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THE U.S. OIL INDUSTRY IN TRANSITION: CAUSES, IMPLICATIONS, AND POLICY RESPONSES

A STUDY

PREPARED FOR THE USE OF THE

SUBCOMMITTEE ON ECONOMIC GOALS AND INTERGOVERNMENTAL POLICY

OF THE

JOINT ECONOMIC COMMITTEE CONGRESS OF THE UNITED STATES

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LETTER OF TRANSMITTAL

May 13, 1986.

Hon. David R. Obey,
Chairman, Joint Economic Committee,
Congress of the United States, Washington, DC.

Dear Mr. Chairman: Herein is transmitted a study prepared for the Subcommittee on Economic Goals and Intergovernmental Policy entitled "The U.S. Oil Industry in Transition: Causes, Implications, and Policy Responses." The study has been prepared by Dr. Bernard L. Weinstein and Dr. Harold T. Gross with the Center for Enterprising at the Edwin L. Cox School of Business, Southern Methodist University in Dallas.

The study examines the dramatic adjustment underway in the domestic energy industry. That industry is heavily influenced by events beyond our shores and the pricing decisions of the Organization of Petroleum Exporting Countries (OPEC). Since late 1985, OPEC has vigorously manipulated the price of oil down. The domestic industry has fallen prey to the same debilitating forces any industry faces during periods of dramatic price reductions. Employment has declined. Exploration activity has nearly ground to a halt. Investment is dropping. And a wide variety of related businesses serving the domestic energy industry have been placed at risk by this downturn.

The study explores these various forces and concludes with suggestions for moderating the severe economic troubles weakening the domestic industry. Oil is a strategic commodity. The maintenance of a healthy domestic energy industry is a national security concern. And this study explores the concrete steps which we should be taking to ensure that our national defense is not imperiled by the impact of manipulated OPEC pricing decisions.

I believe this study will be useful to Members of Congress, the Joint Economic Committee, and the public. The study was coordinated by George R. Tyler of the Committee staff. The study does not necessarily reflect the views of the Committee or the Subcommittee.

Sincerely,

Lloyd Bentsen,
Vice Chairman, Subcommittee on
Economic Goals and Intergovernmental Policy.

PREFACE

This study on structural change in the U.S. oil industry was prepared at the request of the Joint Economic Committee of the United States Congress. It documents the increasing vulnerability of the oil industry to rapidly changing international market conditions and to inefficient or counterproductive public policies. The study also examines policy alternatives that may help to place this distressed industry in a more competitive posture.

Drs. Harold T. Gross and Bernard L. Weinstein are, respectively, Assistant Director and Director of the Center for Enterprising, an applied business and economics research center in the Edwin L. Cox School of Business. The authors and the Cox School welcome any views or comments prompted by this study.

ROY A. HERBERGER, Jr., D.B.A.,
Dean, Edwin L. Cox School of Business,
Southern Methodist University.

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I. INTRODUCTION

Falling oil prices since 1981 have directed considerable media and public attention to their potential impacts on the international and national economies, subnational regional economies, financial institutions and consumers. Little attention, however, has been focused on the implications of lower oil prices for the U.S. oil industry. This omission undoubtedly reflects the American public's traditional antipathy toward the oil industry, which was heightened during the mid- and late-1970's by rapidly rising prices for crude oil and refined products. There is an apparent lack of public awareness about the structure of the oil industry and its linkage to a broad range of natural resource, manufacturing, transportation and service industries. Today, the oil business is a "distressed" industry that has much in common with other distressed American industries such as agriculture, steel and textiles.

The purpose of this study is to document the increasing vulnerability of the U.S. oil industry to rapidly changing market conditions and to inefficient or counterproductive public policies. Critical to such an assessment is an understanding of how market forces and public policies interact to influence the structure and location of an industry over time and geography. The following section of this study describes briefly the process and political economy of industrial change to establish a conceptual context for the subsequent detailed analysis of the U.S. oil industry.

II. THE PROCESS AND POLITICAL ECONOMY OF INDUSTRIAL CHANGE

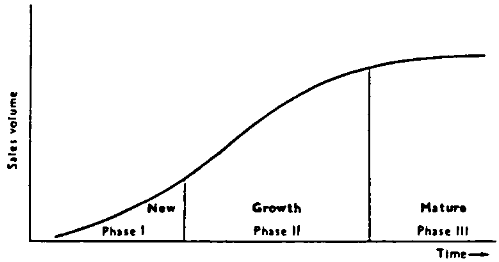
Industrial change is constant and continuous process conditioned by the interaction of market forces with political expediencies. It is characterized by technological innovation and changes in the level and composition of output, market structure and location of production. Too frequently, such changes are misperceived as disconnected events that occur randomly in an irrational marketplace; when severe dislocations of workers and investment result they may be seen as "crises" and prompt *ad hoc* public policy responses. But empirical evidence indicates that these changes occur in a fairly systematic and predictable manner and also suggests a more rational and carefully reasoned role for public policy throughout the industrial change process.

THE PROCESS OF INDUSTRIAL CHANGE

The process by which industries change is explained best by a "life-cycle" metaphor that is a sequence of three discernible phases: "new," "growth" and "mature" [Vernon (1966), Hirsch (1967)]. These phases, each of which possesses distinct characteristics, are illustrated in Figure 1, where sales volume is measured on the vertical axis and time is measured on the horizontal axis. As the life-cycle curve indicates, volume, though increasing, tends to be low during the "new" phase, which marks the entrance of an industry to the marketplace. A sharp rise in both volume and the rate of increase characterizes the second, or "growth" phase. The "mature" phase, finally, is characterized by high volume but diminishing or even negative growth. The driving force of the life-cycle is technological change or, more precisely, the process by which an innovation revolutionizes a production routine, becomes standardized, and is in turn superseded by a new innovation.

Figure 1

The Life-Cycle Model



Source: Hirsch, S. Location of Industry and International Competitiveness. Oxford: Oxford University Press, 1967.

"New" industries are created through technological innovations or a "revolutionary invention or discovery" which "changed the industrial process fundamentally" [Kuznets (1930)]. Thus, the characteristics of the "new" phase of the life-cycle generally include:

—high per-unit production costs;
—minimal investment in fixed assets and capital;
—frequent changes in the production process, sequence and product specifications;
—a labor-intensive production process;
—a high proportion of scientific and engineering inputs;
—a low volume of output; and
—a high price for the product in the marketplace.

As these characteristics suggest, entry into the market is constrained by knowledge rather than financial considerations. To this extent, the number of firms competing in the new industry is initially small since most firms rarely innovate but instead prefer the less risky imitation [Levitt (1965)].

Survivors of the "new" phase progress to the "growth" phase which witnesses the transformation of a technologically innovative production process into a standardized routine as mass production, distribution and organizational structures are introduced. This phase of the life-cycle is characterized by:

—reduced per-unit production costs;
—substantial investment in fixed assets and capital;
—lengthened production runs and less variability of product specifications;
—a more capital-intensive production process;
—a high protion of management inputs;
—a high and rapidly increasing volume of output; and
—a softening price for the product in the marketplace as demand becomes more elastic.

