problem, therefore, has not yet been solved in our country.[1]

Evaluating Soviet Achievements

Soviet figures focus on housing production and not on housing need. Because of an accelerated construction program which took off in 1957,

[1] Alexander Andreyev, *Housing U.S.S.R. Today and Tomorrow*, Moscow, Novosti Press Agency, 1978, pp. 2–16; *Pravda*, Jan. 20, 1979.

peaked in 1959 when 2.7 million dwellings were built and since then has slowly declined to 2.1 million units constructed in 1977, millions of Soviet families have improved their housing standards by moving into a detached apartment of their own. (See Table 1) However, despite this effort, construction was never able to meet demand thereby leaving a smaller but still significant proportion of the urban population living in co-tenancy, sublease or in dormitories.

Contrary to claims made, in the 1970's the U.S.S.R. was no longer the world leader in housing construction in relative terms because production declined while population increased. Between 1970–1977 the Soviet Union averaged 8.9 new units built per 1,000 inhabitants, a ratio which was exceeded by 10 Western countries led by Japan's 14.5 units per 1,000 inhabitants; and since 1975 two of the U.S.S.R.'s allies, Czechoslovakia and Hungary have also topped the Soviet Union in per capita housing production.[2]

There are several reasons why many Soviet citizens still do not enjoy comfortable housing accommodations compared with Western standards.

TABLE 1.—NUMBER OF HOUSING UNITS CONSTRUCTED, THEIR AVERAGE SIZE AND PERCENT BUILT BY THE STATE, 1950–77

	Number of units built (thousands)	Square meters of housing sp. (millions)	Average size of unit in square meters	Units built per 1,000 inhabitants	Percent of units built by state and coops (square meters)	Percent of units built privately and by collective farms
1950	1,073	40.4	37.7	5.9	44.1	59.9
1951–55	6,052	240.5	39.7	6.3	47.0	53.0
1956	1,548	[1] 63.1	40.8	7.4	46.8	53.2
1957	2,060	[1] 85.9	41.7	9.9	44.8	55.2
1958	2,382	[1] 100.3	42.1	11.4	46.6	53.4
1959	2,711	[1] 115.2	42.3	12.8	46.4	53.6
1960	2,591	109.6	42.3	12.0	50.9	49.1
1961	2,435	102.7	42.2	11.8	55.1	44.9
1962	2,383	100.0	42.0	10.7	59.8	40.2
1963	2,322	97.6	42.0	10.3	63.4	36.6
1964	2,184	92.7	42.4	9.5	63.5	36.5
1965	2,227	97.6	43.8	9.6	64.8	35.2
1966	2,291	102.1	44.6	9.8	64.5	35.5
1967	2,312	104.5	45.2	9.7	65.7	35.3
1968	2,333	102.1	45.7	9.3	67.9	32.1
1969	2,231	103.8	46.5	9.3	69.4	30.6
1970	2,266	106.0	46.8	9.3	72.3	27.7
1971	2,256	107.6	47.7	9.2	73.1	26.4
1972	2,233	106.7	47.8	9.0	74.4	25.6
1973	2,276	110.3	48.5	9.1	75.0	25.0
1974	2,231	110.4	49.5	8.9	75.4	24.6
1975	2,228	109.9	49.3	8.8	75.8	24.2
1976	2,112	106.2	50.3	8.2	77.9	22.1
1977	2,110	107.8	51.1	8.2	78.1	21.9

[1] Estimated by Williard S. Smith, "Housing in the Soviet Union—Big Plans Little Action." Soviet Economic Prospects for the 1970's," Washington, D.C., Joint Economic Committee of Congress of the United States, 1973, p. 424.

Sources: Narodnoye khozyaystvo SSSR v 1965 godu, Moscow, Statistika, 1966, pp. 7, 611. Narodnoye khozyaystvo SSSR v 1967 godu, Moscow, Statistika, 1971, pp. 538, 540. Narodnoye khozyaystvo SSSR v 1973 godu, Moscow, Statistika, 1974, pp. 8, 608, 610. Narodnoye khozyaystvo SSSR v 1974 godu, Moscow, Statistika, 1975, pp. 131, 132. Narodnoye khozyaystvo SSSR v 1977 godu, Moscow, Statistika, 1978, pp. 127, 128. Strana soveta za 50 let, Moscow, Statistika, 1967, p. 248. Strana soveta za 60 let, Moscow, Statistika 1977, pp. 127, 128.

[2] The nine others are Canada, Denmark, Finland, France, the Netherlands, Norway, Spain, Sweden and Switzerland. Calculated from *Narodnoye khozyaystvo SSSR v 1970 godu*, Moscow, Statistika, 1971, p. 71; *Narodnoye khozyaystvo SSSR 1922–1972*, Moscow, Statistika, 1972, p. 93; *Narodnoye khozyaystvo SSSR v 1972 godu*, Moscow, Statistika, 1973, p. 118; *Narodnoye khozyaystvo SSSR v 1973 godu*, Moscow, Statistika, 1974, p. 164; *Narodnoye khozyaystvo SSSR v 1974 godu*, Moscow, Statistika, 1975, p. 132; *Narodnoye khozyaystvo SSSR v 1975 godu*, Moscow, Statistika, 1976, p. 153; *Narodnoye khozyaystvo SSSR v 1976 godu*, Moscow, Statistika, 1977, p. 128; *Narodnoye khozyaystvo SSSR v 1977 godu*, Moscow, Statistika, 1978, p. 87.

The Legacy

The new Soviet Government in 1917 inherited an inadequate, dilapidated and overcrowded housing stock from the Tsarist regime.

Rapid Urbanization

Stalin's policy of rapid industrialization begun in the late 1920's and continued by his successors attracted a large and constant stream of rural poor to industrial sites as the Soviet Union rapidly became urbanized. In 1926 only 23.3 million people lived in cities and towns, or 19 percent of the population. But by 1977 the number of urban residents had increased sixfold to 162.5 million, constituting 62 percent of the population (See Table 2). The USSR had only 2 cities in 1926 with a population of over 1 million; 60 years later there were 15.[3] The building of new factories far exceeded the construction of new housing (it still does) resulting in serious overcrowding.

The Destruction of Housing by Wars

Russia and the Soviet Union suffered serious losses of housing stock during World War I, the Civil War that followed when one-fifth of all houses were destroyed and in World War II 6 million buildings, half of all the housing in areas occupied by the Germans, were damaged or destroyed.[4]

TABLE 2.—URBAN-RURAL DISTRIBUTION OF SOVIET POPULATION

[In millions] [1]

Years	Urban	Rural	Total	Percent urban
December 1926 [2]	26.3	120.7	147.0	19
January 1939 [2]	56.1	114.5	170.6	34
January 1959 [2]	100.0	108.8	208.8	48
January 1970 [2]	136.0	105.7	241.7	56
December 1975	156.6	98.9	255.5	61
December 1977	162.5	97.5	260.0	62

[1] Figures for 1926 and 1939 refer to U.S.S.R. borders before Sept. 17, 1939.
[2] Census dates.

Sources: Narodnoye khozyaystvo SSSR v 1970 godu, Moscow, Statistika, 1971, p. 9. Narodnoye khozyaystvo SSSR v 1977 godu, Moscow, Statistika, 1978, p. 9.

Investment and Rent Policies

Stalin, in particular, but also his successors consciously underinvested in housing construction thereby failing to produce the sufficient numbers of housing units needed by a rapidly expanding urban population. This is the fundamental reason for the continuing housing shortage. A contributing component is also the low rental charged which spurs rather than deflates demand because most urban families can easily afford apartments if they were available.

Two other factors need to be noted. Housing units built in the USSR are significantly less spacious and of lower quality than those produced in the West. In 1976 the average new dwelling in the Soviet Union was 50.3 square meters (hereafter sq. m.), an impressive 23.8

[3] *Narodnoye khozyaystvo SSR za 60 let,* Moscow, Statistika, 1977, pp. 59–68.
[4] Alexander Andreyev, *op cit.*, pp. 6–7.

percent increase in size over units built 20 years ago, which averaged only 30.8 sq. m.; nevertheless Western European or American averages for 1976 were 85 and 120 sq. m. respectively.[5] (See Table 1, column 3)

Soviet citizens have limited housing choices because the government controls the housing stock, its construction and distribution. Housing in the USSR consists of three categories: Housing owned by the state, housing cooperatives (multi-dwelling apartments built by state agencies) and housing that is privately owned (owner occupied homes chiefly self-built and legally limited to 60 sq. m. or 648 square feet of floor space). Because private home construction since 1964 may legally take place only in towns under one-hundred thousand inhabitants and in rural areas, urban dwellers living in more populated centers are basically limited to apartment style living. Consequently, a home with a garden, which many urbanites in the West prefer over an apartment, if they can afford it, is not a viable alternative for Soviets.

Measuring by Living Space

Housing in the USSR is primarily measured by the number of sq. m. of "living space" (*zhilaya ploshchad*) which an individual occupies, and not by the number of people per room. Living space encompasses bedrooms and living rooms but not kitchens, bathrooms, corridors and storage areas. Living and non-living areas make up the aggregate "housing space" (*obshchaya ploshchad*) of a dwelling—of which living space is two-thirds of the total. Each of the fifteen republics of the Soviet Union has determined by law the minimum standard for its citizens. For the Russian Republic, as well as for most of the others, it is 9 sq. m. of living space which is slightly less than a room of 10 x 10 feet.

The minimum housing norm of 9 sq. m. of living space adopted in the 1920's, has so far proven to be unattainable nation-wide. In fact the amount of per-capita living space available in urban areas decreased from 5.7 sq. m. in 1926 to 4.5 sq. m. in 1940, because of Stalin's conscious underinvestment policy in this sector. It improved only slightly to 4.9 sq. m. by 1950 (some 7 by 7 feet) per person 4½ years after the war's end.

Per capita living space in urban Housing in the U.S.S.R.

Year:	*Per Capita Square Meters of Living Space*
1926	5.7
1940	4.5
1950	4.9
1958	5.8
1970	7.7
1977	8.2

Sources: Henry W. Morton, "What Have the Soviet Leaders Done About the Housing Crisis?" Henry W. Morton and Rudlf L. Tokes, eds.. *Soviet Politics and Society in the 1970's*, New York, Free Press, 1974, pp. 70, 171; *Narodnoye khozyaystvo SSSR v 1977 godu, op. cit.*, pp. 7, 416.

By the end of 1977 and despite a vigorous construction program over the preceding 21 years, only Estonia, Latvia, and Georgia had achieved the minimum sanitary requirement of 9 sq. m. of living space

[5] "Comparative Housing Positions in the Industrialized Countries," January, 1978, IDCNEC, Paris, France.

for citizens residing in urban areas of each republic. (See Table 3). The Russian Republic, which contains 58 percent of the entire urban population of the USSR, averaged 8.3 sq. m. per urban dweller, while the national average for towns and cities in the USSR was 8.2 sq. m. Eight republics fell below the national average with Tadzhikistan recording the lowest per capita—6.1 sq. m. of living space.

As the data in Table 3 demonstrates, the USSR can be divided into developed and underdeveloped republics in terms of urban housing. Thus while all republics registered housing gains between 1950 and 1970, some did much better than others. Those living in Estonia, Latvia and Georgia clearly benefitted from the highest level of urban housing in the Soviet Union, which also reflected the general high standard of living relative to other sections of the country. As a group the European Republics (excluding Armenia and Azerbaidzhan) represented the most developed housing sector. In 1953 they averaged 6.6 sq. m. per capita of living space compared to 5.4 sq. m. for the five Central Asian Republics Armenia and Azerbaidzhan. By 1977 their respective averages were 8.9 and 6.7 as the gap between the two widened. (See the upper and lower halves of column 2, table 3.)

A primary cause for this development is that the housing poor republics in the USSR had a much higher increase in natural population growth which is reflected in the large percentage increase in their urban population between 1958–1977. (See column 4, table 3.)

The preceding figures show that although the per capita sq. m. of living space of Soviet citizens in cities and towns by 1977 showed a significant increase of 67.3 percent over 1950 and 41.4 percent over 1958 Soviet urbanites still continued to live under very cramped conditions.

TABLE 3.—PER CAPITA LIVING SPACE IN URBAN HOUSING, BY REPUBLIC IN RANK ORDER, 1958 AND 1977

1958, per capita square meters of living space		1977, per capita square meters of living space		Real (square meters) increase of per capita living space, 1958–77		Percent of per capita increase of urban population, 1958–77	
					Percent		
U.S.S.R.	5.8	U.S.S.R.	8.2	U.S.S.R.	41.4	U.S.S.R.	62.5
Latvia	8.4	Estonia	10.3	Belorussia	46.6	Moldakia	136.6
Estonia	7.6	Latvia	10.2	Russia	45.6	Uzbekistan	116.7
Georgia	6.7	Georgia	9.2	Ukraine	37.5	Armenia	116.4
Lithuania	6.6	Ukraine	8.8	Georgia	37.3	Belorussia	108.1
Ukraine	6.4	Lithuania	8.7	Kazakhstan	35.8	Kazakhstan	97.5
Belorussia	5.8	Belorussia	8.5	Estonia	35.5	Kirgizia	95.4
Russia	5.7	Russia	8.3	Moldavia	34.5	Lithuania	91.0
Turkemenia	5.7	Moldavia	7.4	Armenia	34.0	Turkemenia	88.9
Azerbaidzhan	5.7	Kazakhstan	7.2	Lithuania	31.8	Azerbaidzhan	73.3
Moldavia	5.5	Armenia	7.1	Uzbekistan	28.8	Ukraine	58.9
Tadzhikistan	5.4	Turkemenia	6.8	Kirgizia	24.5	Georgia	50.1
Armenia	5.3	Uzbekistan	6.7	Latvia	21.4	Estonia	50.1
Kazakhstan	5.3	Azerbaidzhan	6.6	Turkemenia	20.7	Latvia	44.8
Uzbekistan	4.9	Khirgizia	6.4	Azerbaidzhan	15.8	Russia	38.4
Khirgizia	4.9	Tadzhikistan	6.1	Tadzhikistan	13.0		

Sources: Narodnoye khozyaystvo SSSR v 1960 godu, Moscow, Statistika, 1961, p. 613. Narodnoye khozyaystvo SSSR v 1977 godu, Moscow, Statistika, 1978, pp. 100, 11, 416.

Measuring Housing Need

Soviet citizens still suffer from the poorest housing accommodations of any industrialized nation principally because so many families still live communally. The continuing serious housing shortage in the USSR specifically refers to the fact that there are not enough self-

contained housing units: Apartments or homes for every household. This deficit of units has never been overcome despite a vigorous construction program. A household is defined as a married couple, a parental pair with children, a single parent living with children, or a single individual living by himself.

A common standard accepted in the West, in Eastern Europe and the USSR for measuring adequate housing conditions is that the number of dwellings available for occupancy in a country should exceed, or at least be roughly equal to, the number of households that exist; and that each individual should have a room of his own.

Information regarding the number of households and the size of the housing stock has not been published by the Statistical Administration of the USSR. The numerical relationship between households and units is only occasionally mentioned in articles or books and then very generally; for example, "in 1960, 40 percent of Soviet citizens lived communally in state and cooperative housing," [this refers primarily to cities and towns] "by 1975 only 25 percent of them will." [6] Another was the statement that in January, 1971, 40 percent of Moscow's residents still lived communally and that this ratio had been reduced to 30 percent by the end of 1974.[7] The absence of these figures is not an oversight. The UN Statistical Year Book provides such information for all Western and Eastern European countries with sole exception of USSR.[8]

In most Western countries the goal of matching housing units with households has been achieved. (See Table 4.) In the USSR the deficits of dwellings in relation to the number of households, though decreasing, is still staggering. This is the reason why the waiting period for a new apartment may take as long as a decade, and then only those families with a per capita living space of less than 5 sq. m. will be considered. The deficit in 1970 told to me in an interview was 7.4 million units in urban areas.[9] My estimate indicated an even larger shortfall of 9.6 million units, or 123 households for every 100 households which placed the USSR at the bottom in comparison to her Eastern European allies in 1970 who also found themselves in a housing deficit situation. (See Table 4.)

Housing need is difficult to measure objectively. It is relative to one's experience and changing expectations. Because the housing situation over the past decades improved for many, once tolerable conditions are no longer acceptable to those left behind. The newlyweds of the 1950's hardly envisioned that they could eventually live in self-appointed apartments, which is the optimistic expectation of the current generation, encouraged by promises made as early as 1957. In that year a party resolution called for "eliminating the country's housing shortage within the next 10 to 12 years." [10] The Party Program of 1961 declared that families still living in crowded and inadequate dwellings

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[6] N. Bobrovnikov, "Razvitiye zhilishchnogo stroitel'stva v tekyshchem pyatiletii," *Voprosy ekonomiki*, No. 5, 1972.
[7] V. Promyslov, "Za obraztsovyi kommunisticheskii," *Sovety deputatov trudyashchikhsya*, Nov. 12, December, 1975, p. 24.
[8] *U.N. Statistical Year Book 1974*, New York, United Nations, 1975, pp. 804–11.
[9] Interview, U.S.S.R., 1974.
[10] *Pravda*, Aug. 3, 1957.

would receive new apartment in the 1960's, and that by the end of the 1970's, "every family, including newlyweds will have a comfortable dwelling conforming to the requirements of hygiene and cultural living." [11] Such promises, because of the unrealistic delivery date, had to be deferred to the 1990's.

TABLE 4.—NUMBER OF HOUSEHOLDS/NUMBER OF HOUSING UNITS, WESTERN COUNTRIES AND EASTERN EUROPE

Country	Year	Number of households (thousands)	Number of dwellings (thousands)	Households per 100 housing units
Austria	1971	2,536	2,666	95
Belgium	1961	3,023	3,159	96
Denmark	1965	1,663	1,614	103
Finland	1970	1,494	1,463	102
France	1965	15,778	18,120	87
Germany	1972	22,264	21,292	105
Greece	1971	2,556	3,086	83
Italy	1971	15,981	17,434	92
Netherlands	1960	3,130	2,824	110
Norway	1960	1,913	1,099	82
Spain	1960	7,548	7,726	98
Sweden	1970	3,050	3,181	96
Switzerland	1970	2,051	2,196	95
United Kingdom	1965	18,563	17,559	106
Canada	1971	6,041	6,259	97
United States	1965	63,450	68,679	97
Australia	1971	3,152	3,085	92
Japan	1968	24,687	25,591	96
Bulgaria	1965	2,527	2,055	125
Czechoslovakia	1970	4,848	4,410	110
German Democratic Republic	1971	6,408	6,057	106
Hungary	1970	3,378	3,150	107
Poland	1970	9,376	8,295	113
Rumania	1965	5,956	5,380	107
U.S.S.R.	1970	[1] 72,892	59,202	123
Yugoslavia	1971	5,375	5,110	105

[1] Refers to census date Jan. 15, 1970; families and singles.

Source: Compendium of Housing Statistics 1972–74, New York, United Nations, 1976 pp. 78–96. Itogi vsesoyuznoi perepisi naseleniya 1970 zoda VII, Moscow, Statistika 1974 pp. 187, 252.

The number of housing units in relation to households measures most accurately the existence of a housing surplus or deficit. Since such information is not published in the USSR and estimates made for households are least reliable between census years the comparison between yearly marriages and the number of housing units built is the next best indicator of whether a surplus or deficit in housing units is taking place.[12] If more dwelling units are built annually than marriages registered and the country possesses an equal or superior number of units over households then the basis for a good housing situation is present. This does not mean that a nation's housing problems are solved when this stage is reached. It does signify, however, that a basic goal has been achieved and that other ever-present concerns can now

[11] Jan Triska, ed., *Soviet Communism: Programs and Rules,* San Francisco, Chandler, 1962. pp. 92–93.

[12] It is however, not as accurate because on one hand it does not include the number of households lost by death. On the other hand the number of dwelling units that are yearly eliminated are also not counted. These amounted to 14.6 percent of new housing units constructed between 1960–77, nor does it include the number of new singles formed—most of these will live in sub-tenancy or in workers dormitories. See Narodnoye khozyaystvo SSSR v 1970 godu, op. cit., p. 548; Narodnoye khozyaystvo SSSR v 1975 godu, op. cit., p. 578; Narodnoye khozyaystvo v 1977 godu, op. cit., p. 418, for the number of units destroyed.

receive greater priority such as the ability to pay for comfortable housing (in the USSR this applies only to cooperatives, private homes and summer houses, and to the use of bribes to acquire accommodations in state housing), the size of a dwelling, the facilities with which it is equipped, the desirability of the neighborhood or house, the time it takes to get to and from work, and so on.

The dilemma of Soviet citizens wishing to move into a dwelling of their own in the second half of the 20th century is found in the figures in Table 5. Even if a serious housing deficit in relation to household had not existed, a critical housing shortage would have been created between 1950–58 because 7 million more marriages took place than there were housing units constructed. But because Soviet leaders after Stalin's death in 1953, realizing that housing was the worst consumer problem, invested heavily in housing construction, and by 1957 the Soviet Union had doubled its housing output from one to two million. Two years later it registered the first surplus of new units built over marriages formed. For the next decade, 1958–68, the USSR achieved a favorable balance of 1.7 million new units over new marriages, partially due to the fact that the number of marriages declined between 1963–68. (See column 1, Table 5.) Even though significant housing gains were made, the surplus of that decade fell short by more than five million units of overcoming the deficit incurred in the 1950's. A new year of deficits began again in 1968 as the number of marriages increased while new housing construction declined. In the nine years between 1969–77 the USSR suffered a shortfall of 2.7 million units.