During this phase, an increasing number of firms is attracted to the industry. Financial, rather than technological, considerations become critical determinants of entry. The "growth" phase, therefore, is characterized more by imitation than by innovation.

As more producers compete in the industry, the life-cycle enters its "mature" phase. By this time, the industry has become quite routinized with very little evidence of innovation. The characteristics of this phase typically include:

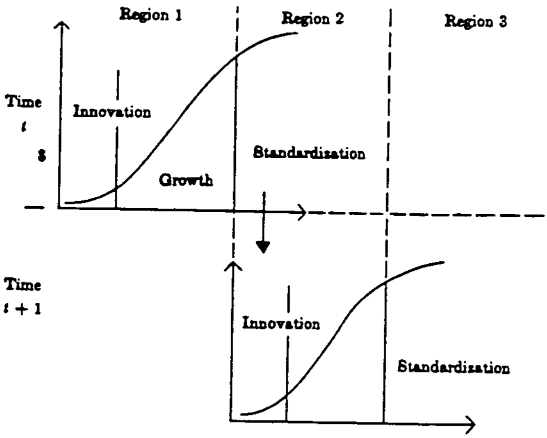
—reduced per-unit production costs;
—increased investment in fixed assets and capital;
—large manufacturing units and standardized product specifications;
—a more capital-intensive production process;
—a high proportion of unskilled and semiskilled labor inputs;
—a stable or declining volume of output; and
—a continued softening of the product price as demand becomes increasingly price-sensitive.

During the "mature" phase, the structure of the industry is transformed as well. Contractions and closings occur more frequently than expansions or openings. Entry, moreover, is achieved usually through merger of acquisition rather than through the birth of new firms. Exit from the industry, in turn, becomes increasingly costly since specialized manufacturing equipment and labor force skills can rarely be employed in the production of other commodities without substantial modification and retraining.

As an industry passes through the successive phases of its life-cycle it is characterized by different methods of production and organization which, in turn, imply different resource requirements for the industry at each phase of its life-cycle. Since locations vary in resource endowments, at each phase of the life-cycle some locations will possess a comparative advantage relative to other locations in the production of a given commodity [Heckshper (1919), Ohlin (1933)]. In addition to distinct technological and organizational characteristics, therefore, each phase of the life-cycle is accompanied by a particular spatial dynamics, which is illustrated in Figure 2 [Ress (1974)].

Figure 2

Spatial Manifestation of the Life-Cycle Over Time



Source: Rees, J. "Regional Industrial Shifts in the U.S. and the Internal Generation of Manufacturing in Growth Centers of the Southwest," in W. C. Wheaton, ed., Interregional Movements and Regional Growth. Washington, D.C.: Urban Institute, 1979.

During the "new" phase of the life-cycle, production is likely to be concentrated in only one or very few locations since entry into the industry is constrained by knowledge. Moreover, although many firms may seek entry, very few will survive because of the enormous risk associated with technological innovation. During the "growth" and "mature" phases of the life-cycle, as entry to an industry becomes less constrained by knowledge, more producers are likely to appear in competing locations. As demand for a product becomes increasingly price-sensitive during these later phases of the life-cycle, resource costs and combinations become the critical determinants of a location's ability to retain its comparative advantage. The life-cycle model, in fact, suggests an "economic landscape" [Losch (1939)] characterized by continuously expanding and contracting industries and, therefore, by concentration into and dispersion out of specific locations.

The Political Economy of Industrial Change

While an incomplete explanation of industrial change, the life-cycle model provides a basis for understanding the market-driven dynamics of the process. Indeed, the rapid diffusion of many manufacturing technologies has permitted developing nations with comparatively abundant and less-costly material and human resources to compete successfully in industries dominated formerly by developed nations. Nonetheless, political expediencies can, and often do, alter the pace of industrial change and the progression of industries through their life-cycles.

It is important at this point to draw a rather sharp distinction between the comparatively developed economies of North America, Western Europe and Japan, and developing economies elsewhere in the world, not only to clarify the terminology used in this analysis but also to suggest a typology of political expediencies. This distinction, of course, contains no pejorative significance and is drawn simply to note that a nation's relative economic status defines, to a significant degree, its political, social and economic obligations and aspirations which, in turn, influence its chosen role in the international marketplace.

On one end of the continuum, it can be argued that the developed economies demonstrate an overwhelming preoccupation with the preservation of established patterns of production, trade and consumption, while the developing economies, at the other end of the continuum, have a strong interest in the disruption of those patterns and their replacement with an economic order that addresses their needs more favorably. The developed economies are constrained politically to maintain the relative prosperity of their populaces and are therefore inclined to pursue policies aimed at the promotion of economic stability through moderate growth in those basic industries upon which that prosperity depends. In each of the developed economies, elaborate "safety nets," ranging from subsidies to substantial social welfare expenditures to central bank interventions in currency markets, have been erected by the public sector to cushion the private sector against economic instability, which is one by-product of industrial change. The developing economies, in contrast, are constrained politically to increase rapidly the relative prosperity of their populaces and are inclined to pursue policies aimed principally at the development of export-oriented resource and manufacturing industries to provide not only jobs and income but, more importantly, foreign currency earnings upon which other domestic social improvements depend. Indeed, to the extent a populace's social and economic expectations are raised by rapid industrialization, political stability, particularly for governments not popularly elected, may depend increasingly upon economic achievement. In contrast to the safety nets erected in the developed economies, within developing economies governments are more inclined to invest comparatively scarce resources in industries perceived to be vehicles for social and economic mobility.

These very different sets of political constraints and obligations, conditioned by differing economic circumstances, dictate, to a significant degree, the "industrial policies" pursued by nations in the world market. Generally, the developed economies have not pursued industrial policies per se but have made extensive use of indirect mechanisms such as monetary or fiscal policy to influence trade patterns and, hence, industrial change, in a way to promote domestic economic stability. Most developing economies, in contrast, have traditionally pursued aggressive and explicit industrial policies that include many of the following: Prohibitive tariffs or quotas on imports of foreign commodities, subsidies for research and development, production or marketing activities, and "targeting" of foreign markets for entry with specific products or services.

There are many instances, of course, where the distinction between developed and developing nations may become vague or even disappear. Japan, for example, has traditionally pursued aggressive policies to protect domestic markets and simultaneously nurture export-oriented industries. Similarly, some Western European nations, notably France, have also displayed a tendency toward chauvinism in the international marketplace. Moreover, both developed and developing nations pursue, from time to time, "industrial policies" aimed at geopolitical rather than economic goals. One example is the United States' decision to embargo exports of agricultural and high technology products to the Soviet Union following that nation's invasion of Afghanistan in 1979.

INDUSTRIAL CHANGE AND PUBLIC POLICY

Industrial change, driven and conditioned by the interaction of market forces with political expediencies, entails profound implications for national, regional and local economies. Indeed, for over a decade, the American economy has experienced a profound structural transformation manifested principally in the contraction of basic resource and manufacturing industries and the expansion of nonindustrial sectors such as services, trade and finance. In response to the local impacts of such changes, communities, states and regions across the country have initiated or intensified economic development efforts aimed, first and foremost, at industrial retention and, second, at new industry development.