This is a reason why most newlyweds still live in an extended family situation. Adding to the housing deficit is the fact that the number of divorces more than tripled from 270,227 in 1960 to 910,0000 in 1977.[13] Every divorce results in a new household formed for which separate accommodations are difficult to acquire. Among the alternatives available are: going back to one's parents, becoming a co- or sub-tenant or continuing to live together with one's ex-mate. The ratio of divorces to marriages is higher in urban than in rural areas and highest in large cities where more than three divorces are registered for every ten marriages.[14]

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[13] Naseleniye SSSR 1973, Moscow, Statistika, 1975, p. 150; Narodnoye khozyaystvo SSSR v 1977 godu, op. cit., pp. 7, 26.

[14] In Kiev 3.5 divorces for every 10 marriages in 1973. Viktor Perevendentsev, "Commentaries on Statistics: Cities of 1,000,000." Literaturnaya gazeta, Apr. 30, 1975, translated in the Current Digest of the Soviet Pres, Vol. XXVII, No. 18, p. 3.

TABLE 5.—SURPLUS/DEFICIT: NUMBER OF MARRIAGES/NUMBER OF HOUSING UNITS BUILT, 1950–77

	Marriages	Units built (millions)	+Surplus −deficit		Marriages per thousand population	Units built per thousand population
1950	2,080,817	1,073	−1,007,817		11.6	5.9
1951–55	10,555,944	[1] 6,052	−4,503,444	−7.0	11.0	6.3
1956	2,361,928	[1] 1,548	−813,928		11.8	7.7
1957	2,517,229	[1] 2,060	−457,229		12.4	10.2
1958	2,598,152	[1] 2,382	−216,152		12.5	11.5
1959	2,558,315	[1] 2,711	+152,685		12.2	12.2
1960	2,591,509	2,591	−509		12.1	12.0
1961	2,404,091	2,435	+30,959		11.0	11.1
1962	2,221,526	2,383	+161,474		10.1	10.8
1963	2,051,432	2,322	+270,568		9.2	10.4
1964	1,939,780	2,184	+244,220	+1.7	8.5	9.6
1965	2,008,673	2,227	+218,323		8.7	9.6
1966	2,087,599	2,291	+203,401		8.9	9.8
1967	2,131,888	2,312	+180,112		9.0	9.7
1968	2,120,925	2,333	+212,075		8.9	9.3
1969	2,250,624	2,231	−19,624		9.4	9.3
1970	2,365,259	2,266	−99,259		9.7	9.3
1971	2,459,947	2,256	−203,947		10.0	9.2
1972	2,333,470	2,233	−100,470		9.4	9.0
1973	2,516,267	2,272	−244,267	−2.7	10.1	10.1
1974	2,606,731	2,231	−375,731		10.3	8.9
1975	2,772,833	2,228	−494,833		10.7	8.7
1976	2,603,780	2,113	−490,780		10.1	8.2
1977	2,782,000	2,110	−672,000		10.7	8.1

[1] Estimated by William S. Smith, "Housing in the Soviet-Union—Big Plans Little Action," Soviet Economic Prospects for the 1970's, Washington, D.C. Joint Economic Committee Congress of United States, 1973, p. 424.

Sources: Narodnove khozyaystvo SSSR v 1965 godu, Moscow, Statistika, 1966, p. 7. Narodnove khozyaystvo SSSR v 1977 godu, Moscow Statistika, 1978, pp. 7, 26. Naseleniye SSSR 1973, Moscow, Statistika, 1975, p. 150.

The Urban Housing Shortage Is Really Much Worse than the Figures Indicate

The urban deficit in housing is really much larger than the figures show. With a zero vacancy rate in Soviet urban areas the desire for each household to live in a self-contained unit is strictly (if not always successfully) monitored by the authorities. Not only are there waiting lists for state and cooperative housing but only certain households will receive permission to be placed on the list. This is done to prevent the number of households from rising to their natural level in urban areas. If that were permitted then the household figures discussed earlier would take a sudden jump as would the deficit number of housing units.

To discourage new households from forming, singles who wish to split off from the extended family, grown children, grandparents, aunt or uncle, will frequently be denied a place on the list. Also denied a place on the list are the many who live in the countryside, not by choice, but out of necessity, and commute to work in cities and towns. Many of these suburbanites form the urban poor of Soviet society. The large population centers are closed off to them to prevent Moscow, Leningrad or Kiev from being overrun by rural and provincial migrants. Permission to move to them is rarely granted.

Beyond the city line, with the last high-rise structures still in sight a hard, rural life-style prevails, greatly lacking in creature comforts and timesaving devices. Sprawlings suburbs, as Americans know them, with well equipped homes and bustling shopping centers do not exist.

Shopping is a major problem. Consumer goods are inadequately and capriciously stocked in local stores; Moscow and the capitals of the

republics are best supplied. Frequent trips to the city are necessary to buy meats and fresh vegetables. The same holds true for clothing, appliances, furniture and other items. Purchases are carried home by hand, on public transportation. Few Soviet citizens have cars. Those who live outside the city spend much more of their non-working time tending to daily needs. Out of necessity, many cultivate vegetable gardens for personal consumption. Leisure time is limited and so are leisure activities. Rural schools are qualitatively inferior to those in cities, drawing teachers who are less competent and pupils who are culturally deprived. The opportunity to enroll in local colleges or universities is severly limited, since such institutions are located primarily in the larger urban areas.

Thus, the difference in the quality of life between the city and in surrounding settlements can be a fundamental one in terms of the availability of basic consumer needs, modern-type shelter and access to health, educational and cultural facilities.

City residents generally are better educated, possesses greater skills, hold more responsible positions, and are more likely to be members of the Soviet middle class or blue collar-elite than their out-of-town cousins. They can provide better opportunities for their children and better care for their aging parents. The less well-off who live beyond the city's fringe wait and hope to be let in.

Reasons for the Shortage

Urban policy in general and housing policy in particular which includes the financing, siting, constructing and distributing of dwellings is decided and carried out by party and government officials in the USSR. The leadership exercises a monopoly in setting capital investment priorities which are expressed in 5-year and yearly plans. For housing these plans will stipulate, among other things, the planned rate of financial investment, the amount of building materials to be produced by the State and how much money to set aside for private builders applying for State loans to construct their one family homes.

There is no private credit market to which the consumer may turn to as an alternative source of financing. This greatly limits the consumer's choice in housing and stifles private initiative as far as housing construction is concerned. In industrialized societies housing differs markedly from most other consumer goods in terms of cost. A modern housing unit equipped with hot and cold water, bathroom, toilet and central heating is a high-cost investment which the consumer can rarely self-finance.

From the beginning of the first five-year plan in the late 1920's to this day Soviet leaders have consciously overinvested in heavy industry, which they consider to be the productive sector of economy and underinvested in consumer goods industries the nonproductive sector of which housing is a part. Had the Soviet leaders reversed their investment priorities and asked the consumer to share in paying for construction costs then the promise to provide each family with a self-contained unit might have become a reality.

Capital investment in housing for the 1930's was governed by two factors. The investment capacity of the USSR, a capital-poor nation,

was severely limited and stretched to the breaking point by the unrealistic goals set by Stalin. Secondly, within the confines of the capital investment structure, Stalin determined that housing construction would receive low priority. Consequently, capital investment in housing from the public and private sectors averaged 15 percent of the total amount of capital invested for the first three 5-year plans, 1929–July 1940 (see table 6). The German invasion of the Soviet Union in June 1941 caused widespread destruction of housing in the European part of the USSR. Despite the war's devastation Stalin's low-priority treatment of housing continued. Although 19 percent of the investment of the fourth 5-year plan (1946–50) was allocated for housing construction, only 36 percent of housing built during that period was constructed by the state sector—the lowest percentage since the institution of the 5-year plan.

TABLE 6.—CAPITAL INVESTMENT IN HOUSING CONSTRUCTION, 1918–77

[In 1976 prices]

	Capital investment from public and private sectors (in billions or rubles)	Capital investment from public and private sectors (in billions of rubles)	Housing as percent of total investment	Percent of square meters housing built by the state
1918–70	17,003.7	185,430	17.2	56.5
1918–Sept. 19, 1928	4.4	2,838	64.3	11.7
1929–32 (1st FYP)	8.8	1,346	15.4	57.3
1933–37 (2d FYP)	19.7	2,516	12.8	55.2
1938–July 1941 (part of 3d FYP)	20.4	3,470	17.0	42.2
July 1941–45	20.5	3,073	15.0	40.3
1946–50 (4th FYP)	47.4	9,206	19.4	36.0
1951–55 (5th FYP)	89.8	17,794	19.8	47.0
1956–60 (6th FYP)	168.0	39,454	23.5	47.2
1961–65 (7th FYP)	243.5	45,218	18.6	58.5
1966–70 (8th FYP)	347.9	59,696	17.2	61.5
1971–75 (9th FYP)	493.0	75,354	15.3	70.0
1975	112.9	16,265	14.4	70.5
1976	118.9	16,504	14.0	[1] 77.9
1977	122.3	17,014	13.9	[1] 78.9

[1] includes state and cooperative housing.

Sources: Narodnoye knozyaystvo SSSR v 1975 godu, Moscow, Statistika, 1976, p. 570–575. Narodnoye khozyaystv SSSR v 1977 godu, Moscow, Statistika, 1978, p. 352, 353, 411.

Only after Stalin's death did a breakthrough in housing construction investment take place. For the sixth 5-year plan (1956–60), 23 percent of the country's capital investment from the public and private sectors went for housing construction, the highest percentage so far achieved for any five year plan period. Moreover, the ruble investment more than doubled. (It is also noteworthy that this was the last time that private home building accounted for the majority of the construction.) Since then, although the ruble investment for housing has increased substantially for each succeeding 5-year plan, its percentage share of total capital investment outlays in the economy declined significantly to 15.3 percent for the ninth 5-year plan (1971–75). This decline clearly indicates that for the Soviet leadership housing no longer holds a priority in investment within the consumer sector as it did in the late Fifties.[15] (Agriculture has taken its place.)

[15] See Table 6.

The increased amount of rubles for housing had actually accompanied a decrease in new units constructed from a highpoint of 2.7 million units in 1959 to 2.1 million in 1977. The reasons for this are several, the most important being that since 1960 the state has built the majority of new housing, mostly in urban areas, which accounted for 78.1 percent of all housing constructed in 1977.[16] These units are much costlier than private homes because they came fully equipped. In addition, although the number of units constructed is smaller the space within each dwelling is larger and there has been an improvement in quality. The rise in cost of building materials and wages also contributed to higher construction expenses.

The financing of public housing construction and other urban services in many large cities and towns comes primarily from federal ministries, and not from city governments, which paradoxically holds back urban development. Many large and medium sized Soviet cities are company towns. Their destiny is chiefly in the hands of directors of enterprises belonging to large federal ministries, which provide revenue for the cities' essential services. In many instances, these enterprises and not the city are in physical control of discharging and maintaining essential urban services. But since factory directors concentrate on productivity, upon which their job security depends, the building of housing holds low priority for them. There are frequent reports in the press that yearly construction goals for residential housing fail to be met, often by a wide margin, even though funds had been set aside for this. Exceptions to this are found in the super-sized cities of Moscow, Leningrad and the capitals of republics, where city officials have greater control over resources; but even there a large proportion of the financing originates from ministries and institutions. The fact that industrial ministries and not the city fathers still hold the upper hand in controlling housing and infrastructural investments is a serious constraint on a city's ability to improve urban services.[17]

Different Models for Financing Housing and for Rents: The U.S.S.R. and Eastern Europe

Since 1960 the Soviet state has been the primary financier of housing. In the Fifties, when housing investment and construction rates were low in Eastern Europe, state financed construction in Czechoslovakia, the GDR and Poland also played a dominant role in urban areas. (See Table 7) By 1960 the ratio of housing investment from both private and public sectors compared to 1950 has increased 2.5 times for Bulgaria, 2.6 times for Czechoslovakia, 1.6 times for Hungary, 5.3 times for Poland, 2.5 times for Rumania and 4.1 times for the U.S.S.R.[18] As a result of the sizable investment costs a different mode of financing housing construction evolved.

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[16] See Table 1.

[17] *Planovoye khozyaystvo*, No. 8, August, 1978, pp. 138–142; translated in the *Current Digest of the Soviet Press*, Vol. XXX, No. 41, p. 7. See also William Taubman, *Governing Soviet Cities*, New York, Praeger, 1973, pp. 54–72.

[18] The ratios were calculated from table 4 in Henry W. Morton, "Housing Problems and Polices of Eastern Europe and the Soviet Union," paper delivered at the annual meeting of AAASS, October 1976. Forthcoming in *Studies in Comparative Communism*.

TABLE 7.—PERCENT OF HOUSING FINANCED BY STATE IN U.S.S.R. AND EASTERN EUROPE

	1950	1955	1960	1965	1970	1975	1976
Bulgaria[1]			10.0	23.0	29.3	56.1	55.0
Czechoslovakia[2]	76.1	69.3	63.7	25.8	36.3	45.3	43.6
German Democratic Republic	45.8	63.7	35.2	56.9	69.2	39.3	38.3
Hungary	16.6	31.2	31.7	41.0	41.1	38.2	34.5
Poland	60.1	68.0	48.1	54.3	23.2	33.3	19.8
Rumania[1]	11.5	27.7	22.4	42.1	43.9	51.8	48.5
U.S.S.R.	38.4	40.3	51.4	67.0	68.4	74.4	76.2

[1] And cooperatives.
[2] And enterprises.

Sources: Statisticheskii ezhegodnik stran-chlenov Soveta Ekonomicheskoi Vzaimoposhchi 1971, Moscow, Statistika, 1971, pp. 1978, 1979. Statisticheskii ezhegodnik stran-chlenov Soveta Ekonomicheskoi Vzaimoposhchi 1977, Moscow, Statistika, 1977, pp. 164, 165. Annual Bulletin of Housing and Building Statistics for Europe 1976, New York, United Nations 1977, pp. 34, 35.

Leaders of Eastern European governments had to decide whether the state should be the chief subventer of new urban housing, the Soviet practice by 1960; or whether cooperative housing and privately financed housing construction in urban areas would predominate. In either category the consumer pays a significant share for a new housing unit. The latter model, already in use in Bulgaria, Hungary and Rumania was adopted by Czechoslovakia and Poland in the sixties and by the GDR in the seventies. (See Table 7) Involving the consumer financially held several important advantages for the state. It relieved pressure on the government as the main source of housing investment and reduced consumer spending power that would have been used to shop for goods in short supply.

A new rent policy in state housing followed a similar pattern. All Eastern Europe countries except the USSR increased their rents in the 1960's and early 1970's. Rents which had been less than 5 percent of a family's income were raised, although an economic rent was not charged because it would have been a serious political liability. In addition, in Bulgaria, Czechoslovakia, Poland and Rumania tenants living in state housing units were encouraged to purchase the apartments which they leased so that the state would be freed from subsidizing rents and would also recover part of the construction cost of a unit.[19]

In the USSR such cooperative housing and rent policies were not adopted. Although the government in 1962 supported cooperative housing construction by providing state credit for the first time, the number of cooperative housing units built averaged only 9.3 percent of all dwellings constructed in urban areas between 1964–1975.

TABLE 8.—*Cooperative housing constructed in percent of urban housing built 1963–75 (based on square meters of housing space)*

1963	3.1	1970	10.8
1964	8.3	1971	9.4
1965	10.7	1972	8.8
1966	9.9	1973	9.1
1967	9.9	1974	8.1
1968	9.7	1975	7.6
1969	9.1		

Sources: *Narodnoye khozyaystvo SSSR v 1968 godu,* Moscow, Statistika, 1969, pp. 574, 579. *Narodnoye khozyaystvo SSSR v 1970 godu,* Moscow, Statistika, 1971, pp. 539, 545. *Narodnoye khozyaystvo SSSR v 1975 godu,* Moscow, Statistika, 1976, pp. 570, 575.

[19] Radio Free Europe (hereafter RFE) *Bulgaria,* January 4, 1957 p. 1; RFE *Czechoslovakia,* August 16, 1966, p. 3; RFE *Poland*/21, June 29, 1976, p. 11; RFE *Rumania,* August 5, 1974, p. 12.

A chief reason for the low building rate of cooperative housing in the USSR is the cost of the downpayment. In Eastern European countries it ranges from 6 to 20 percent and the enterprise or institution that employes the prospective buyer will frequently advance the cost of downpayment and will forgive the loan if that person continues in employment for a specified number of years.[20]

In the USSR, the downpayment is 30 to 40 percent of cost and the coop member pays it all. Occasionally a reduction in the downpayment to 20 percent and its advancement by an enterprise has been recommended but so far such suggestions have gone unheeded.[21] Outright purchase of a cooperative or state-owned apartment is not permitted.

The USSR also retained its low rent structure, although the annual state subsidy for housing maintenance and repairs was 2 billion rubles in 1970.[22] To raise rents to an economic level would have sharply reduced the disposable income of Soviet citizens. Either a price reduction of consumer goods or an increase in wages would have been necessary. Some moderate rent increase could have been instituted but the government undoubtedly questioned whether the additional income would be worth the political cost because the low rate is very attractive to the consumer. An increase might also lead to tenant demand for better service and repair; it would also reverse the direction in which rents were supposed to be going, according to the Party Program of 1961 which promised that in the 1970's, "housing will gradually become rent-free for all citizens." [23] Since this has not happened no reminders of this promise have appeared in the Soviet press for years.

The Distribution of Housing

Those households that are domiciled in a large city, preferably in the capital of a republic and living comfortably by Soviet standards in a highly subsidized public housing unit equipped with modern conveniences that is located near a metro station and not more than 30 minutes from work have no housing problems to speak of. But what if an out-of-towner wishes to move into a large city? Because of severe overcrowding every large urban center is closed to newcomers. Moscow is the most severely restricted of all. The first obstacle to overcome is to receive a permanent residence certificate, a propiska.[24]

The Propiska System

The likelihood of receiving permission to move to Moscow, Leningrad or Kiev without agency sponsorship or with no apartment to exchange from another city is next to nil. Even with these, many diffi-

[20] See Henry W. Morton, "Housing Problems and Policies of Eastern Europe and the Soviet Union." *op. cit.*

[21] V. Svetlichny, *Kommunist*, No. 6, April, 1965, translated in the *Current Digest of the Soviet Press*, Vol. XVIII, No. 11, p. 11.

[22] Everett M. Jacobs, "Urban Housing in the Soviet Union," in *Economic Aspect of Life in the USSR*, Brussels, Belgium, NATO Directorate of Economic Affairs, 1975, p. 71.

[23] John F. Triska, *op. cit.* p. 93.

[24] For a full discussion on housing distribution see Henry W. Morton, "Who Gets What, When and How? Housing in Soviet Union." Paper delivered at the annual meeting of the American Political Science Association, September, 1977. Forthcoming in *Soviet Studies*.

culties will have to be overcome and their resolution will be measured in months and years. It would be necessary for the sponsoring agency also to provide an apartment or a room for the newcomer because a residence must be established before the propiska is issued. Going to the housing authority and requesting that one be put on the waiting list is out of the question since only residents are eligible. Chances of receiving a residence permit improve if two families of approximately the same number living in different cities agree to exchange apartments of approximately the same size. Such an exchange is more likely to be approved between Moscow and Leningrad than between Moscow and Gorky unless strong sponsorship from a Moscow agency is forthcoming.

The Waiting List

Those who are city residents and have a propiska, but live in co-tenancy, sublease or in dormitories and wish to improve their substandard housing situation by moving into an apartment of their own are solely dependent on the housing authorities. They will determine whether one is eligible to be placed on the waiting list. If a family's per capita sanitary norm of 9 sq. m. of living space has been satisfied it is only through connections that it can be placed on the list. Eligibility usually begins with less than 5 sq. m., but this differs from locality to locality. There are two kinds of lists for which individuals may seek registry, those belonging to enterprises and organizations and those belonging to municipalities. A particularly skillful applicant may get them both or try one after another if turned down. Waiting lists of enterprises and organizations are much preferred since their distribution of housing is usually carried out in half the time of municipalities.

How many succeed in getting on the waiting list? Figures on this subject are not published but for Moscow, in November, 1974, 180,000 families or 590,000 persons made the list. This accounted for 7 percent of the capital's population. Sixty percent of them averages less than 5 sq. m. of living space. The others lived in dilapidated quarters or lacked basic conveniences such as central heating or hot water. Of the total, 70 percent were on preferred lists. They will be accommodated earlier; the other 30 percent may have to wait as long as a decade.[25]

The Housing Market

Those who wish to bypass the bureaucratic process can try their luck with the housing market. It picks up where the allocation process leaves off and depends largely on one's ability to pay. Private rentals, cooperatives, apartment exchanges and private homes are all part of an active housing market priced at the going market rate, which is invariably higher than the officially permitted price and is, therefore, illegal.

If an individual or couple have a residence permit but are not the leasees of an apartment or room they have no housing to exchange; therefore, their options are few. They can try to rent a room or an apartment. This is difficult, and expensive, because of black market

[25] Interview, Moscow, 1974.

prices—a room may cost as much as 30 to 50 rubles a month if centrally located in Moscow. Or they can try to join a housing cooperative but first the couple will have to get approval from the housing authorities by showing need. Cooperatives are also expensive. A two room apartment of 32 sq. m. of living space requires a down payment of 3,200 rubles. Even at these prices coop units are at a premium and difficult to obtain.

To engage in a housing exchange a person must have a room or an apartment registered in his or her name. It can be state of cooperatively owned. In either case it becomes that person's "working capital" to try to exchange current quarters for more suitable housing. For a Soviet citizen to succeed in the exchange market it takes ingenuity, tenacity, patience, luck, influence and cash.

To find out about exchanges an interested party goes to the Bureau of Housing Exchanges which maintains a card file, for a 3 ruble fee per entry, of those citizens who wish to exchange their present housing and a separate one for those who wish to make an intercity exchange. Notices may be placed in the Bulletin for Housing Exchanges which most large cities publish. The Moscow Bulletin appears weekly and carries more than 1,000 ads. Because the Bulletin is, like many Soviet journals, capriciously distributed so that only certain newsstands carry it, notices for exchanges are ubiquitiously affixed on kiosks, bus and trolley stops, street lamps, fences and building walls.[26]

Because exchange bureaus do not assist clients in finding exchange partners beyond the card file registry that is kept, a lively open air "stock market" trading in rooms and apartments, operates in all weather just outside a central exchange bureau's office. Sunday is its most active day. Exchanges which usually involve a chain of families, are rarely equal. Some will incur an increase, others a decrease in sq. m. living space; others will swap a desirable, centrally located district for one that is at the city's outskirts and so on. Those who stand to gain from a transaction will privately pay their exchange partners a sum of money mutually agreed upon; this is the gray market aspect of the exchange process. Such illegality is winked at by the housing authorities who will approve an exchange as long as the same number of persons roughly exchange similar amounts of space.

Dachas-Summer Homes

A second home market in summer houses (*dachas*) is flourishing. They come in all sizes from stately villas with servants for the political leadership to an overpriced room rented from a collective farmer. It is strictly a seller's market because the government is not permitting a rapid expansion of dacha construction cooperatives nor does it liberally grant permits to private dacha builders.[27]

Therefore, the price for renting one goes up every year. To rent a comfortable dacha with modern conveniences may cost 1,000 rubles for the summer; and to rent a room in a dacha shared with other tenants, which has electricity, running water, no gas or indoor plumbing may cost 200 rubles. Legally the rent is 1 ruble and 32 kopeks—on which the peasant landlord pays taxes—but the authorities do not enforce it.

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[26] From observation and *Izvestiya*, July 6, 1973.
[27] *Literaturnaya gazeta*, July 2, 1975.

Buying a dacha is even more difficult than renting one because so few are up for sale. The cheapest is a little shack with a small plot of land that costs about 5,000 rubles, if one can be found. The price for a comfortable country home with four or more rooms and modern conveniences will range from 15,000 to 50,000 rubles and more, but they are scarce.

Corruption in Housing

Just as the housing market has led to a score of illegal practices in the USSR so have the propiska, the housing allocation process and the constrictions placed on private-home ownership. Since government officials monopolize the supply of housing it is understandable that housing bureaucrats will be the focal point of bribes because the demand far exceeds the supply. For those on the waiting list jumping the queue is a universal wish because it can reduce one's waiting time from ten years to zero. For such an act to take place, *blat* (influence), a bribe, or both are needed. It is one of the most frequently cited violations in the housing system. Officials are frequently on the take, but knowing which ones will accept money is tricky and to initiate such an act without some kind of signal is dangerous because if one is apprehended, the sentence is 8 years.

Another form of corruption practices occurs when local party and government officials, plant managers, state bank directors and others use their connections to build well-equipped, over-sized homes (far in excess of the permitted 60 sq.m. of living space), on illegally assigned plots, using stolen building materials and illegal loaned construction machinery and labor. Sometimes they own several private homes (although only one is legally permitted to each household), while still maintaining a state owned apartment in the city.[28]

Housing Classes

Housing is an integral part of the reward system of Soviet society. State agencies, holding a monopoly in the distribution of housing, ration out new units on the basis of occupational work and influence and only secondarily on need. Thus, housing is increasingly becoming stratified among the haves and have-nots to society and is also slowly becoming geographically segregated in cities as different professional groups cluster together in housing complexes built by their organizations. The poorest urban housing class in the USSR, the "least favored" are the millions that cluster beyond the limits of large cities. They are also the most segregated, and are mainly semi and unskilled workers. In the city the housing poor are the "less favored," who live communally or in dormitories. Possessing a legal right to live in the city they can at least hope that in the distant future they too will receive an apartment of their own. In the meantime they can profit from the advantages that urban life offers over rural living. Much better off are those households living in self-contained apartments in newly erected housing districts. They are "the more favored," even though they are located far from the center. Commuting to work may take an hour by crowded bus or metro; and shopping where they

[28] See Henry W. Morton "Who Gets What, When and How? Housing in the Soviet Union," *op. cit.*

live is difficult. "Most favored" are those families living in apartments in or near the center of town. These are mainly the Soviet political, military, security, economic, scientific, cultural, educational and worker elites. They are the most heavily subsidized because they are paying the same low rent rate as those living communally. Thus the most advantaged become the beneficiaries of redistributed social wealth which they can pass on to their children.[29]

Economic and Social Consequences of the Housing Shortage

Poor housing conditions in the Soviet Union contribute to the acute manpower shortage, high labor mobility and the low birthrate; they also affect migratory and commuting patterns, transportation and consumer needs.

Factories, agencies and organizations cannot hire labor if there is no place for workers to live. Moscow's most serious problem, according to its mayor, is not lack of money but a shortage of 150,000 workers and employees whose skills are in great demand but for whom accommodations cannot be found.[30] The capital and other large cities, officials feel, have a disproportionate number of retired people. In Moscow they constitute one-sixth of the population. Pensioners refuse to leave Moscow, Leningrad, Kiev and other large urban centers because resort towns like Sochi are overcrowded and have no room for them, and life in small towns and rural areas is primitive.

Labor mobility is highest among singles under 25. When not living with parents singles find accommodations in subleases or in workers dormitories of factories where 5 to 20 are crowded into a room. In the USSR in the early 1970's some 4 million of them lived in workers dormitories—about 9 percent of all urban households.[31] Few singles will receive an apartment and have no hope of receiving one unless they marry. Poor housing accommodation is one reason for their frequent change of jobs.

Cramped housing conditions also contribute to a decline in the birthrate. Soviet leaders for economic and military reasons, view their aging population with deep concern. It has been demonstrated that couples will have their first child even if they live in co-tenancy, but they are less likely to have a second if it means even greater crowding and a further lowering of their living standard.[32]

Concluding Remarks

After years of neglect, the Soviet regime in the mid 1950's launched an ambitious residential construction program with the stated purpose

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[29] I am greatly indebted to Ivan Szeleyi for this section. I have adapted his seminal analysis of Hungarian housing classes (which he developed with Gyorty Konrad) for the USSR. See his "Housing Systems and Social Structure." The Sociological Review Monograph. Vol. XVII, (Feb. 1972) pp. 269–297.

[30] Interview, January, 1978.

[31] See *Komsomolskaya Pravda,* August 20, 1974, translated in the *Current Digest of the Soviet Press.* Vol. XXVI, No. 40, p. 9 for millions living in dormitories and *Itogi vsesoyuznoi perepisi naseleniya 1970 godu* VII. Moscow Statistika, 1974. pp. 186–187, 256–257 for percent of singles of urban households. To arrive at household figures, which do not appear in Soviet data, I added the number of familities and singles. See Table 4 under USSR.

[32] *The Socio-Demographic Consequences of Urbanization in the Soviet Union,* Jeffrey Chinn. Unpublished doctoral dissertation, Department of Political Science, University of Wisconsin, 1975, pp. 273–90.

of eliminating the severe housing shortage which had forced the majority of urban households to live communally with many families sharing an apartment and averaging 5 sq.m. per person. Now, almost a quarter of a century later, the majority of urban families live in apartments of their own which is a significant improvement.

However, 30 percent or more of urban households (families and singles) still live communally or in dormitories. Therefore, the promise that each family would have an apartment by 1980 will not be kept because the number of dwellings has still not caught up to the number of households. The rate of construction which peaked with 2.7 million units in 1959 has levelled off to 2.1 million units in the latter half of the 1970's and since 1969 has fallen below the yearly number of marriages. This is why most newlyweds are compelled to live with their parents for many years before receiving a place of their own. Housing conditions would seriously worsen if large urban centers were not legally closed to millions of would-be migrants, many of them working in cities but denied permission to reside in them.

The still acute housing shortage is the government's responsibility. It invests heavily in industry, attracting workers and managerial personnel to urban areas yet under-invests in housing construction and other consumer services which are needed to take care of them. It restricts consumer choice to high density apartment-style living in cities thereby discouraging consumer initiative for private home building and for cooperative housing by charging a costly down payment instead of offering more generous credit terms. As long as the state remains the principal financier or urban housing construction without even a partial return on its investment, the housing deficit in relation to households can only be reduced incrementally. However, if rents were raised to pay for a significant portion of the construction cost and for the upkeep of the housing stock then the state would be in a much more favorable position to increase substantially its investment in housing and accelerate the rate of construction without seriously neglecting other sectors of the economy. Since such a change in policy is not feasible at the present time because of the government's stated commitment to distributing housing free of charge, which the Soviet urban consumer finds very attractive (not realizing that he is paying higher prices for food, clothing and durable goods to pay for the state's huge housing subsidy) the shortage in housing will continue for many years to come.

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AUTOMOBILES AND THE SOVIET CONSUMER

(By Toli Welihozkiy*)

CONTENTS

TABLES

SUMMARY

The automobile age has finally arrived in the Soviet Union with the mass production of passenger cars for private use. Production has increased by more than fourfold since 1970 as new automobile production capacity has been expanded, production efficiency improved and existing excess capacity more fully utilized.

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Relative to Western countries and even their East European neighbors, however, private car ownership in the USSR is still very low and the average consumer faces frustration and bureaucratic impediments in purchasing a new car. In addition to a carefully orchestrated allocational system whereby "elite" groups are granted special privileges in obtaining cars, retail car prices are relatively high, and consumers face a long waiting period for delivery, a lack of installment credit, and little freedom of choice of model, color and equipment options. Domestic consumption is also stymied by the fact that Moscow exports over one-quarter of the passenger cars produced.

Having successfully purchased a car, a new owner is faced with still further problems. Existing service and maintenance facilities do not meet the public's need—in both quantity and quality. In addition, spare parts and the supply of gasoline are in short supply. As a result, a flourishing black market exists supplying those who can afford the higher prices. Finally, the opportunity to travel by car within the Soviet Union is limited because of both an inadequate and poorly constructed road system and a lack of roadside accommodations.

As private car ownership continues to grow into the 1980's, Soviet authorities will also be faced with a number of formidable problems. Inadequate parking space and traffic safety have already become major problems and will probably get worse. Pollution and traffic congestion in urban areas will also have to be faced as Soviet citizens use automobiles more to commute to work, to shop, and for long excursions.

I. Introduction

During the first half of the 1970's, with the completion of the FIAT-designed Volga Motor Vehicle Plant (VAZ) at Tol'yatti, and the expansion of capacity to produce Moskvich and Zaporozhets cars, the U.S.S.R. entered into the modern automobile age. Between 1970 and 1975 automobile production nearly tripled. Today, in the 1976–80 plan period, Soviet citizens are experiencing the growing pains of that new era: a consumer demand characterized by long waiting lists; very high excise taxes on automobiles and hence, relatively high prices; a weak maintenance and parts supply system; a poorly articulated highway system; and few food and overnight accommodations for long distance excursions.

This paper describes the basic elements of the Soviet automobile industry, recent trends in developments affecting the purchase and use of automobiles by Soviet consumers, and the prospects for private car ownership in the 1980's.

II. Background

A. Production

From 1965 to 1975, growth in Soviet motor vehicle output greatly accelerated.[1] Due mainly to the expansion of passenger car produc-

[1] Throughout this study the output of the motor vehicle industry refers to the production of automobiles (passenger cars) as well as trucks and buses. For other discussions of the Soviet motor vehicles industry during this period, see Imogene U. Edwards, "Automotive Trends in the USSR" in *Soviet Economic Prospects for the Seventies* (Washington, D.C., Joint Economic Committee of the Congress of the United States), pp. 291–314 and John M. Kramer, "Soviet Policy Towards the Automobile," *Survey* (Spring, 1976), pp. 16–35.

tion, output grew at an annual rate of nearly 8.5 percent during the last half of the 1960s and then jumped to roughly an average of 16 percent annually during 1971–75 (Table 1). Output of passenger cars, which amounted to roughly 200,000 units in 1965—one-third of motor vehicle out-put—increased to 1.2 million units by 1975, or more than 60 percent of motor vehicle production (Table 2). The VAZ Plant, largely equipped with highly productive Western machine tools and equipment, was, overwhelmingly, the most important factor in this growth. The output of Zhiguli model cars, produced at the VAZ plant, grew rapidly from initial production in 1970 to 667,000 units a year by 1975, slightly above original design capacity.

TABLE 1.—U.S.S.R.: PRODUCTION AND GROWTH OF MOTOR VEHICLES BY 5-YEAR-PLAN PERIOD,[1] 1966–80

	Actual		
	1966–70	1971–75	Plan, 1976–80
Production (thousand units):			
Total	3,965.1	7,934.0	10,786
Including—			
Passenger cars	1,399.5	4,496.2	6,575
Trucks	2,352.6	3,152.9	3,831
Buses	213.0	284.9	380
Average annual rate of growth (percent):			
Total	8.3	16.5	3.2
Including—			
Passenger cars	11.4	28.4	3.0
Trucks	6.7	5.8	3.5
Buses	6.0	7.3	3.6

[1] This data was compiled on the basis of annual production figures for past years contained in Narodnoye khozyaistvo SSSR, various issues and plan data found in Ekonomicheskaya Gazeta, No. 17, April 1977, p. 18.

TABLE 2.—U.S.S.R.: ANNUAL PRODUCTION OF MOTOR VEHICLES, 1970–80[1]

[In thousands]

Year	Total[2]	Passenger cars	Trucks	Buses	Passenger car share of production (percent)
1970	916	344	525	47	38
1971	1,143	529	564	49	46
1972	1,379	730	597	52	53
1973	1,602	917	630	56	57
1974	1,846	1,119	666	61	61
1975	1,964	1,201	696	67	61
1976	2,025	1,239	716	70	61
1977	2,088	1,280	734	74	61
1978	2,151	1,312	762	77	61
1979[3]	2,178	1,310	787	81	60
1980 (plan)[4]	2,297	1,392	825	80	61

[1] Narodnoye khozyaistvo SSSR, 1977, p. 265 except as otherwise noted.
[2] Totals may not add because of rounding.
[3] Ekonomicheskaya Gazeta No. 9, February 1979, p. 1.
[4] Ekonomicheskaya Gazeta, No. 17, April 1977, p. 18.

In addition, the construction of both the Ishevsk Automobile Plant (ZIMA) and the reconstruction of the Lenin Komsomol Plant (AZLK) in Moscow, both equipped with assistance from Renault of France, and the modernization of facilities at Zaporozhe helped boost output of Moskvich and Zaporozhets model cars (Table 3). Overall, the U.S.S.R. invested more than 8 billion rubles—11 billion dollars [2]—

[2] Converted to dollars at the 1977 official exchange rate of one ruble equals 1.36 dollars.

in constructing, modernizing, and expanding motor vehicle production, assembly and parts plants during the period 1966–75.[3]

During the current 1976–80 Plan period, the emphasis has shifted from installation of new production capacity to improvement in manufacturing processes and products. Increases in output are being achieved principally by bringing production up to full capacity at modernized facilities. As a result, the increase in passenger car production has slowed from an average annual rate of 28 percent a year during 1971–75, to a planned rate of roughly 3 percent per annum during 1976–80. By 1980, total annual output of passenger cars is scheduled to reach 1.4 million units, about 200,000 units above the 1975 level.

[3] *Avtomobil'naya Promyshlennost'*, No. 1 (January, 1976), p. 2, indicates investment of 7 billion rubles between 1971 and 1975. In the 1968–70 period an estimated 1.2 billion rubles was invested in production facilities associated with the VAZ plant. Additional, but smaller investments, may have been expended in other facilities.

TABLE 3.—U.S.S.R.: ESTIMATED PASSENGER CAR PRODUCTION BY PLANT AND MODEL, SELECTED YEARS[1]

[In thousands]

Plant name	Location	Models	1965	1970	1971	1972	1973	1974	1975	1976	1977	1978	1980[2]	1985[2]
Volga Automobile Plant (VAZ)	Tolyatti	Zhiguli (Lada), Niva (Cossack)[3]	0	22	172	323	492	638	667	684	696	711	735	760
Lenin Komsomol Automobile Plant (AZLK)	Moscow	Moskvich	72	104	106	116	135	149	164	176	181	186	200	220
Izhevsk Automobile Plant (ZIMA)	Izhevsk	Moskvich-412 (IZH)	0	32	71	105	122	153	165	166	176	178	200	220
Zaporozhe Automobile Plant (ZAZ)	Zaporozhe	Zaporozhets (LUAZ)	41	87	92	97	107	119	135	143	150	160	165	200
Gorkiy Automobile Plant (GAZ)	Gorkiy	Volga	55	51	56	61	61	60	70	70	77	77	90	100
Total			168	296	497	702	917	1,119	1,201	1,239	1,280	1,312	1,390	1,5000

[1] Production of individual plants was estimated from various sources. In some years, summation of estimated plant outputs do not exhaust to officially published totals in table 2.

[2] Estimated assumming no new production capacity added. If deals currently being negotiated with West European countries are implemented in time, production could increase substantially by 1985.

[3] Export models.

In the upcoming 1981–85 Plan period, growth of automobile production, however, could again increase substantially. Moscow is negotiating with Fiat of Italy to nearly double the annual level of production at the VAZ plant (to about one million units),[4] and with other Western manufacturers for a front-wheel drive car to replace existing Moskvich models.[5] This implies that production capacity may be further increased at the Lenin Komsomol plant or Izhevsk, or both. Some of this expanded capacity may be on stream in the early 1980's.

B. Models

The USSR now produces four basic makes of passenger cars, in several variants (Table 4). With the exception of limousines, these cars can be characterized as follows: most are subcompact size with engine displacements less than 1,600 cubic centimeters (cc). Only one model, the GAZ–24, with a 2,400-cc engine could be classed as medium-sized. Most are very light, about 1,000 kg (2,200 lbs.) or less, and as a result, gas mileage ratings are high. With the exception of the relatively heavy GAZ–24, the USSR claims that their passenger car models attain at least 21 miles to the gallon.

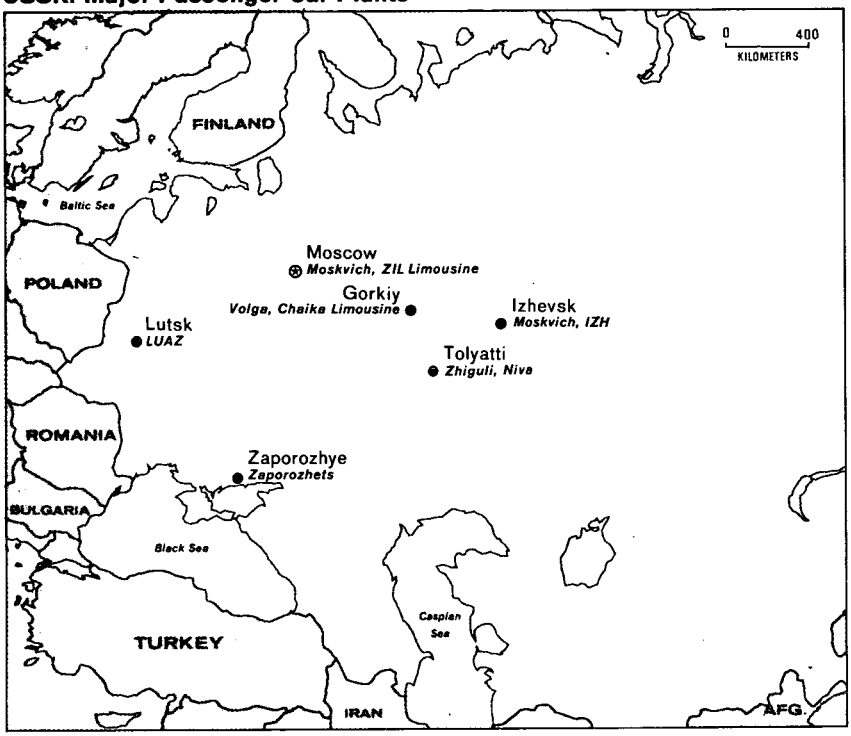
TABLE 4.—U.S.S.R.: PRINCIPAL CHARACTERISTICS OF PASSENGER CARS BUILT IN 1977 [1]

Model	Model year	Occupants	Weight (kilograms)	Engine (cubic centimeters)	Horsepower	Cylinders	Octane rating	Miles per gallon
Sedans:								
Zaporozhets:								
ZAZ–968	1972	4	790	1,198	40	4	76	29
ZAZ–968A	1975	4	840	1,198	45	4	93	28
Zhiguli:								
VAZ–2101	1975	5	955	1,198	62	4	93	23
VAZ–21011	1974	5	955	1,294	70	4	93	23
VAZ–2103	1972	5	1,030	1,452	77	4	93	22
VAZ–2106	1976	5	1,050	1,568	80	4	93	26
Moskvich:								
IZH (Moskvich–412)	1968	4	1,045	1,475	79	4	93	21
Moskvich–2138	1976	4	1,080	1,358	50	4	76	21
Moskvich–2134	1976	4	1,080	1,475	75	4	93	21
Voga: GAZ–24	1968	5	1,420	2,445	95	4	93	18
Station wagons:								
VAZ–2101	1970	5	1,010	1,198	62	4	93	23
IZH (KOMBI)–2125	1973	4	1,085	1,475	75	4	93	21
Moskvich–2136	1976	4	1,120	1,358	50	4	76	21
Moskvich–2137	1976	4	1,120	1,475	75	4	93	21
GAZ–24–02	1968	7	1,550	2,445	95	4	92	17
All-wheel drive:								
Luaz–969	1970	4	940	1,198	39	4	76	29
VAZ(NIVA)–2121	1976	4	1,150	1,568	80	4	93	24
Limousines:								
GAZ–14 (CHAIKA)	1977	7	2,580	5,530	220	8	93	14
ZIL–117	1971	7	2,880	6,960	300	8	98	12

[1] Za Rulem, July, 1977, p. 19.