The consequences of these efforts over the past decade confirm, not surprisingly, that market forces are the principal influences on industrial change. Experience also demonstrates that public policies can neither effectively stimulate industrial growth in the absence of *prima facie* market conditions that precipitate such growth, nor halt market-induced industrial decline without imposing significant costs on consumers and the economy generally. It is also clear that economic development is likely to proceed most rapidly and broadly if supported by a governmental infrastructure that encourages innovation and new industry development and also enhances industrial retention.

A broad framework for an infrastructure is suggested by the phases of the life-cycle model. With respect to tax and regulatory burdens imposed on industries by all levels of government, industrial retention efforts would appear to be enhanced by policies that systematically remove or reduce such burdens on industries that have entered the "mature" or "declining" phases of their life-cycles. By extension, new industry development efforts would appear to be enhanced by tax and regulatory exemptions or reductions during an industry's "new" phase. Conversely, the life-cycle model also suggests that during an industry's "growth" phase, and perhaps well into its "mature" phase, the industry has sufficient strength, in terms of both earnings and growth, to absorb tax and regulatory burdens. Moreover, it is during this phase, when the industry's output is growing rapidly, its production process is becoming standardized, and entry to the marketplace depends principally on financial resources, that taxation and regulation are most efficient, equitable and necessary.

Of course, a distinction must be drawn between the comparatively passive, systematic policy framework outlined above and the more activist, ad hoc policies undertaken thus far to assist declining manufacturing industries such as steel and textiles or the several proposals for a "national industrial policy." In stark counterpoint to activist industrial policy efforts, which are characterized principally by the diversion of productive resources from their market-driven employment to some preferred employment, passive measures, exemplified by tax or regulatory abatement for growing and declining industries, amount simply to the "benign encouragement" of an inevitable and, for the economy as a whole, beneficial process.

III. THE U.S. OIL INDUSTRY: COMPOSITION AND CURRENT CONDITIONS

In the early 1980's, the U.S. oil industry achieved maturity as a result of steadily increasing demand and rising prices for crude oil and refined products that had occurred throughout the previous decade. Oil industry expansion, in turn, stimulated employment and output growth in a wide range of manufacturing, construction, transportation and service industries, and it also encouraged rapid economic growth in communities across the country. In the wake of a world-wide oil industry adjustment since 1981, however, the U.S. oil industry has experienced severe and rapid contraction, and many once-growing communities have suffered dislocations of workers and investment. The evidence suggests that trends characterizing the U.S. oil industry are motivated by structural, rather than cyclical, forces; that is, the industry's recent contraction represents the beginning of a long-term decline like that underway in steel, autos and agriculture. This chapter documents the changing organizational and spatial structure of the U.S. oil industry, its diminishing competitiveness in the international marketplace, and the implications of its decline for the national and subnational regional economies.

THE COMPOSITION OF THE U.S. OIL INDUSTRY

The U.S. oil industry is a complex amalgam of many natural resource, manufacturing and transportation industries. As such, it defies precise definition. Conceptually, however, it is helpful to decompose the industry into three functional groupings: crude oil and natural gas production, processing of refined products, and distribution. Within each grouping, specific industries based on two-, three- or four-digit Standard Industrial Classifications (SICs) can be identified to serve as the basis of a workable,[1] though incomplete, definition of the U.S. oil industry. (See Table 1). For the purpose of analysis, the production grouping is defined to consist of SIC's 131 and 132 (Crude Petroleum and Natural Gas), SIC 138 (Oil and Gas Field Services) and SIC 3533 (Oil Field Machinery). This definition is extremely narrow in that it omits several important production-oriented transportation and manufacturing activities nominally assigned to other SICs. For example, the large workboat, barge, and helicopter fleet that supports offshore drilling is classified into SICs 44 and 45 along with a range of unrelated water and air transpor-

[1] The definitional problem is compounded by differences in data collection, classification and reporting between the U.S. Department of Commerce, Bureau of Census, the U.S. Department of Labor, Bureau of Labor Statistics, and the U.S. Department of Energy, Energy Information Administration. The principal discrepancies center on the number of establishments and employment level with Standard Industrial Classifications. While these discrepancies rule out a *precise* accounting of SIC establishment and employment levels, they are not severe enough to obscure general trends or invalidate the analysis.

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tation industries. Similarly, the manufacture of much oil field equipment is scattered among SIC 3317 (Steel Pipes and Tubes), SIC 3498 (Fabricated Pipe and Pipe Fittings), SIC 3561 (Pumps and Pumping Equipment) and SIC 3731 (Ship and Boat Building and Repairing). The processing grouping is defined to include SIC 2865 (Cyclic Crudes and Intermediates), SIC 291 (Petroleum Refining) and SIC 295 (Paving and Roofing Materials). The distribution grouping, finally, is limited to SIC 46 (Pipelines), although as in production grouping, related distribution activities are also found in other classifications, notably SIC 42 (Trucking and Warehousing).

As Table 1 indicates, the bulk, (76.2 percent) of U.S. oil industry employment is concentrated in production and, more specifically, in oil and gas field services, which consists of exploration, drilling and miscellaneous services. Jobs in crude petroleum and natural gas production comprise 29.7 percent of industry employment, while the manufacture of oil field machinery accounts for 7.0 percent of oil industry jobs. The processing phase of the industry employs 21.7 percent of the industry's workers, with the majority in petroleum refining. Distribution accounts for a modest 2.1 percent of U.S. oil industry employment. As of October 1985, total oil industry employment, as defined above, stood at 880,400.

TABLE 1.—EMPLOYMENT AND INDUSTRY DISTRIBUTION OF U.S. OIL INDUSTRY, AS OF OCTOBER 1985

Grouping/SIC/industry	Employment October 1985	Percent of total
Production:		
131,2 Crude petroleum, natural gas	261,700	29.7
138 Oil and gas field services	347,200	39.4
3533 Oil field machinery	61,800	7.0
Subtotal	670,700	76.2
Processing:		
2865 Cyclic crudes and intermediates	30,600	3.5
291 Petroleum refining	132,000	15.0
295 Paving and roofing materials	28,300	3.2
Subtotal	190,900	21.7
Distribution:		
46 Pipelines	18,800	2.1
Subtotal	18,800	2.1
U.S. oil industry total	880,400	100.0

Source: U.S. Department of Labor, Bureau of Labor Statistics.

Traditionally, public attention and antipathy to the oil industry have been directed toward the large, integrated oil companies. Because of their high profile, and because they represent a microcosm of the entire industry, a review of the major integrated companies is an appropriate beginning to the more detailed examination of the industry that follows. It is important to note also that the integrated companies illustrate rather dramatically the maturity achieved by the oil industry in that they are characterized lately by considerable merger and acquisition activity. Moreover, the recent spate of mergers and acquisitions in the oil industry, which is characteristic also of several other American industries, has altered the relative status of the major companies with respect to revenues, capital spending, reserves and liquids productions.