[4] "Russia Plans Talks on UK Car Deals", *Financial Times*, March 23, 1978, p. 6.
[5] "Soviets Plan Auto Venture with West", *Wall Street Journal*, May 1, 1978, p. 6.

USSR: Major Passenger Car Plants



The most popular passenger car in production is the Fiat-designed Zhiguli which is produced in both sedan and station wagon versions. By the end of 1977, over 2 million Zhigulis were in personal use, including state-owned vehicles.[6]

In addition to sedans and station wagons, two limousine models are produced which are not sold to the public—the Chaika and ZIL, both similar in size to the U.S. Cadillac. These models have automatic transmissions, 8-cylinder engines, and seats for seven persons.

Approximately four-fifths of the variants of passenger car models have been introduced since 1970, modifying somewhat the industry's image as a backward producer of motor vehicles. Production of passenger cars by major models is shown in table 5 below.

[6] Official vehicles, owned by ministries and other government organizations as well as enterprises are assigned to Soviet executives for their personal use.

TABLE 5.—U.S.S.R.: PASSENGER CAR PRODUCTION BY MAJOR MODEL, 1978

	Production	Share of production (percent)
Zhiguli	711,000	54
Moskvich	[1] 364,000	28
Zaporozhets	160,000	12
Volga	[1] 77,000	6
Total	1,312,000	100

[1] Estimated.

III. Private Ownership

A. Growth

Until a decade ago, the USSR had never seriously attempted to produce automobiles for popular use. Cars, like other consumer durables, had a very low priority in a system governed by planners' preferences, and were produced mainly for official uses. With high-volume output from VAZ, however, production during the 1974's rapidly exceeded official requirements, resulting in increasingly larger increments of output available for sale to the public. In addition to increased production, private ownership probably benefited also from planners' efforts to renew the inventory of government-owned vehicles. During 1971–77, more than 1.2 million vehicles were allocated to government use, while the government park expanded by less than one-half million. Almost certainly a portion of the government cars replaced were sold to consumers on the used car market. In addition, because exports fell below official expectations, greater number of cars than expected were available for private purchase.

Inventory data reveal the dimension of the transformation in private ownership that has taken place in recent years. In 1960, the estimated total car park (private and other) was roughly one-half million units or about 1 car for every 424 persons.[7] By the end of 1978, however, the inventory of passenger cars had increased to approximately 7.3 million vehices, 80 percent (5.8 million) of which were privately owned.[8] By 1980, the number of privately owned cars is expected to reach 7.6 million units or 1 car for every 35 persons.[9]

Among the constituent republics, per capita ownership is largest in the Baltic republics. In 1977, Estonia topped the list with a car for every 16 inhabitants, followed by Lithuania and Latvia with one per 20 persons. Georgia and Armenia had 1 car for every 30 persons and the remaining republics, including the Russian Federation, averaged one for every 40 to 60 inhabitants. Without recourse to data on ownership by ethnic group within the several republics, the Baltic republics appear to have priority in the distribution for private ownership. This is in keeping with other evidence that these republics enjoy a higher standard of living reflecting, in part, their higher levels of productiv-

[7] The park is based on official production figures and estimated retirement rates. For production data, see *Narodnoye khozyaistvo SSSR,* various issues.
[8] See Table 8.
[9] E. Bashindzhagyan, "Avtomobilestroyeniye V. Desyatoi Pyatilyetke," *Za Rulem,* November, 1976, p. 3.

ity and per capita real income and, in part, Moscow's wish to placate an endemically hostile populace with an acute awareness of the large gap between Soviet and Western consumption levels.[10]

For the country as a whole, the Soviet consumer still has a long way to go to catch up with its East European neighbors in private car ownership. Per capita ownership of cars at the end of 1976 in every East European Communist country, except Romania, was higher than in the USSR (Table 6). Even if growth in private ownership in those countries falls to the level of population change during 1976–80, they would still be much better off than the USSR in 1980.

Based on present trends and Soviet plans, however, the consumer's chances of car ownership could improve dramatically in the next decade. If the private household's share of the output of cars stays at the current level of nearly 70 percent (Table 7), and scrapping is negligible, the number of privately owned cars will more than double by 1985, and increase about threefold by 1990.[11] By comparison with the United States, the total inventory of cars in 1980 would be where the U.S. inventory was in 1920, and by 1990 will almost reach the level of the United States in 1925.

TABLE 6.—U.S.S.R. AND EASTERN EUROPE: PASSENGER CAR REGISTRATIONS IN SELECTED COMMUNIST AND DEVELOPED COUNTRIES (JAN. 1, 1977)

Country	Passenger cars [1]	Persons per car
Developed West:		
United States	110,351,327	2
West Germany	19,180,469	2
Japan	18,475,570	6
United Kingdom	14,354,900	4
France	16,250,000	3
Italy	15,900,000	4
Austria	1,828,050	4
Eastern Europe:		
East Germany	2,052,240	8
Czechoslovakia	1,677,493	9
Yugoslavia	1,732,131	13
Hungary	737,973	14
Bulgaria	450,000	20
Poland	1,290,100	27
U.S.S.R.	[2] 5,600,000	46
Romania	200,000	108

[1] Motor Vehicle Manufacturer Association, Motor Vehicle Facts and Figures, 1978, Detroit, pp. 28–31.
[2] Estimated. A similar figure was published in the journal Automobile International, vol. 55, No. 11, November 1978, p. 98.

[10] For a discussion of relative economic development by region, see Gertrude E. Schroeder, "Soviet Regional Development Policies in Perspective," *The U.S.S.R. in the 1980s: Economic Growth and the Role of Foreign Trade*, NATO Colloquim (1978).
[11] Calculations based on privately owned inventory data presented in Table 8.

TABLE 7.—U.S.S.R.: ALLOCATIONS OF NEW PASSENGER CARS TO CONSUMERS, GOVERNMENT, AND EXPORTS, 1970–77

	Units				Share of total allocations (percent)		
	Total allocations	Consumers [1]	Government [2] [5]	Exports [3]	Consumers	Government	Exports
1970	344,000	108,000	151,000	84,800	31	44	25
1971	529,000	120,000	269,000	149,700	22	50	28
1972	730,000	241,000	294,000	194,900	33	40	27
1973	917,000	353,000	327,000	237,500	38	36	26
1974	1,119,000	[4] 686,000	146,000	287,326	61	13	26
1975	1,201,000	800,000	105,000	295,616	66	9	25
1976	1,239,000	[2] 840,000	54,000	344,743	68	4	28
1977	1,280,000	[2] 880,000	38,000	361,993	69	3	38
1978	1,312,000	[2] 880,000	44,000	367,806	67	3	30

[1] Except for years noted, L. M. Shakhnes, Ekonomike i Ekspluatatisiya Avtomobilnogo Transporta, Moscow, 1976, p. 185.
[2] Estimated.
[3] Vneshnyaya Torgovlya SSSR, various issues.
[4] R. A. Lokshin, Spros, Proizvodstvo, Torgovlya, Moscow, 1975, p. 211.
[5] The dramatic decrease of car allocations to the government sector may be explained by the increased availability of cars for sale due to expanded production, thus government officials who had previously enjoyed a government car for free personal use were buying them as procurements were decreased.

TABLE 8.—U.S.S.R.: ESTIMATED PASSENGER CAR PARK, SELECTED YEARS

	1975	1977	1980	1985
Total park	[1] 4,730,000	[2] 6,500,000	[2] 9,500,000	[2] 14,000,000
Privately owned park	[1] 3,400,000	[2] 5,000,000	[3] 7,600,000	[2] 12,500,000
Persons per car, total park	54	40	28	20
Persons per car, privately owned	75	52	35	22

[1] MVMA Motor Vehicle Facts and Figures, 1977, p. 31.
[2] Estimated.
[3] Planned.

B. Structure of Ownership

Most car owners are members of "elite" groups that receive special consideration in the allocation of cars. From various and disparate source materials, the composition of these groups and their order of priority for purchasing cars appears to be roughly as follows: [12]

(1) High ranking party officials at the national and republic levels;

(2) Holders of medals for heroic and scientific achievements (e.g., Hero of Socialist Labor, Lenin Prize);

(3) Members of the Academy of Sciences, Writers' Union and similar prestigious organizations;

(4) Managing executives in industry, central and local governments;

(5) Disabled veterans of World War II (some receive cars at no cost with discount rates for all services), and specially configured cars are built for invalids at the Zaporozhets plant (ZAZ) and AZLK; and

(6) Heroes of Labor (usually industry and agriculture workers who have especially distinguished themselves).

Next in line are persons who perform an important state service and live in rural areas (e.g., agricultural technicians, teachers, and doc-

[12] For a discussion of the special benefits, including the purchase of cars afforded elite groups in Soviet society, see Mervyn Matthews, *Privilege in the Soviet Union* (London): George Allen and Unwin, 1978.

tors). These are followed by production workers who have distinguished themselves on the job (e.g., brigade leaders, and "shock" workers). After all these groups have received their disproportionate share, the remaining inventory of unsold cars is allocated to retail outlets with long waiting lists. Because of these and other considerations, ownership of a private car in the USSR is prized not only for its utility, but also as a symbol of status. Only authorization to travel abroad confers greater prestige.

IV. Impediments to Ownership

As a result of the allocation system, most new passenger cars are sold in urban areas through state institutions. Moreover, as suggested above sales are not made on a first come-first served basis reflecting the relative purchasing power of potential owners, but rather according to priorities following the principles outlined. In addition to a carefully orchestrated distribution system, there are a number of other impediments to private ownership. For example, installment credit is not available and the cost of cars is relatively high. Waiting periods are long, and there is little freedom of choice of model, color and equipment. In short, the buyer takes what he is offered.

A. Prices

Prices in the Soviet Union are set by planners and not by the interaction of supply and demand in a freely operating market. Nevertheless, the planners account for demand implicitly—and imperfectly—by adding differential "turnover" or excise taxes to commodities sold at retail. Luxury items, such as cars tend to have very high turnover taxes. For example, in the case of the lowest priced Zhiguli (VAZ-2101), the turnover tax amounts to 3200 rubles (about $4,350, or nearly 60 percent of the retail price.)[13]

Moreover, as cars improve in quality, the turnover tax also increases corresponding to the planner's perception of the potential demand. The tax acts as a means of rationing cars to consumers by partially closing the gap between the normal supply price (reflecting production costs plus profit, retail markup, and distribution charges) and demand.[14]

As a result, retail prices of new model Soviet cars are high relative to prices of comparable U.S. cars. For example, the Soviet Volga in 1977 sold for 9,200 rubles, or $12,500 at the official exchange rate. A comparable model—the Chevrolet "Nova"—sold for roughly $3,500 in the United States. The Moskvich-2140 sold for about 6,300 rubles, or $8,600, compared with $3,000 for the comparable AMC "Gremlin" in the United States.[15] The 1977 price of various Soviet automobiles were as follows:

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[13] D. P. Velikanov, *Avtomobilniye Transportniye Stredstva* (Moscow: "Transport," 1977), p. 279.

[14] As witnessed by waiting lists of two or three years, the current high excise tax does not equilibrate demand with supply. To this extent, planners are not maximizing the government's position as a monopolist, i.e., gross revenues could be enhanced by even higher taxes.

[15] The prices of U.S. models are manufacturer's suggested retail prices for January 1977.

	1977 sales price	
	Rubles	U.S. dollars[1]
Zaporozhets, ZAZ-968	3,510	4,770
Moskvich-2140	6,346	8,630
Zhiguli, VAZ-2101	5,500	7,480
Zhiguli, VAZ-21011	6,030	8,200
Zhiguli, VAZ-2103	7,500	10,200
Zhiguli, VAZ-2106	8,300	11,290
Volga, GAZ-24	9,200	12,510

[1] Rounded. Converted at the 1977 exchange rate of 1 ruble equals $1.36.

Automobile retail prices are high also relative to the income of the Soviet consumer.[15a] The price of a Moskvich-2140 was equivalent to 20 months earnings for an average family with two income earners in 1977.[15b] By comparison, the price of a U.S. counterpart was equivalent to 2 months income for an average American family.[16] Because of higher prices, the financial burden of a new car for the average Soviet citizen has not changed in the past 7 years despite increased domestic supply and a 27-percent increase in the average wage. In 1970, it took the same Soviet family the same 20 months' worth of earnings to purchase the same Moskvich car.[17]

B. Other Impediments

A major source of frustration for a prospective buyer is the requirement to pay cash on delivery, and normally a 25-percent down payment at time of order. This requirement, imposed to help keep the lid on demand, is not likely to be lifted soon. S.A. Trifonov, Deputy Minister of Internal Trade, recently stated that sales of cars on the installment plan are "unacceptable at current levels of passenger car production."[18]

The prospective Soviet car buyer faces a long, sometimes staggeringly, waiting period for delivery of a new car. The official claim of an average waiting period of 18 to 24 months, is inconsistent with other evidence indicating that the average delay is usually much longer. In 1975, in some cities consumers had been on the Registration List 10 years or more before they were given authorization to buy a car; in 1977, in the city of Uzhgorod, the wait was 5 to 7 years. An exception to these norms is made for the privileged "elite" who receive cars after an average wait of one year.[19]

The multiple roadblocks to new car ownership have led to the development of a flourishing and very lucrative illegal trade in both new and used cars.[20] The used car market offers some relief to the ordinary

[15a] For a discussion of wholesale prices of Soviet automobiles, see below.

[15b] Calculated on the basis of an average monthly wage in the U.S.S.R. of 155.2 rubles. See *Narodnoye khozyaistvo SSSR*, 1977, p. 385.

[16] The calculation for the United States is based on a median annual income of $18,704 for a family with two wage earners. See U.S. Department of Commerce, Bureau of the Census, *Money Income and Poverty Status of Family and Persons in the U.S. Public* Consumer Series P–60, No. 116, (Washington, D.C.: U.S. Government Printing Office, 1977) Forthcoming.

[17] Called the Moskvich-412 in 1970. Quality changes as reflected in design and engineering differences between the Moskvich-412 and the -2140 are minor.

[18] S. A. Trifonov, "Mneniye Zamestitela Ministra Torgovli U.S.S.R.," *Ekonomika i Organizatsia Promyshlennova Proizvodstva*, No. 2 (March–April, 1977), p. 176.

[19] "One the approved Rules for Selling Passenger Cars and Motorcycles with Sidecars to the Population," *Byulleten' Normativnyka Aktov Ministorstv i Vedometv SSSR*, No. 9. (1978), pp. 42–48.

[20] Some prospective new car buyers have even bribed officials to circumvent the waiting list. Buyers sometimes are swindled by the officials being bribed, or are caught, convicted, and imprisoned for long terms. See Matthews, *loc. cit.*, p. 52.

citizen from the entanglements of official procedures. But, as in the case of new cars, the buyer must pay in cash. Moreover, usually the price is above the new car price. Finally, he must himself determine if the desired car is mechanically acceptable. Sales of used cars in officially sanctioned markets, after peaking in 1973 are on the rise again. In 1977, 227,000 used cars were sold, more than one-fifth of all sales (Table 9).

TABLE 9.—U.S.S.R.: COMPARISON OF RETAIL SALES OF NEW AND USED PASSENGER CARS, 1970–77

	Units			Share of total sales (percent)	
	Total sales [1]	New [2]	Used [3]	New	Used
1970	123,000	108,000	15,000	88	12
1971	222,000	120,000	102,000	54	46
1972	486,000	241,000	245,000	50	50
1973	682,000	353,000	329,000	52	48
1974	871,000	686,000	185,000	79	21
1975	964,000	800,000	164,000	83	17
1976	1,021,000	840,000	181,000	82	18
1977	1,107,000	880,000	227,000	79	21
1978	1,173,000	880,000	293,000	75	25

[1] Narodnoye Khozyaistvo, SSSR, various issues.
[2] Col. 2, table 7 above.
[3] Total sales, sales of new passenger cars.

Sales of used cars must be registered with Soviet authorities. Moreover, prices have been set at which used cars can be sold and State-operated commission stores have been established by the government to police such transactions. The commission outlet charges a fee of 7 percent of the selling price for acting as middleman and for providing a safety inspection.[21]

Because of the excess demand for used cars, sellers often find it more profitable to obtain their own buyers—e.g., a friend or a contact at the local bazaar—who is willing to pay a price higher than the price set by the government. That being the case, the prospective buyer pays the seller the difference between the agreed upon price and the posted price. The sale is then transacted and registered through the Commission Store but at the official price. In effect, then, the authorities are sanctioning the existence of a used car market.

Under such arrangements sellers of used cars can realize substantial profits. In 1978, for example, a used Volga in Tbilisi was sold for 16,000 rubles, nearly double the officially posted price of 8,700 rubles and the new car price of 9,200 rubles.[22] Such private sales can be very profitable even on old cars. In 1977 a 1953 vintage Pobeda—still in drivable condition [23] was sold to a private buyer for 2,660 rubles, net-

[21] Kramer, *Loc. cit.*, p. 21.
[22] *Die Wirtschaft Des Ostblocks*, No. 25 (Mar. 17, 1978), p. 2.
[23] Length of service lives of Soviet cars is comparable to that found in less developed countries. Soviet cars tend to have a long service life because of (1) their predominant recreational use, and hence, low annual mileage and (2) the incentives to owners through current and capital repairs to maintain used cars beyond service lives considered "normal" in other industrialized economies. These incentives include the long wait and high price for replacement vehicles and the relatively low cost of spare parts—when obtainable—and repair services. For example, recently completed research indicates that the ruble-dollar ratio for automobile repair services is 0.864 (1967 rubles—1976 dollars) compared to 1.62 for new cars at retail prices (including taxes). See Imogene Edwards', Jim Noren, and Marge Hughes', "Comparisons of the Size and Structure of the Soviet and American Economies." in this volume. All ruble dollar ratios used in this paper are expressed in 1967 rubles and 1976 dollars. However, although the official MBMW wholesale price index indicates that machinery prices fell 19 percent between 1967 and 1976. we believe the index is biased downward. We suspect that machinery prices have risen, but we do not have sufficient evidence to support that contention. Therefore. we have assumed here that machinery prices have remained roughly the same between 1967 and 1976.

ting the seller a profit of 1,376 rubles above the commission store price of 1,200 rubles and the commission fee of 84 rubles.

V. Exports

A. Patterns

In 1978, the USSR exported about 368,000 passenger cars compared with roughly 85,000 cars in 1970, an increase of more than three times. As a share of production, however, exports changed only slightly, increasing from nearly 25 percent in 1970 to only 30 percent in 1978. Lada's export version of the Zhiguli, accounted for most of these exports (Table 10).

More than two-thirds of passenger car exports go to Eastern Europe, and more than one-half of these are Ladas. A large share of these are in repayment for automotive components and parts shipped to VAZ and its suppliers by East European countries under a standing arrangement with the USSR. For example, one-half of the 122,000 cars shipped to Hungary during 1971–75 were in repayment for parts supplied.[24-26]

The USSR has gradually expanded passenger car exports to the West. In 1978, about 93,000 cars (mostly Ladas), slightly less than one-fourth of all car exports, were shipped to Western Europe. Indeed, after only 2 years of large-scale production, the Lada, with its Western styling and more powerful engine, had displaced the Moskvich as the leading Soviet car export to the West as early as 1973. Few Western countries are interested in importing other Soviet models.

TABLE 10.—U.S.S.R.: EXPORTS OF PASSENGER CARS BY GEOGRAPHIC AREA, 1971–77[1]

[In thousand units]

	1971	1972	1973	1974	1975	1976	1977	1971–77
Exports of all cars:								
Total	149.7	194.9	237.5	287.3	295.6	344.7	362.0	1,871.8
Including to—								
Western Europe	9.6	26.9	45.1	41.9	64.2	90.8	85.2	363.6
Eastern Europe	129.4	155.2	185.6	225.2	213.0	221.0	252.5	1,381.9
Other	10.7	12.8	6.8	20.1	18.4	33.0	24.4	126.2
Exports of LADA:								
Total[2]			148.0	177.8	192.0	256.7	257.5	1,032.0
Including to—								
Western Europe and other capitalist			29.4	42.0	65.6	100.9	95.5	331.9
Eastern Europe and other socialist countries			118.6	135.8	126.4	155.8	162.0	700.1
Shares (percent):								
Total LADA as share of total exports	NA	NA	62.3	61.9	65.0	74.5	71.1	55.1
Share of LADA to—								
Western Europe and other capitalist	NA	NA	19.9	23.6	34.0	39.3	37.0	32.2
Eastern Europe and other socialist countries	NA	NA	80.1	76.4	66.0	60.7	63.0	67.8

[1] Vneshnaya Torgovlya, SSSR, various issues. Because of rounding, components may not add to the totals shown.
[2] Soviet Export, No. 5 (116) (May, 1978), p. 4.

[24-26] For a discussion of East European automotive industries, see Imogene Edwards and Robert Fraser, "The Internationalization of the East European Automotive Industries" in *East European Economics, Post-Helsinki* (Washington, D.C.: Joint Economic Committee of the Congress of the United States), pp. 396–419.

B. Acceptability in Western Markets

A strong Soviet export promotion program has been felt in Western markets. Although the Lada does not measure up to comparable Western models in overall performance, it is being offered at highly attractive prices. Its popularity has been growing in West Germany, France, and Great Britain as inflation has pushed up prices of domestic models and Moscow has maintained retail prices at previous levels. In 1974, these three countries imported about 6,000 Ladas; and by 1978 the volume of imports, although still small, had increased by over seven times.

In Great Britain, the Lada is offered in four models and styles, with some models priced 200 to 300 British pounds—about 14 percent—below the comparable British "Morris Marina".[27] In Canada, the Lada went on sale in late 1977, for slightly over $3,000 (U.S.) more than 20 percent below the price of Canada's comparable top selling foreign car, the Honda, and a little less than 20 percent below Chrysler's Omni-Horizon.[28] Canadian dealers sold out their entire 1978 import of cars (3,250) before the end of the year, most of them sight unseen. Moreover, Canada has contracted with Avtoexport to buy Ladas worth $100 million over 5 years[29]; at the current market selling price that implies about 32,000 cars.

Consumer reaction to the Lada has been generally good in both Britain and Canada. A leading British auto consumer magazine considers it a reliable car and a very good value at current prices. Similarly, a Canadian weekly magazine recently endorsed the Lada as "incredibly solid". A U.S. publication for automobile enthusiasts was more lukewarm in its assessment but still noted that the car probably would provide "Volvo-like longevity".[30]

Whether the export prices charged for the Lada are out of line with domestic prices is hard to say. If the official exchange rate in 1976—1.33 dollars per ruble—is used to convert the 1976 domestic wholesale price of the VAZ–2103 model Zhiguli passenger car to U.S. dollars, a price of $3,400 is obtained. This is considerably higher than the price of $2780 actually charged for the counterpart export model in Great Britain—the Lada 1500.[30a] But since the official exchange rate is arbitrarily set and does not reflect the relative purchasing power of the two currencies, such a comparison has little meaning.

Alternatively, the ratio of the dollar export price to the domestic ruble price of the Lada (1.09) can be compared with: (*a*) the higher ratio prevailing for Soviet industrial exports generally (1.56); [30b] and (*b*) the even higher ratios of US prices to Soviet prices for goods and

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[27] *Motor*, Jan. 7, 1978, p. 21.
[28] *New York Times*, Nov. 13, 1978, Section 4, p. 1.
[29] *Ibid.*, Section 4, p. 1.
[30] *Motor*, Oct. 28, 1978, p. 56, and *Wall Street Journal*, Apr. 27, 1979, p. 44.
[30a] The price of the Lada 1500 was £1536. This was converted to U.S. dollars at the 1976 dollar-pound exchange rate of 1.81 dollars per pound.
[30b] The ratio for industrial exports is based on coefficients used by the Foreign Demographic Analysis Division of the Department of Commerce to recast foreign trade rubles in the 1972 Soviet input-output table into domestic rubles. See V. G. Treml, G. D. Guill, D. M. Gallik, and B. C. Kostinsky, "The 1972 Input-Output table and the Changing Structure of the Soviet Economy" in this volume. The 1972 foreign trade price conversion coefficient for total Soviet industrial exports was 1.39. This can be multiplied by the official exchange rate in 1972—.826 foreign trade rubles per U.S. dollar—to obtain a 1972 dollar-ruble ratio for industrial exports. The U.S. wholesale price index for industrial commodities rose 79.6 percent between 1972 and 1976. Adjusting for this price change and assuming no change in ruble prices yields a 1976 dollar-ruble ratio of 1.564.

services that could conceivably enter foreign trade.[30c] That the Zhiguli export price is low compared with these alternative points of reference is about all one can say.

Most probably the USSR is simply setting export prices on its passenger cars just low enough so that they will sell in competition with foreign cars. The USSR does not have a wide range of machinery that can be sold for hard currency, so domestic costs would have to be extremely high to discourage a sale below prevailing prices in a given market. As succinctly summarized by Mr. V. F. Dikarev, a deputy director of AVTOEXPORT, Moscow's primary objective in exporting cars is to acquire hard currency to finance imports:

> People may complain that we are giving away cars for low prices abroad compared to the price in the Soviet Union. But we explain that we must sell cars abroad in order to buy foreign equipment for projects like Kamaz (Kama Truck Plant).[31]

The USSR has been steadily working to strengthen its marketing organization in foreign markets and currently AVTOEXPORT is trading with about 200 firms and organizations in more than 75 countries.[32] Although sales on foreign markets are still small, important inroads have been made in Western Europe and Canada, and the US may be next. It will be difficult to compete successfully against a Soviet car that offers the Western consumer the performance he wants: low gas consumption, power, good handling, styling and reliable service, all at a substantial discount from prices of domestic US models. Moreover, Soviet export models include additional equipment at no extra cost to the buyer, such as tachometers, electronic ignition systems, and upgraded interiors. Finally, although most Westerners associate poor preventative maintenance service and difficulties in obtaining spare parts with the purchase of Soviet automobiles, the evidence suggests that this has not been true in the case of the Lada. Both U.K. and Canadian consumers have reported satisfaction with the services provided by LADA dealers, including a ready supply of spare parts.[33]

Another Soviet vehicle gaining wider acceptance in the West is the cross-country Niva, or Cossack in its export model. This vehicle is of original Soviet design built to Western quality standards and performance. A low-priced (roughly $4,200) all-purpose four-wheel drive vehicle designed for Soviet road and climate conditions, the Cossack was well received at various auto shows in Western Europe during its debut in 1977.[34] It could become a steady hard currency earner for the USSR in the next few years or until a strong Western competitor emerges. However, sales will not be large, because even at capacity in

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[30c] For example, dollar-ruble ratios for major end-use categories of Soviet GNP have been estimated as follows:
Food, 1.72; soft goods, 1.74; consumer durables, 2.19; and machinery and equipment, 3.76.
These ratios are expressed in 1976 dollars and 1976 rubles and have been adjusted to remove turnover (indirect) taxes. See Imogene Edwards, Jim Noren, and Marge Hughes, "Comparisons of the Size and Structure of the Soviet and American Economies" in this volume.

[31] *Wall Street Journal*, July 8, 1976, p. 1.

[32] V. Petrov, "AVTOEXPORT: 20th Anniversary," *Foreign Trade*, No. 11 (1976), p. 24.

[33] *New York Times*, Nov. 13, 1978, Section IV, p. 1 and "Lada 1300ES" *Autocar*, Jan. 14, 1978, pp. 36–40.

[34] *Motor*, Apr. 29, 1978, p. 3.

1980, it will be produced at the relatively low per annum rate of approximately 50,000 units. The Soviets have already contracted to export the Cossack to Great Britain, Canada, France, West Germany, and Austria.[35]

In addition, the USSR is negotiating with Western automobile manufacturers for the joint production and international marketing of a new generation of small cars by the early 1980's. This new car, smaller than the Zhiguli, would replace Moskvich models. If a deal can be arranged, the cars probably would be produced at the AZLK Plant in Moscow in a volume up to 250,000 units annually.[36] In addition, a new compact car with a 900 cc engine is being designed at VAZ. This also probably is earmarked for future export.

The Soviet push to expand exports to the West in the 1980's could run into stiff competition from some of its own CEMA trading partners. Poland, for example, also builds a Fiat-designed car—the Polski—that is exported to the West. The Polski has been overshadowed by the Soviet Lada because it is produced and exported in much smaller quantities. But in late 1978 a new rival emerged from Poland, a five-door hatchback, the Polonez, built using Polski-Fiat parts. Poland received considerable help in design engineering and manufacturing technology from Italy, West Germany, Britain and the United States. Already 150 dealers in Britain have contracted to market the car.

East Germany will probably unveil a new export car in the 1980's, a small front-wheel drive compact being designed and built with the aid of Citroen of France and Skoda of Czechoslovakia. Almost certainly, Czechoslovakia, already a large producer of cars for its domestic market, will seek to expand its exports to the West in the 1980's with a new competitive model.

Soviet entry into the U.S. market has been hindered in the past by the inability of Soviet cars to meet U.S. pollution emission standards. However, the Lada passed its 1979 emission-control test for the U.S. market using catalytic converters purchased in the United States. Satra Corporation, the New York-based trading company which handles the distribution of the Lada in the United States, is having the car tested for the 1980 standards. Satra hopes to begin selling the Lada in the United States in the second half of 1980 and hopes to sell upwards of 40,000 cars a year by 1983. The selling price is expected to be about $4500.[37] This means that the value of gross sales would approximate $180 million if Satra's expectations are fulfilled.

VI. Major Problems

A. Services and Maintenance

Existing service and maintenance facilities in the USSR cannot meet the public's demand. In a recent year, the service network took care of only 56 percent of the private car park; 30 percent of car own-

[35] In Austria it will be known as the "Tiger."
[36] *Wall Street Journal*, May 1, 1978, p. 6.
[37] *The Wall Street Journal*, Apr. 27, 1979, p. 44.

ers perform repairs themselves, and 14 percent seek help from self-employed mechanics who are moonlighters or pensioners.[38]

In 1970, the repair network for private cars consisted of 447 repair garages with 3,320 repair bays, an average of one bay for every 300 cars.[39] Many of these were old garages or other types of structures that had been reconditioned and reequipped to serve private cars. By and large, they were relatively small garages with about seven bays apiece. To accommodate mushrooming growth in private ownership during 1971–75, the Soviets doubled the number and constructed larger garages with double the number of bays per garage. By the end of 1975, however, a repair bay existed for only every 328 cars, and the consumer was less well off than in 1970.

The 1976–80 Plan calls for the construction of an additional 457 repair garages, with 7,030 repair bays at a cost of more than one-half billion rubles. The number of garages and bays to be built is similar to that accomplished in 1971–75, but the investment cost is about 40 percent greater. This suggests that the Soviets have planned major improvements in servicing equipment and facilities for the new garages. If all these garages are built as scheduled, the number of cars per bay can be expected to rise to about 440 by 1980, an increase of about one-third over 1975. If productivity does not improve, however, an additional 6,000 bays or roughly 400 more garages will be needed to keep repair services for the private car owner at the level of 1975. Even the Volga Motor Vehicle Plant (VAZ), which operates its own automotive service network under the slogan "we build, we sell, we service," will be able to service only three-fourths of all the Zhiguli owners by 1980.[40]

The shortage of State-run repair garages has resulted in long delays and increased costs. In 1977, an average of 162 hours per year per car was spent waiting for service, i.e., from the time the owner arrives at a repair shop until repairs are completed.[41] Bribes to mechanics help to speed up servicing but these add to owner costs. Some costs are particularly ludicrous such as the need to make several trips to a garage for a single servicing. One owner spent four full working days to obtain a 90-minute repair of a faulty carburetor; the amount of gasoline burned making multiple trips to the repair garage amounted to 40 liters, or the equivalent of 270 km of urban driving.[42] The waste in man-hours and fuel stemming from the inadequacies of the repair and service network represents a major loss to the economy in terms of goods and services foregone.

Soviets who choose the do-it-yourself path for servicing face difficulties of a different kind, such as the acquisition of needed spare parts. If a spare part cannot be found in retail parts stores, it is either procured through the black market—at a very high price—or stolen from

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[38] Data are presumably for 1977. *Literaturnaya Gazeta,* Sept. 20, 1978, p. 12.

[39] Soviet and U.S. data on automobile repair facilities are not directly comparable for 1970 or other years. However, the number of cars per repair station in both countries is suggestive of a relative measure of repair facilities. In 1975, it is estimated that there were 3,800 private cars in the U.S.S.R. for each repair station. In the United States in 1972 there were roughly 800 private cars for each repair station. See *MVMA Motor Vehicle Facts and Figures '78,* p. 68.

[40] E. A. Ustinov and B. P. Dushkin. "Za Dostoinuyu Vstrechu XXV S'ezda KLSS" *Abtomobil'naya Promyshlennost'* No. 2 (February, 1976), p. 1.

[41] A. Arrak. "Ispol'zovaniye Automobilei Lichnogo Piol'zovaniya" *Voprosi Ekonomiki,* No. 7 (July, 1978), p. 136.

[42] *Literaturnaya Gazeta,* Sept. 20, 1978, p. 12.

another vehicle. Even though the USSR plans to increase production of automotive spare parts by 50 percent in 1980 over 1975, the ordinary citizen may still have very limited access because of a primitive and inefficient parts distribution system.

1. GASOLINE STATIONS

In 1977, there were 3,500 fixed gas stations in the USSR and perhaps as many as 1,500 mobile stations (fuel trucks for rural areas). These stations are mainly for private passenger cars, since State-owned cars and trucks have their own gasoline facilities at transport enterprises. In 1977, on a countrywide average, a gas station served 1,250 cars. In the United States, on the other hand, where the private car park was nearly 100 times as large as in the USSR, each gas station served approximately 430 cars.

Gasoline supplies for the private consumer are limited to a maximum of 20 liters a week—equivalent to at most 250 kilometers (or 150 miles) of driving—in some parts of the USSR because of the poor gasoline distribution system. This has spawned a black market of unmeasurable, but suggestive dimensions. In Kazakhstan, for example, only about one-fifth of the fuel and lubricants used by private car owners per year is actually bought at gas stations.[43] One important additional source of supply comes from drivers of State-owned trucks. They often have "extra gas," either in their tank or in the form of paid coupons transferable to car owners.[44] In Moscow in 1971, almost 20 percent of the gas station attendants were arrested for black market dealings.[45] More than 30 percent of the private motorists in the USSR (motorcycles included) drove, at least in part, on State-owned gasoline in 1972.[46]

2. PARKING

Parking space is fast becoming a major problem in the cities of the USSR. In Moscow in 1971, about 80 percent of all the private cars were parked in open parking lots and garages, occupying about 500 acres. By 1977, land use for parking had increased to about 1,400 acres. By the year 2000, if the city's car ownership reaches the estimated 150 to 200 vehicles per 1,000 inhabitants, parking space will require an area equaling more than 25 percent of the city's present housing area.[47] Some Soviet architects feel that the future belongs to above ground multistoried parking garages. Using a standardized design, construction costs per parking space in above ground structures would be 50 percent cheaper than for a comparable-sized underground garage.[48]

Construction of parking garages does not have a priority high enough to warrant the diversion of relatively scarce construction ma-

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[43] "Need Gasoline? Ask Your Friendly Truck Driver," *The Current Digest of the Soviet Press*, Oct. 13, 1976, p. 16.

[44] Truck drivers have "extra gas" because transport enterprises frequently fail to record accurately the amount of gasoline sold and the serial numbers of the coupons distributed. This type of gasoline theft is most prevalent in rural areas where the number of gasoline stations is small, but it exists also in urban areas.

[45] *Ibid.*, p. 16. See also Aron Katsenelinboigen, *Soviet Economic Planning*, (White Plains, N.Y.: M. E. Sharpe Inc., 1978), p. 189.

[46] *Radio Liberty Research*, RL 132/75, Mar. 27, 1975, p. 1.

[47] L. Agalkov, "Pochemu Nye Stroitsya Garazh" *Za Rulem*, No. 1, (January, 1978), p. 17.

[48] *Ibid.*, p. 17.

terials to that use. Although 8–10,000 new parking places a year have been designated for Moscow, only 10 percent have been built.[49] To some extent private individuals are taking matters into their own hands by building individual garages next to their apartments and homes with building materials acquired on the black market.

B. Roads

The Soviet road system is poorly developed. It is not suitable for high-density use, or conducive to the development of widespread tourism. At the end of 1976, the total length of surfaced roads in the USSR was only 17 percent that of the United States.[50] It was about 7 percent, if the comparison is limited to cement/asphalt paving. Hence, more than half of Soviet surfaced roads are comprised of gravel or other granular type construction. Many of the surfaced roads, and up to 70 percent of the overall Soviet road system, are closed to traffic in the Spring thaw because of impassable conditions. Low quality road surfaces and low to light-load bearing bridges on most rural roads limit the use of recreational vehicles and commercial trailers and the weight of vehicles generally.

The private car owner has little opportunity for recreational excursions into sparsely populated areas. Most of the construction of new roads and improvement in old ones has been concentrated in the heavily populated and industrialized areas. Areas of low density population occupying nearly two-thirds of the USSR continue to be virtually roadless. As a result, it is not possible to travel by continuous highway from European Russia to the Pacific Coast, although scattered stretches of a transcontinental highway are being built in support of the Baykal-Amur (BAM) railway currently under construction.

In the 1976–80 Plan period, the total (urban and rural) surfaced road network is planned to increase by over 50,000 kilometers, but this is far below the surfaced road expansion in the previous two Five Year Plans (120,000 kilometers and 133,000 kilometers, respectively). Less than 30 percent of the new roads in the current Plan period are earmarked for construction in rural areas. According to Soviet estimates, to correct the "disproportion" between urban and rural road systems construction of a million kilometers of surfaced roads in rural areas is needed to restore some balance consistent with long-term development of a viable farm-to-market infrastructure. Official estimates indicate that the cost of such an expansion of the rural road system would be enormous—about 120 billion rubles.[51]

Although the lag in the construction of surfaced roads in the USSR coupled with a rapid buildup of automobile inventories has led to a sharp upturn in traffic density, it remains far below the comparable

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[49] *Pravda*, Sept. 24, 1977, p. 2.

[50] Surfaced roads in the U.S.S.R. include roads paved with asphalt and concrete as well as those that have gravel or other granular surfaces other than dirt.

[51] Yu. Mezhberg, "Sovremennye problemy pereustroistva sela," *Voprosi Ekonomiki*, No. 5 (May, 1978), p. 83. This amount is equivalent to roughly 20 percent of total capital investment planned in 1976–80. Soviet investment in rural road systems would be about $194 billion if such a system was purchased in the United States (in 1976 dollars). This figure is derived using a ruble-dollar ratio of 0.617 found in CIA ER 76–10068, *Ruble-Dollar Ratios for Construction*, February, 1976, and revised to 1976 rubles and 1976 dollars by use of price indexes. The United States, in comparison, invested approximately 104.5 billion 1976 dollars on highways and streets over the entire period 1970–77. See *Construction Review*, December, 1978, p. 9.

density in the United States. During 1966–75, total distance of surfaced roads in the USSR increased by 74 percent while output of passenger cars grew sixfold. The number of passenger cars (private and State-owned) per mile of paved road has increased from about 2.9 in 1970 to 7.4 in 1977, or to 14.5 if trucks are included. In the U.S., there were about 35 passenger cars (private and publicly owned) per mile of surfaced road in 1976, or 44 vehicles per mile if trucks are included.[52]

C. Rising Accident Rate

Traffic safety is a serious problem in the Soviet Union. Although Moscow does not publish statistics on traffic accidents and fatalities, information pieced together from the Soviet press indicates that the number of accident-related fatalities in the USSR approximates that in the United States despite a much smaller car park and road system. The principle factors contributing to the traffic safety problem include poor driver education, drunken driving, irresponsible pedestrian conduct, absence of proper safety equipment in Soviet cars, and dangerous road conditions.[53]

John M. Kramer in his 1976 article compiled some statistics on Soviet traffic safety. These data although unofficial, convey a feel for a severity of the traffic safety problem in the USSR.

> * * * Thus Hendrick Smith, former *New York Times* correspondent in Moscow, reports that he was told "unofficially but reliably" that in 1974 there were approximately 45,000 road accident-related fatalities in the USSR as compared to 46,200 in the United States, and that the former's automobile fatality rate was roughly 10 times higher that the latter's. Soviet reports lend support to Smith's data. For example, a recent *Pravda* account reported that traffic accidents in 1971 caused "thousands of dead and injured." In 1971 there were almost 9,000 traffic fatalities in the republics of Kazahstan and the Ukraine, twice as many as in California in the same year, although that state had almost five times as many vehicles. Comparative data indicate that in 1972 Moscow with seven times less automobiles suffered almost 60 percent as many traffic fatalities as New York City. Further, traffic fatalities in Moscow more than doubled between 1970 and 1974, although reportedly they decreased somewhat in the first 10 months of 1975.[54]

Fatality rates due to dangerous road conditions are particularly high in outlying mountainous and desert republics. For example, in 1974, dangerous road conditions accounted for 48 deaths per 100 highway accidents in Azerbayzhan, 45 in Georgia, 39 in Kirghiz, and 37 in Kazakhstan. These figures may be compared with a national average of 19 fatalities per 100 highway accidents from all causes.[55]

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[52] *MVMA Motor Vehicle Facts and Figures '78*, pp. 23 and 64.
[53] For a good discussion of traffic safety in the Soviet Union, see Kramer, *loc. cit.*, pp. 27–29.
[54] Kramer, *loc. cit.*, p. 27.
[55] "Stati Stika Dorozhnykh Proishestvii," *Za Rulem*, No. 2 (February, 1976), p. 25.

Private motorists are involved in roughly half of the motor accidents nationwide, and the trend has been upward. An official insurance survey found that traffic accidents caused by private motorists increased from roughly 40 percent of all road accidents in 1970, to nearly one-half of 1975.[56] The projected doubling in the private car park between 1975 and 1980 will exacerbate the accident rate due to private motorists as more novice drivers get behind the wheel.

The private car owner has little financial protection in the event of an accident since few drivers in the USSR are insured against damage and liability. In 1976, less than 18 percent of an estimated total park of 11.4 million private passenger cars and motorcycles were insured by GOSSTRAKM, the state insurance company.[57] The private motorist is probably discouraged by the high cost of insurance and the the relatively small benefits. The most GOSSTRAKH will pay for an accident (collision and liability) is 3,000 rubles roughly one-half the retail price of a Zhiguli. Damages in excess of this amount—both property and personal injury—can be recovered from an individual only by initiating legal action through the Soviet judicial system.

D. Accommodations

Despite a rapid increase in inventories of privately held automobiles, the opportunities for tourism in the USSR are extremely limited. Overnight motel and hotel accommodations are scarce in towns and small cities, and almost non-existent along highways. Officially operated camping sites, however, do provide overnight accommodations for trailers near some towns and most cities. Such sites usually provide the traveler with a tent and a cot, and infrequently a small cottage. Often tableware is provided if no feeding area exists at the site. Camp sites are differentiated between domestic and foreign travelers. In recent years, the explosive growth of private motoring has led to overcrowding in popular tourist areas like the Caucasus and the Black Sea shoreline with its beaches and health spas. In fact, construction of new tourist accommodations has so fallen behind the need, that disorganized, spontaneously pitched motor vehicle tent camps frequently crop up close to major resort centers like Sochi. With existing facilities already overwhelmed, and the crush of tourists mounting annually, Soviet planners face an awkward and unprecedented problem. In the Caucasus alone, by 1980, 14 million tourists are expected, 2 million by private car.[58]

In addition, roadside amenities—restaurants, rest areas, gas stations—are almost non-existent along primary highways, and the traveler is forced to drive to the nearest town or city to obtain these services. In 1975, according to the Soviets, existing rest areas constituted only about one percent of the number needed to meet current demand.[59]

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[56] L. K. Nikityenkov, "Ekonomicheskoye Znacheniye Strakhovaniya Grazhdanskoi Otvetstvennosti Individual' Nykh Vladel'tsev Sredstv Transporta," *Finansy SSSR* No. 7 (July 1978), p. 53.