In terms of revenues, a distinction can be drawn between Exxon, Mobil/Superior, Chevron/Gulf and Texaco/Getty, each of which reported 1983 revenues in excess of $50 billion, and a "lower five" consistent of Amoco, ARCO, Shell, Sun and Phillips, each of which realized 1983 revenues between $15 and $30 billion. (See Table 2.) With the exception of Chevron's acquisition of Gulf, however, the industry's merger and acquisition activity appears to have had little effect on the companies' relative standing. The same pattern is evident with respect to capital and exploration spending. (See Table 3.) In 1983, Exxon, Chevron/Gulf, Texaco/Getty and Mobil/Superior each spent approximately $5 billion or more on capital and exploration. Exxon, in fact, spent $9 billion, nearly twice the average of the other merged companies. Once again, Chevron's acquisition of Gulf represents the only significant change in the relative status of the major integrated companies with respect to capital and exploration spending. In terms of proven reserves, however, Table 4 indicates that the relative standing of the major companies was altered considerably by merger and acquisition activity, apparent confirmation of pundits' speculation that it is more profitable for companies to seek reserve additions through exploration on Wall Street than through risky and expensive exploration and drilling. Table 5, which reports the 1983 liquids production of the major companies, appears to offer a more fundamental economic rationale for the expediencies of merger and acquisition. The convergence of liquids production among Exxon, ARCO, Texaco/Getty and Chevron/Gulf suggest a quasi-oligopolistic industry organization in which the principal concern of companies is the maintenance of market share.

TABLE 2.—*Revenues of Major U.S. Oil Companies, 1983*

[Revenues]

Company:	*(Billions)*
Exxon	$94.7
Mobil and Superior	60.8
Mobil	59.0
Chevron and Gulf	58.1
Texaco and Getty	53.2
Texaco	41.1
Amoco	29.5
Chevron	29.2
Gulf	28.9
ARCO	26.3
Shell	19.9
Sun	15.5
Phillips	15.4

Source: Oil and Gas Journal, September 10, 1984.

TABLE 3.—*Capital and Exploration Spending of Major U.S. Oil Companies, 1983*

[Capital spending and exploration]

Company:	*(Billions)*
Exxon	$9.0
Chevron and Gulf	5.8
Texaco and Getty	5.1

TABLE 3.—*Capital and Exploration Spending of Major U.S. Oil Companies, 1983*—Continued

[Capital spending and exploration]

Company:	(Billions)
Mobil and Superior	$4.9
Amoco	4.1
Texaco	3.8
Mobil	3.8
ARCO	3.4
Chevron	3.1
Shell	2.8
Gulf	2.8
Sohio	2.3
Unocal	1.8
Conoco	1.7

Source: Oil and Gas Journal, September 10, 1984.

TABLE 4.—*U.S. Reserves of Major U.S. Oil Companies, 1983*

[U.S. reserves (liquid, billions of barrels)]

Company:	
Sohio	2.82
Exxon	2.78
ARCO	2.57
Shell	2.17
Texaco and Getty	2.16
Chevron and Gulf	1.97
Amoco	1.71
Chevron	1.18
Mobil and Superior	1.04
Texaco	0.97
Mobil	0.86
Gulf	0.79
Unocal	0.66

Source: Oil and Gas Journal, September 10, 1984.

TABLE 5.—*Liquids Production of Major U.S. Oil Companies, 1983*

[U.S. liquids production (billions of barrels)]

Company:	
Exxon	0.28
ARCO	0.24
Texaco and Getty	0.23
Chevron and Gulf	0.22
Sohio	0.22
Shell	0.19
Amoco	0.15
Texaco	0.12
Chevron	0.12
Getty	0.10
Mobil	0.10
Gulf	0.10

Source: Oil and Gas Journal, September 10, 1984.

A more detailed and accurate picture of the oil industry's composition, however, can be drawn through a examination of the structural and spatial characteristics of its production, processing and distribution phases. From this examination emerges a generalization that is important to note before proceeding: Although misperceived too often as being composed almost exclusively of large, integrated, multinational companies, the U.S. oil industry also consists of a large concentration of relatively small, independent drillers, service companies, manufacturers and refiners.

Production.—As Table 6 indicates, over 96 percent of the establishments involved in oil and gas extraction in the United States in 1983 employed fewer than fifty workers. Moreover, these relatively small establishments also employed nearly 53 percent of all workers engaged directly in oil and gas extraction in 1983. Indeed, less than 20 percent of oil and gas extraction workers are employed by establishments of 500 or more employees. Not surprisingly, slightly over 70 percent of oil and gas extraction employment is located in five oil- and gas-endowed states: Texas, Louisiana, Oklahoma, California and Alaska. (See Table 7.) The remaining 30 percent is sprinkled among only a few more states including Wyoming, Colorado, Mississippi and Alabama.

TABLE 6.—ESTABLISHMENT AND EMPLOYMENT DISTRIBUTION OF U.S. OIL AND GAS EXTRACTION INDUSTRY, 1983

Establishment size	Number of establishments	Percent of total	Total employment	Percent of total
Less than 5 employees	12,628	50.7	22,229	4.6
5 to 9	4,219	16.9	27,962	5.8
10 to 19	3,341	13.4	45,840	9.5
20 to 49	2,776	11.1	84,915	17.5
50 to 99	1,083	4.3	74,132	15.3
100 to 249	598	2.4	91,110	18.8
250 to 499	167	0.7	56,274	11.6
500 to 999	62	0.2	42,148	8.7
Over 1,000	26	0.1	40,626	8.4
Total	24,900	100.0	485,236	100.0

Source: U.S. Department of Commerce, Bureau of Census.

TABLE 7.—GEOGRAPHIC DISTRIBUTION OF U.S. OIL AND GAS EXTRACTION INDUSTRY EMPLOYMENT, 1983

State	Employment	Percent of total
Texas	184,685	38.1
Louisiana	69,342	14.3
Oklahoma	56,066	11.6
California	29,320	6.0
Alaska	7,023	1.4
Other	138,800	28.6
Total	485,236	100.0

Source: U.S. Department of Commerce, Bureau of Census.

Table 8 lists the major manufacturers of oil field machinery (SIC 3533 only) and reports estimated 1984 oil field machinery sales and their share of each company's total 1984 sales. Most of the major manufacturers of oil field machinery appear relatively diversified in that, on average, only 30 percent of the companies' sales are in oil field machinery. As in oil and gas extraction, most (nearly 80 percent) of the establishments engaged in the manufacture of oil field machinery are relatively small, and employ fewer than fifty workers. (See Table 9.) Conversely, the bulk of oil field machinery manufacturing employment is concentrated in the larger, diversified manufacturing firms identified in Table 8. In fact, 32.1 percent of the SIC's workers are employed in establishments of at least 1,000 employees. Not surprisingly, given the geographical distribution of oil and gas extraction employment and the practical constraint of market proximity, most oil field machinery manufacturing employment is located in four states characterized by a relatively high level of drilling activity: Texas, California, Oklahoma and Louisiana. (See Table 10.)

TABLE 8.—MAJOR U.S. OIL FIELD MACHINERY MANUFACTURERS, ESTIMATED SALES AND RELATIVE SPECIALIZATION, 1984

Company	Estimated oil field machinery sales (millions)	Oil field machinery as a percent of total sales
Halliburton	$946.9	17.5
Hughes	656.9	54.0
Baker International	411.1	22.4
Smith International	399.1	57.3
Big Three Industries	203.3	26.0
Cameron Iron Works	171.0	33.2
Joy Manufacturing	140.1	20.7
CAMCO	132.4	78.4
Masco Industries	119.8	22.0
Hydril	110.3	33.7
Weatherford International	58.3	40.3
Lufkin Industries	57.0	32.9
Gearhart Industries	51.9	16.4
Trico Industries	25.7	25.7
Hinderliter Industries	24.4	46.1

Source: Dun and Bradstreet, Million Dollar Directory.

TABLE 9.—ESTABLISHMENT AND EMPLOYMENT DISTRIBUTION OF U.S. OIL FIELD MACHINERY INDUSTRY, 1983

Establishment size	Number of establishments	Percent of total	Total employment	Percent of total
Less than 5 employees	224	25.2	467	0.8
5 to 9	163	18.4	1,126	1.8
10 to 19	144	16.2	1,982	3.2
20 to 49	169	19.0	5,183	8.4
50 to 99	55	6.2	3,724	6.0
100 to 249	82	9.2	13,000	21.0
250 to 499	32	3.6	10,865	17.6
500 to 999	9	1.0	5,662	9.2
Over 1,000	10	1.1	19,844	32.1
Total	888	100.0	61,853	100.0

Source: U.S. Department of Commerce, Bureau of Census.

TABLE 10.—GEOGRAPHIC DISTRIBUTION OF U.S. OIL FIELD MACHINERY INDUSTRY EMPLOYMENT, 1983

State	Employment	Percent of total
Texas	[1] 37,112	60.0
California	9,144	14.8
Oklahoma	5,424	8.8
Louisiana	2,187	3.5
Other	7,986	12.9
Total	61,853	100.0

[1] Estimated.

Source: U.S. Department of Commerce, Bureau of Census.

Processing.—Table 11 lists the major U.S. petrochemical and refined product manufacturers, ranked by operable crude distillation capacity as of January 1985. Not surprisingly, large volume refining and distillation is dominated by the major integrated oil companies. Table 11 indicates also that the refining phrase of the oil industry, like reserve additions and liquids production, has been affected by merger and acquisition activity. Chevron's acquisition of Gulf, for instance, increased the former's operable refining capacity by over 50 percent, and widened the margin between Chevron/Gulf and the nation's next largest refiner, Exxon, by over 1,000,000 barrels per calendar day (BCD). Another reflection of merger activity in refining is the presence of U.S. Steel, whose 1983 acquisition of Marathon gave the former considerable petroleum refining capacity. Similarly, Southland entered the refining industry through its acquisition of Citgo's huge Lake Charles, Louisiana refinery to supply gasoline to its 7-Eleven convenience stores. Most refineries, however, are relatively small: over 60 percent of the nation's 223 operable refineries possess a crude distillation capacity of less than 50,000 BCD, while only 22 refineries boast an operable capacity exceeding 175,000 BCD. (See Table 12.)

TABLE 11.—*Major U.S. Refiners, as of Jan. 1, 1985*

[Total operable capacity (barrels per calendar day)]

Company:	
Chevron and Gulf	2,307,900
Chevron	1,484,700
Exxon	1,200,000
Texaco	1,199,000
Shell	1,005,000
Amoco	986,000
Gulf	823,200
ARCO	768,000
Mobil	750,000
United States Steel	588,000
Unocal	490,000
Sohio	456,000
du Pont	429,774
Sun	358,000
Ashland	353,343
Southland	320,000
Phillips	300,000

Source: U.S. Department of Energy, Energy Information Administration.

TABLE 12.—*Capacity Distribution of Operable U.S. Refineries, as of Jan. 1, 1985*

[Number of operable U.S. refineries]

Crude distillation capacity—(Barrels per calendar day)	
Less than 10,000	56
10,001 to 30,000	43
30,001 to 50,000	38
50,001 to 100,000	39
100,001 to 175,000	25
Over 175,000	22
Total	223

Source: U.S. Department of Energy, Energy Information Administration.

As in the production phase of the oil industry, most petrochemical and refined product manufacturing establishments are relatively small with respect to employment size, while most employment is concentrated in the larger establishments. As Table 13 indicates, approximately 66 percent of the nation's petrochemical manufacturing establishments employ fewer than 100 workers. Conversely, the bulk of petrochemical employment is found in establishments of 100 employees or more. Similarly, over 87 percent of establishments engaged in the manufacture of refined products employ fewer than 100 workers. (See Table 14.) Over 78 percent of refined products employment, however is concentrated in establishments of more than 100 workers.

TABLE 13.—ESTABLISHMENT AND EMPLOYMENT DISTRIBUTION OF U.S. PETROCHEMICAL INDUSTRY, 1983

Establishment size	Number of establishments	Percent of total	Total employment	Percent of total
Less than 5 employees	22	12.4	N.A.	N.A.
5 to 9	14	7.9	87	0.4
10 to 19	17	9.6	238	1.1
20 to 49	41	23.0	1,306	6.1
50 to 99	24	13.5	1,555	7.3
100 to 249	35	19.7	5,325	25.0
250 to 499	17	9.6	N.A.	N.A.
500 to 999	7	3.9	N.A.	N.A.
Over 1,000	1	0.6	N.A.	N.A.
Total	178	100.0	21,273	100.0

Source: U.S. Department of Commerce, Bureau of Census.

TABLE 14.—ESTABLISHMENT AND EMPLOYMENT DISTRIBUTION OF U.S. PETROLEUM PRODUCTS INDUSTRY, 1983

Establishment size	Number of establishments	Percent of total	Total employment	Percent of total
Less than 5 employees	714	32.0	1,466	1.0
5 to 9	404	18.1	2,652	1.9
10 to 19	330	14.8	4,551	3.2
20 to 49	343	15.4	10,638	7.4
50 to 99	167	7.5	11,509	8.0
100 to 249	154	6.9	24,549	17.1
250 to 499	57	2.6	19,972	13.9
500 to 999	40	1.8	26,727	18.6
Over 1,000	24	1.1	41,283	28.8
Total	2,233	100.0	143,347	100.0

Source: U.S. Department of Commerce, Bureau of Census.

Unlike the production phase of the oil industry, which is location-sensitive to resource availability and concentrated heavily in a few states, the processing phase is much more sensitive to its consumer and industrial markets and is therefore relatively dispersed geographically. Table 15, which reports the location and capacity of operable U.S. refineries by Petroleum Administration for Defense (PAD) Districts and states, demonstrates the processing phase's relative dispersion. Not surprisingly, given their large consumer and industrial complexes, the East and West Coasts along with the Midwest, boast a large number of refineries and considerable operable capacity.