[57] O. L. Alekseev, "Novye Pravila i Puti Dal'neishego Upuchshye Niya Avtotransportnogo Strakhovaniya." *Finansy SSSR* No. 12 (December, 1977), p. 53.

[58] *Zarya Vostoka*, Aug. 6. 1978, p. 2.

[59] *Sovetskaya Kul'tura*, Mar. 28, 1975, p. 6.

VII. Prospects

Private car ownership in the USSR should continue to increase through 1985 in substantial annual increments, although the size of the increase will depend upon trends in exports. If exports as a share of production remain roughly at the level planned for 1980—28 percent—more than 5 million Soviet citizens will become new car owners during 1981–85. In that event, the park of privately owned cars will reach an estimated 12.5 million, representing a private car for every 22 persons. Additional production capacity for a new model car could be added during the early 1980's, boosting automobile production by the mid–1980's. But the additional output probably will not be in time to substantially increase new car sales before 1985.

Neither domestic nor export models of cars are likely to undergo radical modification—such as the use of diesel and stratified charge engines—during the early 1980's. It is likely that the design of the Lada will remain frozen through 1985 since a major design change would be costly and disruptive to planned production and export programs. A fixed design could reduce the Ladas popularity abroad and hence, sales in the 1980's, and result in a unexpected bonanza of new cars for Soviet citizens.

The Soviet consumer will probably find cities more congested and accidents a rising hazard in the early 1980's. The City of Moscow has ambitious plans to facilitate driving in urban areas but little is being done to implement these plans. Moreover, lagging construction of repair garages, gas stations, and roadside accommodations means that domestic tourism will be restricted. Indeed, with rising car ownership and severely restricted domestic travel opportunities, Soviet car owners may opt to use their cars increasingly for commuting which can only compound the environmental problems Soviet planners would like to avoid.

NOTES ON THE ILLEGAL PRIVATE ECONOMY AND CORRUPTION

(By Gregory Grossman)

CONTENTS

INTRODUCTORY

In a recent article we defined the "second economy" of the U.S.S.R. as all production and exchange that meets at least one of the following two tests: (*a*) Being directly for private gain; and (*b*) being in some significant respect in knowing contravention of existing law.[1] That portion of the second economy which meets both tests is the illegal private economy (hereinafter, the "illegal economy" for short).[2] It and the closely related corruption are the topic of this essay.

Our object is not to present a full description and an exhaustive analysis of the illegal economy of the U.S.S.R. The time is not yet ripe for this. Rather, we limit ourselves, as the title states, to some notes on the subject, in order to summarize the more salient factual features of the phenomenon, to look for the more distinctively Soviet sides of it, and to suggest its importance for personal incomes. It is hoped that this essay will stimulate both general interest in this important and hitherto neglected aspect of the Soviet economy and some systematic investigation of its more researchable areas.

A word about our sources. They are rich but spotty, of uneven reliability, and of course short on useful generalizing data, especially quantitative. They include the Soviet press—censored, of course—which carries innumerable court reports, feuilletons, legal documents and treatises, and works of fiction that in their totality shed an in-

[1] "The 'Second Economy' of the U.S.S.R.," *Problems of Communism*, 26:5, Sept.–Oct., 1977, p. 25. As mentioned therein, n. 1, the term "second economy" seems to have been coined by K. S. Karol in "Conversations in Russia." *The New Statesman*, Jan. 1, 1971. pp. 8–10. However, we erred in ascribing the first use of the term "parallel market" to the same source. The phrase was already employed—though with reference to illegal barter of supplies between socialist producers rather than to a black market patronized by consumers—by Paul Barton in "The Myth of Planning in the U.S.S.R.," *Saturn*, 3:1, Jan.–Feb., 1957, p. 49. Lastly, one must mention the pioneering contribution on the second economy of the U.S.S.R. to appear in this series of compendia, Zev Katz, *Economic Prospects for the Seventies*, 1973, pp. 87–94.

[2] The illegal economy—or the "underground economy"—is sometimes referred to in the U.S.S.R. as *levaia ekonomika*, the economy on the left. This has nothing to do with the political left. In traditional Russian parlance to do something "on the left" (*na levo*) is to do it in an illegal or unauthorized fashion.

dispensable light on the subject. Less voluminous but more revealing is the swelling flow of émigré publications, primarily in Russian but also in Western languages. Western journalists and visitors to the U.S.S.R provide much valuable anecdotal information, while Western scholars are publishing an increasing number of serious articles on various aspects of the second economy. Last but not least, of inestimable value are in-depth personal interviews with knowledgeable émigrés.

The discussion that follows reflects the nature of the data. We do venture some broad statements, but they derive mostly from sketchy and fragmentary information that does not easily admit of rigorous aggregation or inference. Accordingly, the generalizations that are offered are on the vaguer side; they use such qualifying words as "often", "many", and "sometimes", instead of what would be much more desirable, percentages or aggregated magnitudes. This is unsatisfactory. But we feel that even more unsatisfactory would be to follow a false counsel of perfection at the cost of ignoring such an important (how large?) aspect of Soviet reality as the illegal economy. Some progress in quantifying the illegal economy is taking place already, and more will come, we trust.

Main Types of Activity

The illegal economy probably comprises the larger part of the whole private economy, legal and illegal. To begin with, the range of permitted private economic activity is very limited (see Annex), and little of that is conducted without some significant admixture of illegality. Thus, though in principle an activity may not be illegal, some of the inputs (materials, supplies, transport, equipment, space, and—not the least—labor) may be systematically obtained in some illicit manner and at unlawful prices or wages, while the products themselves may often (though not always, see below) be sold in black markets at "black" prices. Finally private plot farming aside, all but the most trivial private activity, if permitted, requires a license (see Annex), but the license inevitably brings the tax inspector and high income taxes in its wake.[3] Hence, taking out a licence is often avoided, thereby rendering the undertaking ipso facto illegal.

To be sure, there is nothing uniquely Soviet about either illegal production and exchange or bribery, although in both their nature and extent these phenomena are distinctively different in the USSR in some respects. More on the distinctive aspects later. As elsewhere, the scope and variety of illegal economic activity in the USSR are limited only by human daring and ingenuity, as well as by the efficacy of law enforcement. A brief review of some of the most common forms of economic illegality may be useful.

[3] See Annex for examples of activities that require no license. Even after substantial reduction of the tax schedule in 1970, on a net income of 1,800 rubles per year (150 per month, a moderate amount) an artisian (*kustar', remeslennik*) is liable for 404 rubles in tax, with the marginal tax rate at 50 percent above 1,800 rubles, 60 percent above 3,000 rubles, and 65 percent above 5,000 rubles. Professionals in private practice (physicians, dentists, teachers, etc.) have been subject to a lower schedule and perhaps for this reason did not receive a rate reduction in 1970. Still, their marginal tax rates are quite high. The tax on a net income of 1,800 rubles per year is 422.40 rubles, with 40 percent on amounts above 1,800 rubles, 46.5 percent above 2,400 rubles, and so forth, reaching 69 percent for amounts in excess of 7,000 rubles. (D. V. Burmistrov, *Naloai i shory s naselenia v SSSR*, Moscow, 1968, pp. 36ff.; *Vedomosti Verkhovnogo soveta SSSR*, 1970 :3, p. 20, art. 24.)

Without doubt the most common crime of this kind is *theft* of socialist property (meaning the property of the state, collective farms and other types of nominally cooperative enterprise, and recognized "social organizations," such as trade unions and sports clubs).[4] It takes place everywhere (not the least while goods are in transport), by insiders and outsiders, varies in scale from trivial to vast, and is pretty much taken for granted by the public, which draws a sharp moral and practical distinction for this purpose between socialist and private (personal) property in favor of the latter. (A curious sidelight on the moral distinction between state and personal property is that cheating the customer, a private person, in a state store is regarded as acceptable—by the cheater, of course—as stealing from the state itself.) Closely related is the seemingly widespread private poaching in the state's forests, and sizable illegal private logging operations, often behind the protective facade of the collection farm.[5]

The vast majority of the culprits remain uncaught, and of those caught very many—the petty as well as the big—remain unpunished.[6] The economic significance of the stealing is of course manyfold: transfer of a large amount of material and monetary value from the state (and other socialist owners)[7] to individuals; damage to the state that may often considerably exceed the nominal value of the goods; non-negligible costs of custody and law enforcement; effects on the size distribution of income and wealth in the household sector; effects on labor supply functions, and so forth. Not the least for our purpose is the importance of stolen goods as inputs into the illegal economy, for further processing as well as for straight resale. Indeed, a great deal of underground production depends entirely or primarily on materials, supplies, tools, equipment, and so forth, stolen from the state.

A variant on the theft of goods and money is the theft by persons employed by the state of what in the United States is colloquially called "company time." Some of the stolen time is devoted to gainful activity in the second economy, at or away from the place of employment.

A most important category of theft, combining theft from both the state and the public, is that practiced by very many managers of retail stores. The cash that is pocketed is obtained by large-scale cheating of customers by means of short measure, adulteration of goods, mismarking, etc., and cheating certain kinds of supplier, especially state and collective farms. Enormous "left" incomes to trade personnel are generated in this manner, while bribes to many authorities and others are also paid from the take. (Private information from knowledgeable persons.)

"Speculation" as it is understood in the USSR—that is, the purchase and resale of goods for the sake of gain, which is per se illegal—is probably almost as widespread an economic crime as theft of social-

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[4] For a thorough treatment from the legal and social standpoints the reader is referred to Stanislaw Pomorski's "Criminal Law Protection of Socialist Property in the U.S.S.R.," in Donald D. Barry et al., eds., *Soviet Law After Stalin*, Leyden, Sijthoff, 1977, pp. 223–58. Soviet law distinguishes a considerable variety of types of theft. Altogether theft of socialist property accounted for 17 percent of total number of convictions c. 1967, though other crimes may have involved theft as well (p. 239).

[5] See, for instance, the account entitled "They Who Reap Without Having Sown: Predatory Destruction of Forests," which describes widespread illegal logging for private gain and associated criminal activities in Kirov *oblast'*, *Pravda*, Jan. 19, 1962.

[6] Cf., Pomorski, *loc. cit.*, p. 239.

[7] Hereinafter "state" subsumes other socialist organizations.

ist property, and much of it is also petty.[8] Closely related is the crime of "middleman activity" (*kommercheskoe posrednichestvo*), described as "assistance to individuals in obtaining goods in short supply and in the sale of goods" done systematically and for considerable gain.[9] Moreover, as elsewhere, some goods are barred from sale; e.g., narcotics. Of key importance for illegal trade is the institution of the open market, somewhat like our flea market, referred to variously as *rynok*, *tolkuchka*, *tolchok* (in Odessa), *barakholka*. The rationale for its existence has been the sale of unwanted used goods by individuals. In fact, however, it became a major outlet for articles stolen from the state, including producer goods, and for those manufactured in underground private establishments (on which more presently). Many of the most active markets seem to have been shut down in recent years, surely in order to suppress speculation, but some remain.[10] Moreover, it seems that the closing of what was the biggest of all, the market in Odessa, where nearly everything under the sun was traded openly albeit illegally, resulted not so much in the suppression of trading as in its dispersal over the city, and incidentally also in the rise in black-market prices.[11]

Illicit production of commodities or services goes on in many ways, but most commonly assumes one of the following organizational forms.

(*a*) *The single artisan.*—As noted, practicing one of the prohibited trades (see Annex), or one of the permitted trades or professions but without a license where such is required, constitutes a criminal offense. Yet such seems to be common practice. A good example are the needle trades where individual activity, in principle legal but generally conducted without a license, seems to have proliferated greatly in recent years thanks to the public's demand for clothes that are superior in quality and fashion to what state industry produces. A walk in any major Soviet city with its many relatively well tailored men and women, and a peek in a clothing store, will bear testimony to the vigor of the private needle trades. The material is frequently supplied by the customer, who often obtains it from the illegal economy, too. An important and extremely common variant of the single artisan case is that of the moonlighting workers who repairs the dwellings and appliances of private citizens, often employing tools and materials stolen from the official job or purchased in the black market. Another very common (and very traditional) variant, especially in the countryside, is the distiller of moonshine (*samogon*), some of which finds its way into the local sale. Lastly, this may be the place to mention the lucrative and usually unregistered private practice of physicians, dentists, dental technicians, teachers and tutors, and even some engineers, (doing quick design work for state enterprises and collective farms).

(*b*) *Putting out.*—Repeating the early history of capitalism, some Soviet individual artisan trades have tended to be transformed into

[8] CF. Valerii Chalidze, *Ugolovnaia Rossiia (Criminal Russia)*, New York, Khronika, 1977, pp. 263ff.

[9] "Rassmotrenie ugolovrykh del'o chastnoprepdrinimatel'skoi deiatel'nosti i kommercheskom posrednichestve: Obzor sudebnoi praktiki," *Biulleten' Verkhovnogo suda SSSR*, 1977 :2, pp. 30ff. Also, Chalidze, *op. cit.*, p. 238.

[10] The following cities apparently still had operating and thriving markets on the dates indicated: Tula, *Trud*, July 7, 1977; Kemerovo, *Komsomol'skaia pravda*, Mar. 2, 1978: Omsk, *Pravda*, Dec. 27, 1978.

[11] Private information; cf. "The Flea Market Was Closed Down But the Speculators Are Doing Even Better," *Trud*, Feb. 16, 1978.

putting-out systems. Such, for instance, has been the case with the underground production of blue jeans. The merchant-entrepreneur engages a number of home workers (for whom it may be a second job), furnishes them with materials and supplies, pays by the piece, and markets the finished product through his agents. He needs little space if any, and the equipment and tools are probably the workers'. Needless to say, the entrepreneur is deeply into the illegal economy in all directions.

(*c*) *Private production on the job.*—Working on the job and on "company time," the worker or technician uses the state's supplies and equipment to produce articles either on custom order or for the market. The goods are smuggled out of the state factory. This is quite a common practice according to eye-witnesses. A lately mushrooming instance is the private repair of private automobiles in state garages.

The following, based on personal observation, may be not untypical: "In ENIMS [Experimental Research Institute for Machine Building], at least before 1965, there was a group of workers that produced shortwave accessories for radio receivers which enabled one to receive transmissions in the range of 11 to 19 meters, such as were lacking in the ordinary radio receivers manufactured in the USSR. The accessories were eagerly purchased in the open market inasmuch as the efficacy of jamming of foreign broadcasts was then considerably lower [than now]. * * * [one worker] devoted up to 90 percent of his time to production for the open market, performing his official work only when watched. The present author also witnessed how, in 1956–58, the workshop of VNAIZ (All-Union Research Institute for Sound Recording) was constantly performing custom orders for the production of studio tape recorders for the free market. The workshop was not guarded, and therefore it was always possible to take anything out." [12]

(*d*) *Parallel production in the plant.*—Whenever materials and supplies are more than ample to meet the official plan, or can be stretched (sometimes literally, as with knitting yarn), the management has the possibility to produce the given product(s) in amounts additional to those officially planned, recorded, and reported. In this simple case, no material need be illegally bought; only its excess and the additional finished product are illegally concealed from higher authorities and law-enforcement agencies. In this manner a certain amount of "unrecorded output" (*neuchtennaia produktsiia*) is regularly produced.

Note that the product(s) are physically identical with the officially produced ones; consequently, superficial inspection will not reveal the illegal output. The necessary additional labor is likely to be recruited from the workers already employed at the plant, who would be paid very handsome—unrecorded—overtime rates. The illicit output is then distributed through exactly the same wholesale and retail channels as the official output, but at each step it is bought and sold on private account. Lastly, the customer cannot distinguish the "parallel product" from the official one, and of course pays for it the same price (or price plus bribe, see below) as for the official product. What makes the whole operation profitable despite high wages "on the left" and bribes to many authorities is the non-payment for the material that is in ef-

[12] Michael Agursky, "The Research Institute of Machine-Building Technology," The Hebrew University in Jerusalem, Soviet Institutions Series Paper No. 8, September 1976 (processed), in Russian (our translation).

fect stolen from the state. By all indications this is a rather common operation, especially but not exclusively in the consumer-goods industries. Some of the uncovered and publicized cases reveal very large-scale operations indeed, at least in the past, involving hundreds of people and millions of rubles' worth of illicit value added, pocketed, and distributed.[13]

(*e*) *Private production behind the facade of a State enterprise or collective farm.*—This differs from the preceding instance in that the commodities or services are not identical with those produced officially, but of course draw on the official inventories, equipment, and labor force. It differs from case (*c*) in that the activity is conducted not by individual workers in the official establishment; rather, it is a fairly highly organized affair run by one or a group of underground entrepreneurs.

(*f*) *Private underground manufacturing without official facade.*—Lastly, underground production on private account can forgo official cover altogether, as in the publicized case of N. Kotlyar, the "lipstick king," who allegedly "set up a private lipstick factory in the basement of a house he owned in Ostankino, a northern suburb of Moscow." It must be very difficult under Soviet conditions to carry on any sizable manufacturing operation without an official facade, and in fact Kotlyar's seems to have been limited to the mixing of the lipstick itself and the filling of cases. The cases were produced elsewhere "by a wide network of home workers" on the putting-out system (as under (*b*) above) under direction of management personnel at a Riga cosmetic factory.[14]

(*g*) *Private construction teams.*—Such teams are especially active in the countryside, contracting for jobs with collective farms, state farms, other state enterprises, and private house and dacha (summer house) owners. They build and repair roads as well as structures, using equipment, tools, materials, and other supplies generally obtained through the second economy. Their reputation for speed and quality of construction is apparently high, at least in comparison with state-owned construction organizations. The standard name applied to such workers is *shabashniki* (free-time workers), although the same term seems to be also used in relation to individual repairmen (as in (*a*) above).

(*h*) *Brokers and information sellers.*—Not surprisingly, the same causes that have occasioned the rise of a large illegal economy have also prompted the appearance of various kinds of brokers in both the consumer and the producer sectors. An example of the former are the apartment brokers in Moscow (private information to the author; for all we know, in other cities as well). Exchange of apartments can generally be carried out within the bounds of the law, but the problem is to bring the prospective parties together, which is where the not-so-

[13] One of the largest known instances of parallel production is that of a number of knitwear factories in the Kirgyz SSR in the late fifties and early sixties. When uncovered the case was deemed to be serious enough to be turned over to the KGB for investigation. It was tried in 1961–62, and—as were other cases at the time—with publicized anti-Semitic overtones. A number of the leading defendants were executed. (*Izvestiia*, Nov. 26, 1961, and July 22, 1962.) This case ("The Frunze Affair") and several major contemporaneous cases are described and discussed in "Economic Crimes in the Soviet Union," *Journal of the International Commission of Jurists*, 5 :1 (Summer 1964), pp. 15ff.

[14] *The New York Times*, Mar. 4, 1962, p. 1. Kotlyar and another person were shot under a law providing for capital punishment for economic crimes that was enacted the year before.

legal broker finds his function and his income. Much more prevalent may be brokerage in relation to the unofficial or illegal bartering and sale of materials and equipment in the production sector.

A curious and probably untypical if not illogical instance of information selling to consumers is worth quoting in full from a story in *Time* filed by its Moscow bureau. It tells of "a Muscovite who recently visited the flea market in Odessa. Hearing a man calling, 'I'll sell one sentence for a ruble,' the intrigued visitor inquired what the sentence could be. 'For a ruble, I'll give you some valuable information,' replied the hawker, who got his ruble and then whispered: 'Imported panty-hose will be sold at 10 a.m. tomorrow on the second floor of the Central Department Store.' " [15] Surely, the hawker's business must contravene some article of the Criminal Code of the Ukrainian SSR, but which?

Many variants on these forms of illegal production can be cited from the Soviet press and the testimony of eye-witnesses, but for present purposes the list will suffice. Let us only keep in mind that many, perhaps most, underground operations do not neatly fall into any single one of our categories but encompass two or more organizational forms (as in the cited case of the "lipstick king"). Nor, needless to say, can one draw a sharp line between "black" production and "black" trade: supplies have to be purchased and the product has to be marketed. Yet another legal infraction present in much illicit production is the hiring of labor on private account, which is of course proscribed in the USSR. Lastly, illegal economic activity is inextricably hooked up with the corruption of officials, to which we now turn.

Corruption.—We have already said something on this score in our previous article; [16] a much fuller and striking account of it has now been provided by Dr. K. Simis, a former Moscow attorney now resident in the United States.[17]

Understanding "corruption" first in its narrower sense of the taking of bribes by officials in relation to the performance of their official functions, there can be no doubt that it is an extremely widespread phenomenon in the U.S.S.R., reaching into nearly all corners of society and up and down nearly all levels of the formal hierarchy. It is in fact so widespread that there would seem to be little point in describing the phenomenon here at any length. We therefore restrict ourselves at this point to a few incidental observations:

(1) Illegal trade and production generate a great deal of bribery of the relevant officialdom: auditors, inspectors, supply allocators in the planning offices, managers and workers in the "first economy" (to shunt materials or to produce goods for underground enterprises), the economic police (OBKhSS) and the regular police, and every kind of *nachal'stvo* (bosses, higherups) in the Party and state bureaucracies. Should the law descend upon the illegal operations, a common reaction is to try to buy oneself free (*otkupit'sia*) of the procuracy and the court, or to lighten the sentence, not always without success.