TABLE 15.—LOCATION AND CAPACITY OF OPERABLE U.S. REFINERIES, AS OF JAN. 1, 1985

District/State	Operable refineries			Capacity—Barrels per calendar day		
	Total	Operating	Idle	Total	Operating	Idle
East coast	18	14	4	1,472,050	1,257,000	215,050
Delaware	1	1	0	140,000	140,000	0
Georgia	2	2	0	28,500	28,500	0
Maryland	1	0	1	14,200	0	14,200
New Jersey	6	5	1	570,400	414,400	156,000
New York: East	1	0	1	41,850	0	41,850
North Carolina	1	0	1	3,000	0	3,000
Pennsylvania: East	4	4	0	622,100	622,100	0
Virginia	2	2	0	52,000	52,000	0
Appalachian No. 1	8	7	1	1,112,891	1,121,711	180
Pennsylvania: West	6	5	1	96,221	96,041	180
West Virginia	2	2	0	16,670	16,670	0
PAD District I Total	26	21	5	1,584,941	1,300,711	215,230
Appalachian No. 2	1	1	0	66,000	66,000	0
Indiana, Illinois, Kentucky	27	25	2	2,251,500	1,996,900	254,600
Illinois	8	7	1	960,500	706,500	254,000
Indiana	6	6	0	442,300	442,300	0
Kentucky	4	3	1	222,500	221,900	600
Michigan	4	4	0	116,500	116,500	0
Ohio: West	4	4	0	449,700	449,700	0
Tennessee	1	1	0	60,000	60,000	0
Minnesota, Wisconsin, Dakotas	5	4	1	306,143	301,143	5,000
Minnesota	2	2	0	204,143	204,143	0
North Dakota	2	1	1	63,000	68,000	5,000
Wisconsin	1	1	0	39,000	39,000	0
Oklahoma, Kansas, Missouri	13	12	1	719,050	711,450	7,600
Kansas	7	7	0	337,450	337,450	0
Oklahoma	6	5	1	381,600	374,000	7,600
PAD District II Total	46	42	4	3,342,683	3,075,483	287,200
Texas Inland	17	16	1	565,100	553,250	11,850
Texas Gulf Coast	22	19	3	3,705,774	3,382,874	322,900
Louisiana Gulf Coast	19	15	4	2,574,656	2,446,500	128,156
Alabama: Gulf	2	1	1	106,600	80,000	26,600
Louisiana: Gulf	16	13	3	2,173,056	2,071,500	101,556
Mississippi: Gulf	1	1	0	295,000	295,000	0
North Louisiana, Arkansas	16	15	1	257,780	235,800	21,980
Alabama: Inland	2	1	1	43,000	33,500	9,500
Arkansas	4	4	0	65,480	53,000	12,480
Louisiana: Inland	5	5	0	75,900	75,900	0
Mississippi: Inland	5	5	0	73,400	73,400	0
New Mexico	4	4	0	68,200	68,200	0
PAD District III Total	78	69	9	7,171,510	6,686,624	484,886
Colorado	3	3	0	82,700	82,700	0
Montana	6	5	1	148,550	135,150	13,400
Utah	7	6	1	161,500	156,500	6,000
Wyoming	6	6	0	172,005	172,005	0
PAD District IV Total	22	20	2	564,755	545,355	19,400
Alaska	4	4	0	139,000	139,000	0
California	37	34	3	2,080,600	2,089,600	296,470
Hawaii	1	1	0	48,000	48,000	0
Nevada	1	1	0	4,500	4,500	0
Oregon	1	0	1	15,000	0	15,000
Washington	7	7	0	411,300	411,300	0

TABLE 15.—LOCATION AND CAPACITY OF OPERABLE U.S. REFINERIES, AS OF JAN. 1, 1985—Continued

District/State	Operable refineries			Capacity—Barrels per calendar day		
	Total	Operating	Idle	Total	Operating	Idle
PAD District V Total	51	47	4	2,994,870	2,683,400	311,470
U.S. Total	223	199	24	15,658,700	14,360,583	1,298,186
Puerto Rico	3	3	0	121,000	121,000	0
Virgin Islands	1	1	0	545,000	395,000	150,000
Guam	1	0	1	43,900	0	43,900
Hawaiian Foreign Trade Zone	1	1	0	62,000	62,000	0

Source: U.S. Department of Energy, Energy Information Administration.

Distribution.—Following the pattern evident in other phases of the oil industry, most of the establishments engaged in the pipe line transportation of petroleum products are relatively small. (See Table 16.) The bulk of the pipeline industry's employment is concentrated in small- to medium-sized establishments. Since the pipeline industry is concerned principally with the transportation of crude petroleum and natural gas, like the production phase of the industry, it is location-sensitive to resource availability and oil and gas extraction activity. Thus, the bulk of U.S. pipeline industry employment is concentrated in Texas, Oklahoma, Alaska, California and Louisiana. (See Table 17.)

TABLE 16.—ESTABLISHMENT AND EMPLOYMENT DISTRIBUTION OF U.S. PIPELINE INDUSTRY, 1983

Establishment size	Number of establishments	Percent of total	Total employment	Percent of total
Less than 5 employees	214	34.7	N.A.	N.A.
5 to 9	95	15.4	644	3.4
10 to 19	108	17.5	1,540	8.2
20 to 49	110	17.9	3,408	18.1
50 to 99	42	6.8	2,926	15.6
100 to 249	38	6.2	6,046	32.2
250 to 499	7	1.1	N.A.	N.A.
500 to 999	2	0.3	N.A.	N.A.
Over 1,000	0	0	0	0
Total	616	100.0	18,804	100.0

Source: U.S. Department of Commerce, Bureau of Census.

TABLE 17.—GEOGRAPHIC DISTRIBUTION OF U.S. PIPELINE INDUSTRY EMPLOYMENT, 1983

State	Employment	Percent of total
Texas	5,123	27.2
Oklahoma	2,356	12.5
Alaska	[1] 1,750	9.3
California	1,284	6.8
Louisiana	892	4.7
Other	7,399	39.3
Total	18,804	100.0

[1] Estimated.

Source: U.S. Department of Commerce, Bureau of Census.

Current Conditions

An examination of current conditions and recent trends in the U.S. oil industry leads inescapably to the conclusion that the industry is distressed and in the throes of a profound, long-term, structural transformation. For example, following healthy employment growth throughout the previous decade, beginning in 1981 the oil industry began to register steep declines in employment as a consequence of business failures, plant closings and capacity reductions. Since 1981, the industry has suffered a net loss of 207,000 jobs. (See Table 18.) It is important to emphasize, however, that because of the very limiting definition of the oil industry used in this report, both overall employment and job losses are considerably understated: actual oil industry employment likely approaches 1,000,000 while actual job losses since 1981 are probably in the vicinity of 300,000. Further, as Table 18 indicates, all phases of the oil industry have experienced severe job losses since 1981. Through the examination of recent trends characteristic of the industry's production, processing and distribution phases, more compelling evidence emerges to suggest an industry in decline.

TABLE 18.—U.S. OIL INDUSTRY EMPLOYMENT CHANGE BY MAJOR GROUPING, 1978 TO OCTOBER 1985

	October 1985	1983	1981	1978	Average annual percent change: 1983 to October 1985	1981–83	1978–81
Production	670,700	671,600	814,400	506,600	−0.1	−8.8	20.3
Processing	190,900	228,700	251,200	244,400	−8.3	−4.5	0.9
Distribution	18,800	20,700	21,800	19,600	−4.6	−2.5	3.7
U.S. oil industry total	880,400	921,000	1,087,400	770,600	−2.2	−7.7	13.7

Source: U.S. Department of Commerce, Bureau of Census; U.S. Department of Labor, Bureau of Labor Statistics.

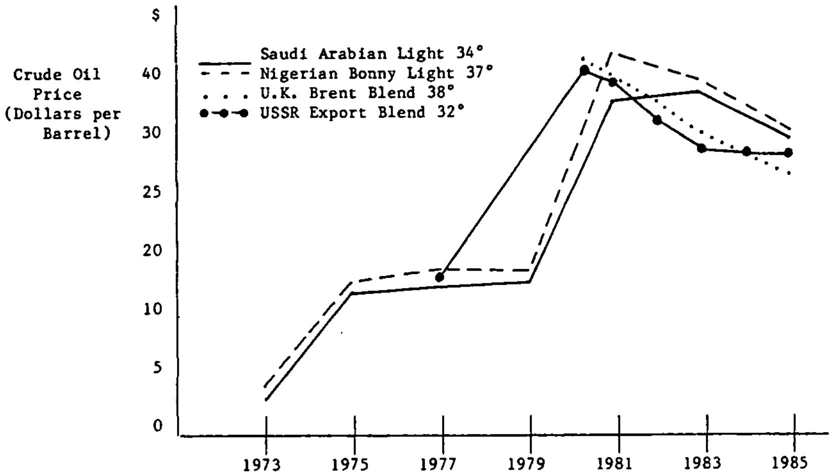
Production.—The single most important influence on the production phase of the oil industry is the price of crude oil, which is a reflection of its relative scarcity. Simply put, rising crude oil prices stimulate a higher level of drilling activity and demand for oil field equipment, while falling prices suppress drilling activity and equipment requirements. Since the U.S. is a comparatively minor producer of crude oil, the price of the U.S. benchmark grade (West Texas Intermediate), tends to follow, rather than lead, the general trend for crude oil prices in the world market. As Figure 3 indicates, prices for the major foreign benchmark grades have been falling steadily from a peak of $35 to $40 per barrel between 1980 and 1981. The fall has been particularly steep for the United Kingdom's benchmark grade, North Sea Brent Blend 38°. Not surprisingly, the U.S. average wellhead price for crude oil mirrors the prices for major foreign grades and has also fallen sharply from a 1981 peak of approximately $33 per barrel. (See Figure 4.)

The sharp fall in oil prices has resulted in a dramatic plunge in domestic drilling activity from a peak of nearly 4,000 operating rotary drilling rigs in 1981 to an estimated 1,700 in January 1986. (See Figure 4.) Moreover, throughout January 1986, and well into

February, crude oil prices continued to slide downward. (See Figure 5.) On the spot market, West Texas Intermediate fell in the course of three weeks, from $26 per barrel to approximately $16 per barrel. A similar trend is evident for the U.K.'s Brent. Futures prices have also fallen sharply, and many oil companies and governments are responding to lowering their official posted prices. In the wake of this latest round of oil price cuts, it is conceivable that the U.S. operating rotary rig count could plunge below 1,000.

Figure 3

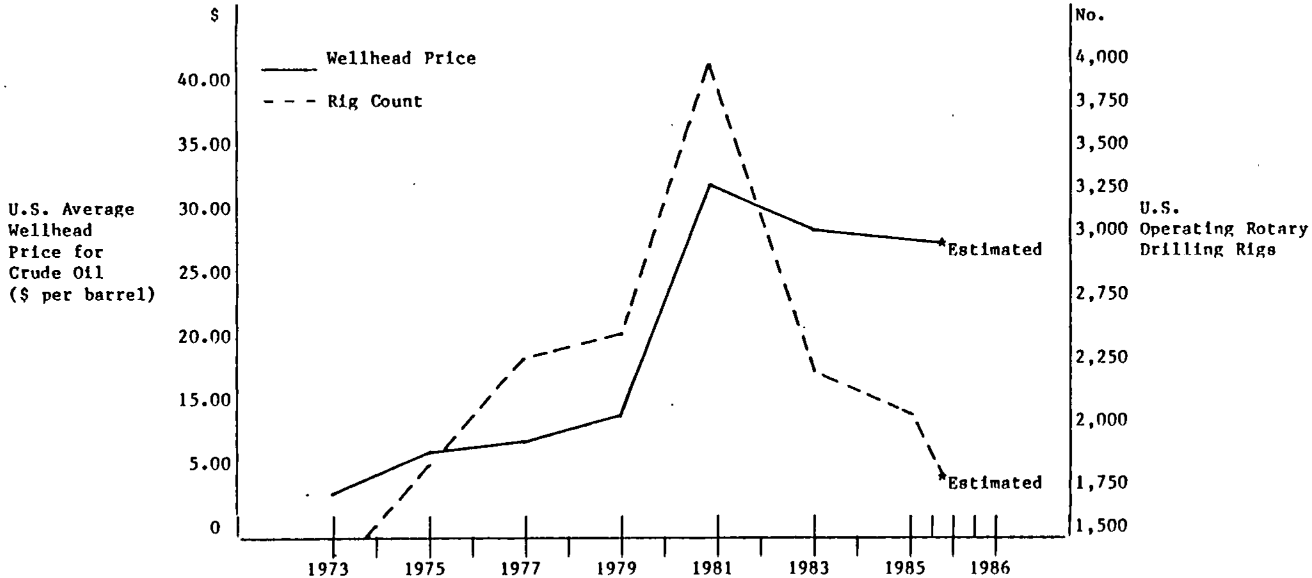
Sales or Long-Term Contract Prices of
Selected Foreign Crude Oils, 1973-1985



Source: Department of Energy, Energy Information Administration.