(2) More broadly, bribe-giving and related methods are seen by the Soviet public as a major regular method of solving one's problems in the social environment. This fact comes out strikingly in the results

[15] *Time*, Mar. 8, 1976, p. 8. Cf.
[16] See note 1.
[17] "The Machinery of Corruption in the Soviet Union," *Survey* (London), 23:4 (105), pp. 35–55.

of an interview with 132 recent immigrants into the United States from the Soviet Union. The specific question was: "If you had a problem in the USSR that demanded an administrative solution, what would be the most effective way of dealing with it?" The replies were as follows:

	Percent
Write a letter to the newspaper	8.3
Speak to a deputy of the local soviet	11.4
Approach the Party city committee (*gorkom*)	6.8
Approach the municipal government (*gorispolkom*)	15.9
Other	43.9
Don't know, no answer	13.6

Nearly half of the respondents—and just over half of those who provided an answer—said "other". Upon further inquiry it turned out that by "other" they generally meant pull, connections, and bribery.[18]

(3) The bribe-giver can of course be not only an individual but also a state enterprise or a collective farm—here we mean one operating exclusively (if this is possible) or primarily in the first economy. In the case of a firm or farm, bribery takes place mostly in connection with (a) inspections and audits of whatever kind and by whatever authority and (b) the obtaining of material and equipment "funds" (allocations) and expediting supplies. The famous "pushers" (*tolkachi*) seem to be frequently nothing more than adroit bribers, though in many cases probably on a small scale (a bottle of perfume to a female clerk, a case of cognac to her superior).

(4) A certain part of the bribery is more like regular tribute collection by those in power. It may be collected from one' direct subordinates, or from those not directly subordinate but within one's reach:

(*a*) In the first case a common instance is the splitting of one's illicit take with the superior, as, for example, the splitting of a salesman's take from under-the-counter sales, short-weighing, etc., with the store manager. The latter, naturally, passes a part of his cut up the ladder, and so on for Lord knows how many rungs.[19]

(*b*) Tribute is also collected from those not subordinate but dependent on the receiver. It may initiate with the giver as a normal prudent practice, or it may be actively solicited by the taker. The latter case is vividly described in an article by a prosecutor's investigator (*sledovatel'*). since immigrated into the United States, who stumbled on the matter while investigating another case. It is worth telling. In 1960, in a rural district of Moscow oblast' on the outskirts of the capital itself, he discovered that the director (a woman) of a vegetable storage warehouse had been forced, on pain of dismissal from her position, to pay regular graft to several of the Party and government chiefs of the given district. One figure mentioned in the article is 15,000 rubles (pre-1961, presumably, equal to 1,500 "new" rubles) per season. Those with smaller establishments were said to be paying 5–10,000 rubles per person to the same individuals. The need to pay tribute forced

[18] Zvi Gitelman, "Recent Emigrés and the Soviet Political System," *Slavic and Soviet Series* (Tel-Aviv University), 2:2 (Fall 1977), pp. 54–55.

[19] CF. "In cooperative (i.e., rural) retail trade over a third of all abuses are with the permissive knowledge (*dopuskaiut*) * * * of store managers and chief salesmen * * *. Every third crime is committed as a result of prior collusion." (Shvetsov in *Pravda*, Apr. 13, 1979, p. 3.)

the woman into various illegal activities in order to raise the cash, which is what triggered the investigation originally.[20]

(5) The last pont is instructive. In many instances one discovers that the need to raise cash (currency) to pay tribute, kickbacks, bribes for protection, etc., is a strong contributory cause in the involvement of many enterprises in "black" trade and production. Another fairly common practice, apparently, occasioned by the same need to raise currency is the placing of dummy persons on the payroll (so-called dead souls, alluding to Gogol's famous novel).[21]

(6) Akin to the exaction of tribute, but perhaps carrying the meaning of "corruption" somewhat further, is the abuse of authority and power by anyone possessed of these attributes. Judging by the almost daily complaints of the Soviet press and the unanimous testimony of eye-witnesses, this is a near-ubiquitous practice that runs the full gamut of conceivable magnitudes. A common practice is to employ the material, monetary, and labor resources of the enterprise in one's charge to enhance one's material welfare and creature comforts.[22]

(7) Another kind of bribe, as it were, is the under-the-counter payment received by the salesperson from the customer for the opportunity to buy goods in short supply. Needless to say, it is an extremely widespread practice. One could equally well call such payment the pocketing by the salesperson of the economic rent inherent in the enhanced scarcity of the good owing to official prices being below market-clearing levels. (The ruble obtained by the purveyor of the "sentence" in Odessa, as described above, of course falls into the same "rent-seeking" category.)

(8) Turning to the sizes of bribes, what strikes the outsider's eye is that the amounts paid by fairly ordinary people to fairly modest officials, as per the numerous figures published in the Soviet press and mentioned by former witnesses, are surprisingly large in relation to average (official) wages and salaries. Let us recall at this point that the average monthly gross wage/salary of workers and employees in the USSR was 96.5 rubles in 1965, 122 rubles in 1970, and 145.8 rubles in 1975. Clearly, many people take in, hold, and pass on a great deal more cash (currency) than the average wage figures would suggest to a "bourgeois economist". But more on this later.

The Causes

Illegal economic activity and corruption exist on a lesser or greater scale in every country, communist or capitalist, backward or advanced. What, then, is noteworthy about the Soviet Union in this regard? Is it not like all the other countries, different at most in degree rather than in kind? If so, perhaps this is the most noteworthy thing about it, for

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[20] F. Neznansky, *"Gusev protiv Sakharova"* (Gusev versus Sakharov), *Novoye Russkoye Slovo* (New York), June 4, 1978. The matter was quashed from above.

[21] Cf., Gorodetskii in *Trud*, July 7, 1977. In this case, however, the reason for raising currency for the enterprise in this manner was the need to buy spare parts for its machinery, obtainable only in the flea market. The dummy persons, if they are at all real, usually get a small cut to keep them quiet, with the remainder going to the enterprise—or directly into private pockets.

[22] A striking case of a palatial weekend retreat built in this manner by the top management of a construction trust at an alleged cost of 140,000 rubles is vividly described in A. Vaksberg's *"Bania"* (The Bath-House), *Literaturnaia gazeta*, 1976 :19, p. 12. The climax of the article is that the legal action against the wrongdoers culminated in heavy sentences (up to 15 years of imprisonment) for several flunkies but much lesser sentences for the real culprits.

it is—or was—supposed to be different. In any case, there can be little doubt that with regard to the magnitude of illegal economic activity and corruption, the USSR is far from "underdeveloped" by world standards.

It would be surprising, indeed a miracle, if it were otherwise, for the Soviet Union possesses nearly every favorable condition for the appearance of a large illegal economy and of corruption of officialdom. Let us enumerate at least the more important ones, noting that each of them separately is sufficient. Taken together, they amount to an unusually fertile ground for the flourishing of the illegal economy and the associated corruption.

(While focusing our attention in this section on consumer goods and services, we note in passing that in the production sector prices are controlled, goods are rationed, credit is relatively easy to get, and, on the micro level, supply typically falls significantly short of demand. Moreover, unlike consumer goods prices, producer goods prices are not even meant to be set at equilibrium levels. Accordingly, as we have seen, black markets and corruption are rife in the production sector as well.)

1. *Price control.*—Applies to all consumer goods of any importance in the "first" economy. Although current doctrine is to set consumer goods prices generally at equilibrium levels (with turnover taxes, state profits, and subsidies filling the cost-price gap), the pitfalls of price planning together with the cumbersomeness and slowness of price adjustment by the authorities virtually ensures that many individual markets at given times and places will not be in equilibrium. In the case of certain "political" goods, retail prices may be deliberately held at below equilibrium levels, either with formal rationing (housing) or without (meat). In short, relative (official) consumer goods prices are often quite distorted with reference to current consumer demand schedules and actual supplies. Inevitably—and quite apart from any general repressed inflation—many prices are below equilibrium levels at given times and places.

True, occasionally the authorities do raise the fixed prices to take account precisely of such imbalances, but all price distortions are not entirely swept away in such actions, and certainly not for long. Also, some continuous price drift and (downward) quality drift may moderate excess demand, but probably not much. Often aggravating the excess demand (or the shortages in the eyes of the consumer) at given times and places—as well as excess supply in other cases—are a poorly adaptive system of production and a very inefficient system of distribution. In sum, the existence of many official prices below equilibrium levels and the persistence of this condition for years in many cases, invite "speculation", "middleman activity", and the various forms of illegal production, bringing also corruption in their wake.

Sticky, controlled prices naturally may also lie above as well as below micro-equilibrium levels, and, indeed, gluts of consumer goods in official stores do occur, and some of them even persist (low quality clothing and shoes, for example). Insofar as the gluts are merely local or temporary, "speculation" may have a moderating effect. But from the standpoint of the illegal economy, shortages and gluts are not algebraically additive. They do not offset one another. A persistent glut of

bad shoes does not offset a persistent shortage of meat and does not nullify a black market in meat.

If, in addition, there is macro-imbalance in the sense of repressed inflation (monetary overhang), the shortages will be more numerous and more acute while gluts will be fewer and smaller. The proposition that Soviet-type economies in fact suffer from repressed inflation as much as "conventional wisdom" has tended to hold, has been lately questioned by Richard Portes and his associates in an imaginative and energetic way.[23] It is not our intention to confront the issue in this essay, though we shall return in a later section to offer a few observations regarding repressed inflation in the USSR in its relation to the illegal economy. Suffice it to say at this point that in the presence of a widespread and vigorous illegal economy, one can really speak of repressed inflation only in relation to the controlled (first) economy. The second economy, where prices are at market-clearing levels, in effect acts to dissipate the monetary overhang and the repressed inflation. But, the excess demand for goods at the lower (official) prices remains, giving the casual observer the impression of a classical repressed inflation.

2. *Prohibition of private activity.*—Since so little private activity is in principle allowed and therefore so much is prohibited (see Annex), an ordinary economic impulse quickly shades over into a criminal act. As was said already in 1776: "* * * the smuggler * * * would have been, in every respect, an excellent citizen, had not the laws of the country made that a crime which nature never meant to be so." (Adam Smith, *An Inquiry into the Nature and Causes of the Wealth of Nations*, V:II, New York, Modern Library, 1937, p. 849.) Many an article in the Soviet press detailing the "misdeeds" of some underground entrepreneur or some team of *shabashniki* betrays between the lines an appreciation of their contribution to public well-being.[24] Which is not to say that many Soviet economic crimes would not be such even in a staunchly private-enterprise society.

3. *Taxes.*—Adam Smith's smuggler reminds us that the USSR shares with other countries and other systems the criminalizing force of high taxes.[25] We have already seen that high marginal tax rates prompt many tradesmen and professionals to forgo taking out licenses and to practice illicitly what in principle are legal private activities. (Few physicians with substantial private practice do so with the benefit of a license, according to private information to the author.) Likewise, high indirect taxes—and, we may add, high profits of the monopolist-state—invite illegal production, the classic case in the USSR as elsewhere being of course alcohol.

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[23] See especially Richard Portes, "The Control of Inflation: Lessons from East European Experience," *Economica*, 44 (May 1977), pp. 109–30, including the bibliography therein. Portes's empirical work has been done on the several Eastern countries that publish relatively ample monetary data, which excludes the U.S.S.R.

[24] In an impassioned article describing the general public's heavy dependence on the black market for all kinds of spare parts, a Soviet *feuilletoniste* sums up that "* * * decent people simply cannot take a single step without resorting to the aid of spivs (zhuliki), and those who do not resort to such help give to those around them an impression of being either mentally retarded or saints, which, incidentally, is the same thing" (Natallia Il'ina, *Svetiashchiesia tablo*, Moscow, 1974, p. 93).

[25] For descriptions of tax-induced "second economies" in Western countries see: for the United States, Irwin Ross, "Why the Underground Economy?," *Fortune*, Oct. 9, 1978, pp. 92ff; for Italy, Christopher Matthews. "'Underground' Workers Keep Italian Economy Running," *International Herald Tribune* (Paris), Feb. 5, 1979, p. 5; for France, Adalbert de Segonzac, "How the French Get By," *idem*, Mar. 24, 1979, p. 4. I am indebted to Prof. F. D. Holzman for drawing my attention to the last two items.

4. *Certain kinds of demand* are left unsatisfied by state industry as a matter of policy: religious articles (which may not be produced by private artisans either); [26] until recently, anything associated with Western youth culture (blue jeans, rock music, chewing gum, American-style cigarettes); not to mention forbidden literature. The demand is there, though, as evidenced by a price of 150–200 and more rubles per pair of blue jeans brought in from the West or faked to look American in an underground establishment. Illegal trade and production have stepped in to fill the gap. (Recently, the state has tried in effect to push out some of this illegal production and to capture some of the economic rent for itself, as with chewing gum, American cigarettes and blue jeans. The latest entry on the part of the state are blue jeans, though still produced in minute quantities and carrying a retail price of only 30 rubles a pair (!)—and immediately resold in the black market at 220. Not surprisingly, a month's output is sold out in a day.) [27]

5. *Impersonal property under inadequate custody.*—Enough has been said here already to bring out that this condition is as important as any in generating the illegal economy. Nearly everything is owned by the state (and other socialist entities), much of its is inadequately guarded, and an enormous amount of state property, material and monetary, is diverted for private gain or simply stolen. Much is stolen by the custodians and guards themselves. Only a small fraction of the culprits confront the law, and only a fraction of these face serious punishment. Many individuals *must* steal not only to make a tolerable living but to keep a job, to propitiate the right authorities, and to operate in the system at all. Alternatively, many jobs are sought for the opportunity to steal or misuse state property.

6. The very *personal power* in the hands of bureaucratic officials and functionaries, and of important and petty agents of the State's economic machine. This power quickly translates into ability to take bribes, to get cuts or kickbacks, to shake down, to extort graft. (Witness how effectively the "squeeze" has been applied to recent émigrés on the part of many petty officials with power to postpone or block the emigration by interposing minor obstacles.)

Exploitation of the power of an office for personal gain is vastly enhanced by the dictatorial and secretive nature of the regime, mutual solidarity of members of the political elite in such matters, and the monopolistic positions of economic entities in their own fields. The small fry are protected by the sheer number of economic crimes. There is no open political opposition, no independent legislature or judiciary, no competitive market, and no free press to impose bounds on corruption and abuse of office. Apart from such law enforcement as occurs, the one internal check that seemingly exists and operates is the intra-bureaucracy or intra-elite rivalry of groups and individuals, which

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[26] On demand by young people for crosses wear, eliciting also underground production of same, see O. Antic, "What Harm Is There in Wearing a Cross?," Radio Liberty Research RL 283/78, Dec. 11, 1978. An interesting case is reported by the well-known *feuilletoniste* I. Shatunovskii (*Pravda*, Feb. 11, 1979, p. 6): someone purchases a silver salt cellar in a state store for 27 rubles, engraved on it the Russian equivalent of "Merry Christmas," and resold it on the open market for 100 rubles. As the author of the story points out, this may have been an attempt to fake an antique as well. Note that the profit is equal to half the average monthly wage.

[27] *Pravda*, Mar. 12, 1979, p. 6. The quality of the state-made blue jeans is considerably below that provided by some underground establishments, according to private information to this author.

strikes against vulnerable targets. But this is more a matter of vulnerability of culpable individuals, not of the bounds of a system of corruption and abuse.

7. *The individual's need.*—The population has been and is still poor, especially in relation to expectations. It has been explained to us by well-informed sources that bribe-taking by judges was not common before the War; it became so after the War when their salaries had dropped sharply in purchasing power. The same must have been true in many walks of life. But as black markets grow and corruption spreads, the individual perceives his cost of living, as it were, rising, and hence his requirement for supplementary income rising, too. More than that: the cost of living for those already significantly benefiting from illegal activities and corruption should be defined to include the cost of security in the face of a high risk of prosecution and denunciation, which often means sharing one's take with superiors, authorities, and others (as we have seen). It is difficult to end one's involvement in major illegalities, which may even necessitate deeper and deeper involvement. In these ways, the illegal economy and corruption feed on themselves. And then there is plain greed in addition to need.

One could mention other conditions in the Soviet system that easily explain—or at least contribute to—the prevalence of illegalities and corruption. Many of them would be intangible: The cultural traditions of corruption in the country and among some of the nationalities, especially in the south, the failure of "socialist morality" to obtain a strong hold on the public; the cynicism that burgeoned with Stalinism and has seemingly been growing since; the regime's own precepts insofar as they stress material incentives; the social contrasts and inequalities that widen the gulf between what is mine and what is "theirs" (the state itself belonging to "them"), and "their" own negative examples; the blocking of certain legitimate careers in the government and the Party to members of national minorities; the consumerist example of the West; and so on.

Two other factors should be singled out, though. First, the diminution of terror after Stalin's death may or may not have been a contributing factor in the (putative) growth of the illegal economy and corruption in the past quarter century. There is evidence that already under Stalin there was a good deal of economic illegality and corruption, especially so after the War. On the other hand, it was Khrushchev, in the relatively mild years of 1961 and 1962, who re-imposed the death penalty for a variety of economic crimes and corruption.[28] There is no clear evidence that the 1961–62 laws succeeded in significantly reducing the incidence of the crimes in question, and there is much impressionistic testimony on the part of eyewitnsss that the trend has been steadly upward despite the 1961–62 laws.

The other factor is the sheer passage of time. It has now been just 50 years since the formal adoption of the First Five-Year Plan by the Soviet Government, and almost this long since the present economic system went into effect. In other words, there has been ample time for the limits of the possible in the covert world of the illegal economy and bribery to have been tested and slowly but steadily pushed outward. Crucial in this regard has been the corruption of the inspec-

[28] See "Economic Crimes in the Soviet Union," *loc. cit.*, pp. 5ff.

torates, the economic and ordinary police forces, other arms of law enforcement, and the various Party and governmental authorities. Time has done its job.

To repeat, it would have been a miracle if, under all the aforecited favorable conditions and with all this time, the illegal economy and corruption had not reached large proportions in the Soviet Union. For the foreseeable future, the situation is hardly reversible.

How Large?

Despite the furtive nature of the beast, it is not entirely hopeless to estimate the magnitude of the illegal economy in ruble terms. One of the most promising approaches is that used by Professor Gur Ofer and his associates at Hebrew University (Jerusalem) namely, by means of a systematic survey of recent émigrés' household budgets (including both legal and illegal items) during their last normal year of residence of the U.S.S.R. His work to speak for itself when published. It is hoped that the same method will yet be replicated with other groups of recent émigrés for the sake of obtaining an even more representative over-all sample, especially in regard to certain categories of the population. Other approaches are possible. But before saying something about them we ought to refer briefly to several methodological problems.

The economist's fancy naturally turns to national accounts. What is the magnitude of the illegal phenomena treated in this article in relation to the main national aggregates? In so posing the question we immediately raise some of the usual problems that attend the construction of such accounts: (*a*) The bounds of the activity to the included; (*b*) the distinction between net and gross; and (*c*) how are the illegal (or even private legal) activities to be "priced into" the accounts (i.e., at what prices do we value them)?

Ad (*a*).—General practice throughout the world is to exclude illegal activities from the scope of national income, but following the rule in this case would merely beg the question. Hence, the proper question is: Which illegal activities are in and which are out? It would perhaps be easy to agree that those production activities in the illegal economy which have close counterparts in the first economy should be in; e.g., the underground production of garments, repair services, etc., including perhaps as well goods for proscribed end uses, such as religious articles. Perhaps much or all of illegal trade should also be in. But what about bribes? Here we may perhaps learn—at least conceptually—from the traditional Russian distinction between a bribe for the purpose of expediting the official's normal duties (*mzdoimstvo*), and that given to prevent the exercise of his normal duties (*likhoimstvo*).[29] A possible rationale for including the former

[29] See, for example, the article on *"Vziatochnichestvo"* (Bribery) in Brokgaus & Efron, *Entsiklopedicheskii slovar'*, Vol. 11, 1892, pp. 213ff; cf., Chalidze, *op. cit.*, p. 235. As might be expected, penalties were lighter for *mzdoimstvo* than for *likhoimstvo*. Soviet law, however, does not recognize the distinction (Chalidze, *op. cit.*, p. 235). This somewhat quaint distinction between two kinds of bribe has, in fact, a parallel in contemporary American legislation in the so-called "unlawful gratuities" statutes. Cf., New York Penal Law, Article 200 ("Bribery Involving Public Servants"), Section 30: "A person is guilty of giving unlawful gratuities when he knowingly confers, or offers or agrees to confer, any benefit upon a public servant for having engaged in official conduct which he was required or authorized to perform, and for which he was not entitled to any special or additional compensation." I am indebted to Prof. John T. Noonan, Jr., of the School of Law at Berkeley, for bringing the American counterpart to my attention.

in national income is that people become officials in expectation of the full customary income which the position affords, which includes income from bribes; this is how the labor market works when there is relatively high freedom of choice of job, as there is in the USSR. In other words, *mzdoimstvo* is part of the proper costs of government. (The rationale for excluding the latter kind of bribe, *likhoimstvo*, is perhaps debatable. For the moment we are satisfied with the pragmatic consideration that no such line can be drawn empirically anyway.) By the same token, we might include as well the bribes and exorbitant "tips" given to sales clerks, etc., to expedite the sale of goods in short supply.

Next, are the pilferage, embezzlement, and theft of goods, money and time by employees at their places of work merely unauthorized transfers from the state to the household sector, or are they in large part custom-sanctioned form of supplemental remuneration, expected (at least in some measure) by both employer and employee? If they are the latter, and if they are a normal parameter in the functioning of the labor market, then they might be included in national income.

Ad (*b*), net vs. gross.—For purposes of national income accounting, the contribution of the second economy should be measured as its value added, with or without consumption of fixed capital employed in the second economy itself (which, presumably, is small). But, as we have seen, much of the input comes from the first economy, whether purchased or gratuitously appropriated. For example, in "speculation" the value of the goods purchased by the trader may be a large part of his value of sales. And in the case of stolen goods, their value may already appear in the national accounts for the first economy.

But for some purposes the more useful concept may be the total value of sales by the second (or illegal) economy to other production sectors and for end use, inclusive of the value of inputs from the first economy (and from the outside world, which are not negligible). And for some purposes one may wish even to "gross up" the transfers within the second (or illegal) economy, including the value of "production bribes" as well. (Bribes are normal costs of production in underground activities.)

Ad (*c*), price basis.—Here we have several choices, such as entering all values in actual transaction prices (which will throw light on money and income flows); or deflate the (usually, though not always) higher prices in the second economy to the levels of those in the first, for the sake of comparability of physical flows in the two; or express flows in both economies at some average realized prices. The choice of valuation method will surely depend on the object of the exercise as well as on the data at hand.

There can be little doubt, however, that the ruble size of the second (or illegal) economy will vary greatly depending on the method of accounting and valuation employed. Thus, the gross sales of the illegal economy valued at actual realized prices will surely be several times—perhaps more correctly, many times—the net value added compared notionally at the corresponding official prices and wages. With time and ingenuity, such calculation may become possible; the aforementioned study by Professor Ofer is a long step in that direction. But there are other ways of getting some idea of the magnitudes involved, and we offer a few terse and fragmentary examples immediately be-

low. In this connection one should bear in mind the following figures, the first figure referring to 1970, the second, to 1975: Personal disposable income (billion rubles)—166.35, 221.90; same, per capita, per year (rubles)—685.13, 871.56; average wage/salary per month (rubles)—122.0, 145.8.[30] These figures pertain to official (legal) income.

In the mid-seventies, some 700–800,000 new cars are estimated to have been acquired by individuals in the USSR per year.[31] The acquisition of a new car almost always involves a large number of payoffs and bribes connected with the purchase itself, registration, inspection, sometimes garage building, sometimes the obtaining of a driver's license, etc. The average amount of such payments per car can only be guessed at; our own guess from what we have read and heard is that 2,000 rubles is perhaps not far off the mark. If so, it would mean that some 1.5 billion rubles per year were so paid in the mid-seventies, adding 0.5–1 percent to personal disposable money incomes. Automobiles are of course not the only new durable goods whose acquisition involves significant bribe payment.

It has been estimated on the basis of some statements in the Soviet press that, in 1972, private automobiles consumed approximately 500 million liters of gasoline stolen from the state.[32] If only 5 kopeks per liter were paid for the stolen gasoline (the official retail price for regular grade gasoline at the time was 7 kopeks per liter, but stolen gasoline sold for less), some 25 million rubles of illegal income was created in this fashion. The middlemen are the service station managers and attendants, and the operation is so lucrative that the jobs are purchased for substantial lump sums (private information).

According to the U.S.S.R. Ministry of Fisheries, crypto-commercial private fishing in inland waters resulted in an annual catch of about 200 million kilograms (presumably in the early seventies).[33] Assigning a moderate retail value of 2.5 rubles/kg we obtain a total value—and second economy income—of some half a billion rubles a year. (Some of this amount may be included in kolkhoz market sales figures.)

In Tula Oblast', in 1977, thefts "that could be determined" within the network of cooperative retail stores (i.e., rural stores) amounted to 400,000 rubles, which comes almost exactly to one ruble per rural inhabitant of the oblast'.[34] Extrapolating to the whole USSR we obtain total thefts from rural stores of 100 million rubles, "those that could be determined."

An underground shoe factory, which employed 10–15 workers and some 60 saleswomen (selling on streets) realized a "street value" (to use an apposite American phrase) of 1–2 million rubles per year. Despite the large number of street sellers, it took the police 1½ years to track down the factory. The workers apparently made 74–90 rubles per "evening," which is as much as ten times the pay per shift for such

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[30] The wage/salary figures are from official statistics. The other two sets of figures are estimates in Gertrude E. Schroeder and Barbara S. Severin, *Soviet Economy in a New Perspective*, Washington, D.C., 1976, p. 652.

[31] V. T., "Automobile Sales in the U.S.S.R.," Radio Liberty Research, RL 177/77, July 26, 1977. The object of this report is to show that Soviet car sales figures have been inflated since 1972 by inclusion of used cars with new cars, and to correct therefor.

[32] A. T., "The Dawn of the Automobile Era Gives a Boost to the Black Market," Radio Liberty Research, RL 132/75. The author of this report arrives at an estimate of sixty million rubles. but we prefer the lower figure.

[33] Andreas Tenson, "Poaching in the U.S.S.R.," Radio Liberty Dispatch, Dec. 4, 1973. The Soviet source is *Ekonomischeskaia gazeta*, 1973 :41, p. 22.

[34] Shvetsov in *Pravda*, Apr. 13, 1979, p. 3. On collusion between state fishery and private fishermen in inland waters see *Sotsialisticheskaia industriia*, Nov. 15, 1977, p. 6.

labor in the first economy.[35] How many such firms operate at one time in the USSR?

Some Sundays the Tula flea market, where a wide variety of goods pilfered from the state can be purchased, brings together up to 14 thousand people, some from far away.[36] What is its turnover per year? What is the turnover of all flea markets (some of which have been closed down, see above)?

Private fur-animal farms are thriving. In Kurgan there are 1,500, in Novosibirsk—1,000, in Sorochinsk (Orenburg *Obl.*)—over 900, in these three places together some 3,500. All of them are registered, i.e., legal, although they obtain the feed in questionable ways, and sell the skins in the black market, which puts them in the illegal economy.[37] How many such farms are there in the USSR? Ten thousand? More? Each probably has sales of at least several thousand rubles per year to make the operation worthwhile. What is the countrywide total of annual sales on the black market? 25 million rubles? 100 million?

The black-market fur feeds into underground making of articles for sale to the public. How much value is added by the illegal furriers and dealers?

"As is known," state-built apartments are rarely in finished form when the first inhabitants move in. The inhabitants have to lay out considerable sums to bring their apartments into liveable condition. For Moscow, where some 120,000 new apartments are constructed annually, the resultant average cost per apartment has been estimated at 120 rubles, or 14.4 million rubles for the whole city, of which roughly 10 million rubles goes to private repairmen.[38] Say, 80 rubles of private repairs per apartment. Extrapolating to the 1.8 million state-built apartments per year for the whole USSR (average annual number over 1970–77, as per official statistics), we obtain a figure of 144 million rubles in the second economy. To be conservative, let us speak of 100 million rubles a year. This is only for newly built apartments, not including the old housing stock which is also largely repaired by private repairmen using supplies and materials of questionable legality.

In 1975, private construction of housing in urban areas alone amounted to 12.6 million square meters (with another 14.0 mill. sq. m. in rural areas).[39] Nearly all of it was built with significant help from the black market for materials and labor, not to mention bribery in the right places. How much fed into the illegal economy? The cost of a square meter built by the state in that year was approximately 150 rubles.[40] Private housing is more modest, but incurs black market prices. If we say entirely arbitrarily that 80 rubles/m^2 was spent in the black market by private builders, the amount that fed into the illegal economy from urban construction alone comes to 1 billion rubles in 1975. Of course, this is nothing but a guess. Illegal incomes from the construction of rural private houses and summer houses are additional.

Last but not least, the *shabashnik* rural construction teams. These

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[35] *Sots. ind.*, Dec. 7, 1975, p. 4, and Radio Liberty Research, RS 529/75, Dec. 22, 1975 (in Russian). The value estimate is ours.

[36] *Trud*, July 7, 1977.

[37] See *Sots. ind.*, Sept. 25, 1977, p. 3; *Pravda*, May 18, 1978, p. 3. Concerning a general shortage of fur articles see *Pravda*, Dec. 27, 1978, p. 3.

[38] A. Likhachev, "Shabashnik," *Literaturnaia gazeta*, 1973:10, p. 12. Additionally, the state itself spends "hundreds of millions of rubles" a year to repair supposedly completed new dwellings (*Pravda*, Apr. 17, 1979, p. 2).

[39] *Nar. Khoz. SSSR 1977*, p. 411.

[40] Cf. *idem*, p. 353, for total cost of housing construction to the state.

teams can be legal or illegal in principle, but even the legal ones draw heavily on materials, equipment, etc., obtained through illegal channels. Their importance has been carefully analyzed in a Radio Liberty Research report of 1976.[41] To summarize, an admittedly incomplete count by the report's author puts the total at 120–130,000 individuals in 1975, and the amount of construction accomplished per season (year) at 13,500 rubles per person. Multiplying, we obtain a total value of rural construction by *shabashnik* teams of 1.75 billion rubles in that year—and probably more because the count is incomplete. The individual worker's earnings are said to average 30 rubles for a very long work day (but in some provinces much higher), and the quality of construction is excellent by Soviet standards. This general picture has been confirmed for this author by a well-informed émigré source, who places a season's earnings at 2–4,000 rubles per *shabashnik* (private information). Applying this range to the above-cited number of individuals, we obtain annual (seasonal) earnings at 1.25 to 1.5 billion rubles—again, with an incomplete count.

One could go on. For example, one might also look into such major sources of illegal income as retail trade,[42] public dining, medicine,[43] education,[44] private selling of southern fruit and vegetables in the rest of the country, private taxis, pocketing of fares by bus drivers and railway conductors, smuggling in of foreign goods and dealing with foreign visitors, the aforementioned illegal private logging, underground making of clothes, auto repair, appliance repair, repair and repainting of old residences, and *samogon*. And plain bribe-taking.

The effects of the second economy in general, and of the illegal economy in particular, on such aggregate magnitudes as the over-all size of the national product, its distribution by end uses, and its rate of growth remain to be investigated. In one regard, however, we can be more definite: The effect on nominal personal incomes is not negligible. The total *nominal* value of personal incomes would almost certainly be significantly augmented by addition of illegal incomes to the total of official (legal) incomes. So would the nominal value of personal consumption and investment expenditures by addition of black market purchases and bribes. This being the case, it is not unreasonable to suspect that there may be perceptible effects also on such break-down measures of personal income as its regional distribution, its distribution

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[41] A. T., *"Vol'nonaemnye brigady v sel'skom stroitel'stve"* (Hired Teams in Rural Construction), Radio Liberty Research, RS 450/76, Nov. 29, 1976.

[42] Several émigrés, interviewed by us were of the impressionistic opinion that employees in retail trade, public dining, and related activities, on the average double their official salaries by illegal means. We have no way to check this opinion. In 1975 there were 6.9 million persons employed in retail trade, public dining, supply, and procurement. Their average monthly (legal) wage was 109 rubles; this comes to 9 billion rubles per year. (*Nar. khoz. 1977*, pp. 381 and 386.) The reader is welcome to apply whatever factor he wishes to obtain the corresponding illegal income.

[43] Private information from a knowledgeable émigré: Clinicians, but not district physicians (who have few opportunities), on the average may double or even treble their official salaries (which are relatively low), from unlicensed private practice and "tips" for official service. Gynecologists and urologists do especially well. Interestingly, a highly placed planner in one of the other East European countries is of the opinion that in his country physicians on the average augment their official salaries by a factor of 2.5–3 with the aid of the same unofficial sources, and those in favored specialties, such as gynecology, by a factor of perhaps 6 (private information). In the U.S.S.R., it now seems to be fairly common practice for nurses to "shake down" hospital patients by demanding tips for such specific services as bringing food and changing linen.

[44] The Soviet press regularly mentions the fact, fully substantiated by émigré accounts, that admission to and graduation from higher educational institutions not infrequently involve bribes, which may run into thousands of rubles per student (especially in the southern republics).

among various functional groups of the population (sectors and branches, occupations, etc.), and, lastly, its size distribution.

Further Observations

Demand for money and propensity to save.—No official data on currency in circulation have been published since 1937, but there is reason to believe that it is considerably in excess of what would be required for normal transaction needs by the legal economy. This is indirectly recognized, for instance, by a leading Soviet economist, S. Shatalin, in a recent article on "Better Balance in Economic Development", who proceeds to propose a large series of bold measures to bring about a better balance between aggregate consumer purchasing power and the supply of consumer goods.[45] And of course this is largely the message of the evidence regarding black markets and the like, adduced in the the present essay. Whether this means that repressed inflation holds sway in the whole economy, first and second together, is something else again, as we have seen. If the second economy is large and active enough, it will presumably largely fill the gap between aggregate consumer demand and aggregate supply from the first economy by supplying its own goods and services at market-clearing prices. But then it may not do so completely owing to risks of illegal activity, and imperfect mobility of "underground" resources.

At the same time, demand for money in currency form may also be quite high under the circumstances, especially if its origin is illegal. Large illegally earned amounts of money are not likely to be deposited in savings banks,[46] for this would tend to incriminate the depositors. Nor can they be easily invested in other forms of liquid asset. Yet it may be very desirable to hold a large amount of money in liquid form for precautionary reasons. The precautionary motive for holding currency includes, for those who can afford it, protection against the risk of ill health (competent surgery, special attention in hospitals, medicine in short supply, may be expensive); and for those heavily in the illegal economy, protection against the law, which may require sudden pay-offs to the mighty and near-mighty. (It should be noted here, however, that borrowing substantial sums of money from friends for emergency needs is rather common in the Soviet Union.) Indeed, reports in the press of uncovered large illegal operations and bribe-taking frequently mention amassed illicit fortunes in tens of thousands and even hundreds of thousands of rubles, which are mostly in currency form.[47]

The possibility to invest large amounts in less liquid assets should not be overlooked. In addition to personal valuables—such as jewelry, art, antiques, all of which have been in rising demand in the USSR—

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[45] *"O povyshenii proportsional'nosti Razvitiia ekonomiki," Material'no-teknicheskoe snabzhenie,* 1979 :1, pp. 8–14.

[46] There exist bearer savings passbooks (i.e., anonymous savings accounts). They are occasionally mentioned in the press as means of payment or cash holding in the illegal economy. A brief description o fsuch accounts can be found in S. D. Tsypkin, *Pravovoe regulirovanie gosudarstvennogo kredita v SSSR,* Moscow, 1977, pp. 12–13.

[47] An example is the recent account of a buyer for a slaughterhouse who allegedly made no less than a million rubles by cheating the sellers of livestock on the weight. The police discovered several caches of currency adding up to just under 500,000 rubles, but the only other find mentioned in the published account is that of 20,000 rubles' worth of government bonds. Some caches may have remained uncovered, of course. *Sots. ind.,* Sept. 11. 1978, p. 4.

they include private homes and summer houses, and automobiles, all often purchased with substantial resort to the illegal economy and to bribery, as we have seen. But there are also other, less tangible assets to be acquired: (*a*) Jobs are frequently purchased, especially those that promise lucrative side-earnings; [48] (*b*) to keep a job, regular tribute may have to be paid to the mighty (see the case of the vegetable-warehouse director, described above); (*c*) for the active underground operators, security must be constantly reconfirmed by means of regular payoffs to various authorities; (*d*) underground entrepreneurs do buy businesses and capital equipment for businesses, i.e., they invest in their enterprises on personal account; (*e*) one transmits economic position to one's children by buying their way into and through higher education establishments, a rather common thing; and (*f*) one enhances one's own security by buying an advanced degree, also not an uncommon thing; and so forth.

The marginal propensity to save (cross-sectional) out of illegal or any high income may also be quite high for these very reasons. If in fact there is a high propensity to save from the higher incomes and to hold one's portfolio largely in currency form, then the empirical studies of Soviet household saving behavior, which perforce take into account only legal incomes and no currency hoarding, may miss something of the real picture. Of course, the hypothesis that the cross-sectional marginal propensity to save is quite high and that the resultant savings are largely held in currency form assumes that the monetary authorities oblige by expanding the currency stock. Or, conversely, the earners of high incomes oblige the monetary authorities by their higher income-elastic demand for currency. It may be a peaceful co-existence of mutual convenience.

Effects on official wages and the demand for jobs.—Since the Soviet labor market is a market, demand and supply have significant influence on specific wages/salaries. This happens in two ways. First, the wage planners do adjust relative wage rates in view of the demand-supply balance for given kinds of labor in given places. Since Stalin's death it has not been possible to lower nominal wages; hence, such adjustment almost always means the raising of nominal wages where they appear to be relatively too low, and not the inverse. This is a slow process, but an important one; witness the periodic adjustment of the "regional coefficients" for the outlying parts of the country. Second, the direct employers (enterprises) have considerable leeway to adjust relative wages, in fact if not in terms of the set rates. They do so by juggling production norms, dispensing material benefits (housing, vacations), awarding bonuses, and—not the least—winking at illegalities. But the attraction of a given job may in large measure be a function of the opportunities for side earnings, many of them illegal. It therefore stands to reason that, through the appeal that they exercise, the relative side earnings in different jobs must in the long run have some effect on the relative official earnings in those jobs. Moreover, those who can profitably divert time from the job for private gainful activity would also tend to lose something in terms of official pay

[48] See our "Second Economy," *cited*, p. 32, where some very large figures are mentioned. We are informed by émigrés that, on a more modest scale, many jobs in retail trade, restaurants, gasoline stations, and other places with good opportunities for side earnings, are purchased for initial lump sums and, of course, sharing of the take afterwards.

(piece work, premia). The relationship would thus be an inverse one: the larger the side earnings, the lower the official pay. In this sense, illegal incomes would tend to be a levelling force in relation to the distribution of *legal* incomes. But in other ways, illegal earnings can have the opposite effect on equality of income distribution.

The literature on repressed inflation stresses that if the phenomenon proceeds far enough there is likely to be a negative effect on the supply of labor. The utility of additional money earnings is too low to justify the work. The behavior of labor supply is therefore one way to test for the presence or absence of repressed inflation. However, if such a test could be performed in regard to the Soviet economy, the results would have to be interpreted in the light of the specific situation, and particularly the presence of a large second economy. To begin with, the second economy may do away with the repressed inflation, as already mentioned, in which case, an observed diminution in labor supply may be due not to any repressed inflation as such, but to the low level of marginal earnings that have to be largely spent at high (black) prices.

Second, insofar as we measure labor supply not in terms of intensity of effort or even hours put in on the job, but in terms of holding jobs, again, Soviet conditions have to be borne in mind. One of them is, of course, the fact that both administrative (legal) imperatives and to some extent social pressure require that the individual hold some official job, i.e., be on some official employer's roll. And in any case it is in the interest of the individual to be on one, not only for the sake of the wage/salary but also for eventual pension rights, access to goods distributed through the place of employment, and so forth. The point to be stressed here, however, is that quite often the holding of a job also provides access to lucrative illegal income, including stealing. In fact, in some cases this may be the main reason for holding a job. Thus, as repressed inflation (with reference to the first economy) mounts, the demand for official jobs—for reasons of access to illegal income—may even increase.

Annex

The following extract indicates the scope of prohibited trades (our translation—G.G.):

Confirmed by Resolution of the Council of Ministers, dated 3 May 1976, No. 283.

Statute Concerning Artisan Trades of Individual Citizens

1. An artisan trade (*kustarno-remeslennyi promysel*) of individual citizens is the activity of making articles for sale to the population, as well as the furnishing of consumer (*bytovye*) services for payment.

The conduct of any trade with the use of hired labor is prohibited.

2. All artisan trades may be conducted on the territory of the USSR, except those that are prohibited by this Statute or by other laws of the USSR or the union republics.

3. Throughout the USSR, citizens are forbidden to conduct the following kinds of artisan trades:

(*a*) the processing of agricultural or other food products, whether purchased or customer furnished, including the preparation of any food articles and any beverages (whether in finished or semifinished form);

(*b*) the making or repair of any kind of weapon, the making of ammunition, explosives, or pyrotechnical articles;

(*c*) the making of duplicating or copying devices, any kinds of seals, [rubber] stamps, or type, [and] the duplication of any kind of printed or photographed matter, phonograph records, cinematographic films, and magnetic recordings;

(*d*) the making of plates or dies for medals or tokens;
(*e*) the making of chemical, toiletry, and cosmetic articles;
(*f*) the making of poisonous articles and narcotics, and of any medicines or medical devices;
(*g*) the processing and dyeing of leather, hide, and fur materials, and the making of articles from the skins of valuable fur-bearing animals, which carry no government brand (stamp) and therefore are liable for compulsory delivery to the state in accordance with legislation of union republics;
(*h*) the carrying of passengers and freight by any means of transport (except [small] boats, horses, and other animals, if so permitted by local government authority);
(*i*) the operation of boarding houses, bathhouses, gambling establishments, any kind of amusements, and the organization of shows;
(*j*) the making of articles from precious or nonferrous metals, precious stones, or amber, and of articles using such materials, and the repair or rebuilding of said articles using own precious or nonferrous metals, precious stones, or amber; and
(*k*) the making of candles, icons, and ecclesiastical articles. In addition, Councils of Ministers of union republics may prohibit the conduct of other artisan trades by citizens, if the development of such trades may harm the interests of society.

From *Sobranie Postnovelenii Pravitel'stva SSSR*, 1976, : 7, No. 39.

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The following extract names some of those artisan trades which are allowed, and those for which no license is required (our translation—G.G.):

"Among permitted trades are, for instance, the blacksmith's trade, engraving, barber's and manicurist's trades, photography and making of photo-portraits, repair of automobiles, motorcycles, motor scooters, motor buggies, mopeds, bicycles, television sets, loudspeakers, clocks and watches, fountain pens, etc. * * * Citizens desiring to pursue artisan trades must obtain * * * special licenses. * * * No licenses are required for the sale of articles made from the agricultural produce of one's own subsidiary garden, or the sale of articles of artisan trades produced under contract with state and cooperative enterprises, institutions, and organizations. Also, no license is required for the rendering of services of a household nature (sawing and chopping firewood, washing of clothes in the home without installation of any special laundering facilities, the washing of floors and windows, etc.).

From *Izvestiia*, 6 August 1977, p. 2.

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