Figure 4

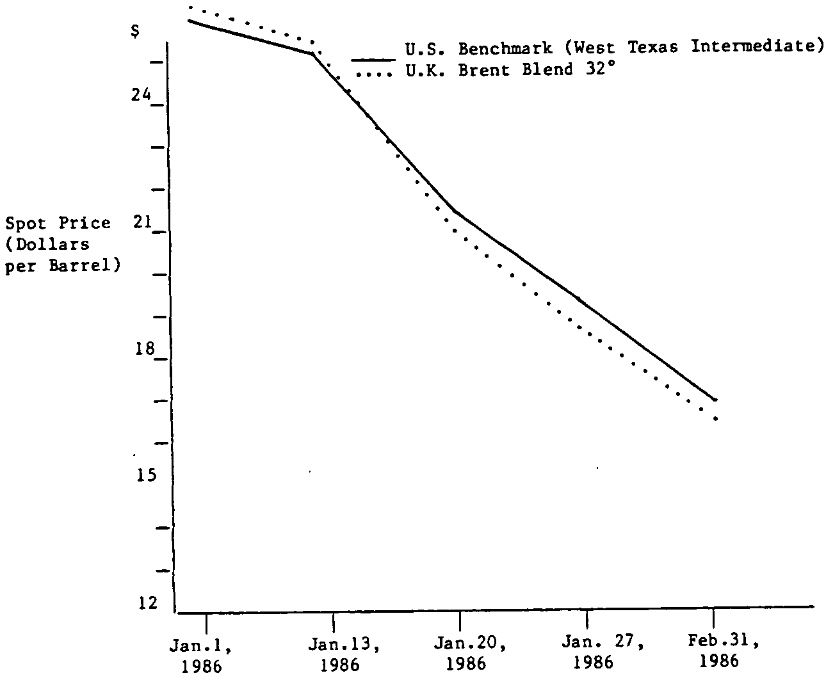
U.S. Average Wellhead Price for Crude Oil
and U.S. Operating Rotary Drilling Rigs,
1973-Present



Source: Department of Energy, Energy Information Administration; Hughes Tool Company.

Figure 5

Spot Prices for U.S. and U.K. Crude Oil,
January 1, 1986 to Present



Source: New York Times.

The sharp drop in domestic drilling activity has been accompanied by a severe contraction of oil and gas extraction employment. (See Figure 19.) In crude petroleum and natural gas, employment has declined only modestly since 1981, reflecting the SIC's largely white-collar makeup. As oil prices continue to decline, however, more white-collar oil and gas jobs are likely to be lost, evidenced by Atlantic Richfield's recent decision to lay off 2,000 predominantly administrative workers. The most severe drilling-related job losses to date have involved mostly blue-collar production workers in oil and gas field services. Since 1981, 83,000 oil field workers have lost jobs.

TABLE 19.—U.S. CRUDE OIL PRODUCTION, DRILLING, EXPLORATION, AND SERVICE EMPLOYMENT CHANGE, 1978 TO OCTOBER 1985

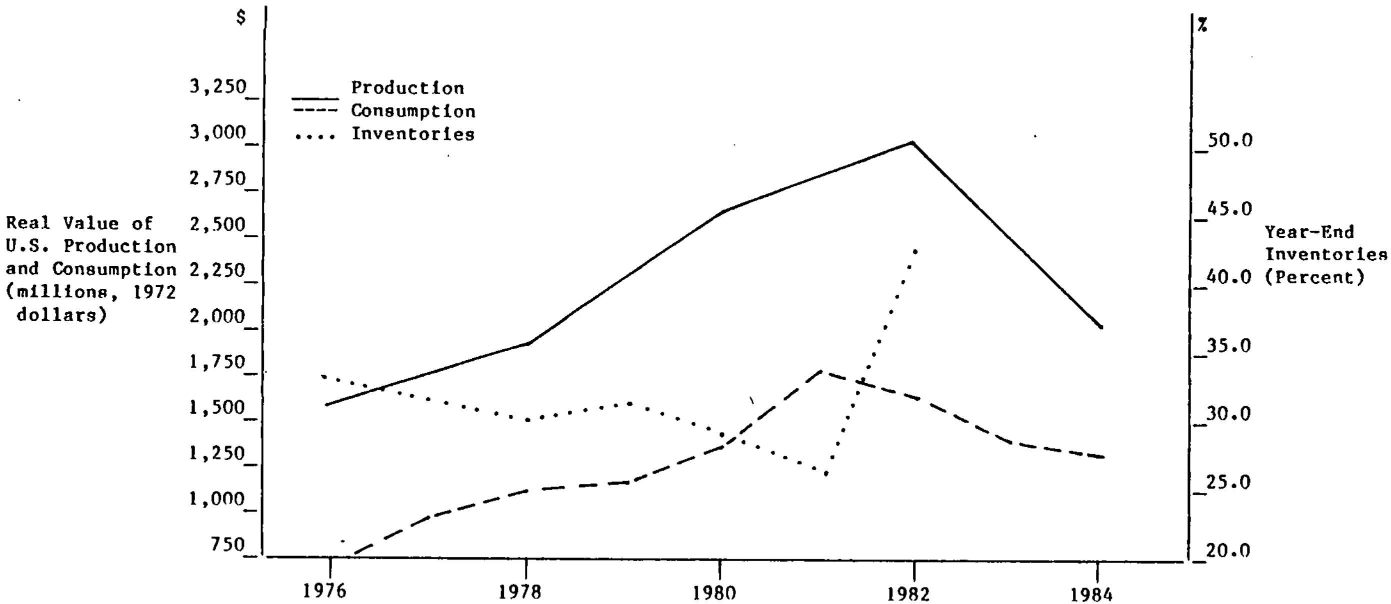
SIC/Industry	October 1985	1983	1981	1978	Average annual percent change		
					1983 to October 1985	1981-1983	1978-1981
131,2 Crude petroleum natural gas	261,700	263,000	261,900	182,500	−0.3	0.2	14.5
138 Oil and gas field services	347,200	336,900	430,200	246,700	1.5	−10.8	24.8
1381 Drilling	N.A.	107,007	153,592	88,923	N.A.	−15.2	24.2
1382 Exploration services	N.A.	33,083	45,760	22,233	N.A.	−13.9	35.3
1389 Oil field services, NEC	N.A.	172,023	173,621	116,965	N.A.	−0.5	16.1
Total	608,900	599,900	692,100	429,200	0.8	−6.7	20.4

Source: U.S. Department of Commerce, Bureau of Census; U.S. Department of Labor, Bureau of Labor Statistics.

As oil prices have fallen and drilling activity has waned, the demand for oil field machinery has diminished considerably. Since 1981, the real value of domestic oil field machinery production and consumption has dropped sharply. (See Figure 6.) Despite declining production, inventories of oil field machinery have risen dramatically and, as of 1982, accounted for slightly over 40 percent of total production. To a significant degree, declining production and inventory accumulation are a consequence also of the growing foreign presence in the oil field machinery industry. (See Figure 7.) Because of experience gained in the North Sea, British, Dutch, Norwegian, French and German manufacturers of oil field machinery are now producing large quantities of relatively high-quality drilling equipment that is price competitive in export markets dominated formerly by the U.S. As Figure 8 demonstrates, in fact, the growing competitiveness of foreign oil field machinery manufacturers, coupled with the vicissitudes of a shrinking market because of falling crude oil prices and diminished drilling activity, has resulted in a sharp drop in the real value of U.S. drilling equipment exports per operating foreign rotary rig. In other words, for each foreign drilling rig, there is an increasing likelihood that the entire apparatus, or most of its components, will have been manufactured outside the U.S. The employment consequences of increased competition in shrinking domestic and foreign markets have been severe: since 1981, employment in the U.S. oil field machinery industry has fallen by nearly half, from over 122,000 workers to 61,800. (See Table 20.)

Figure 6

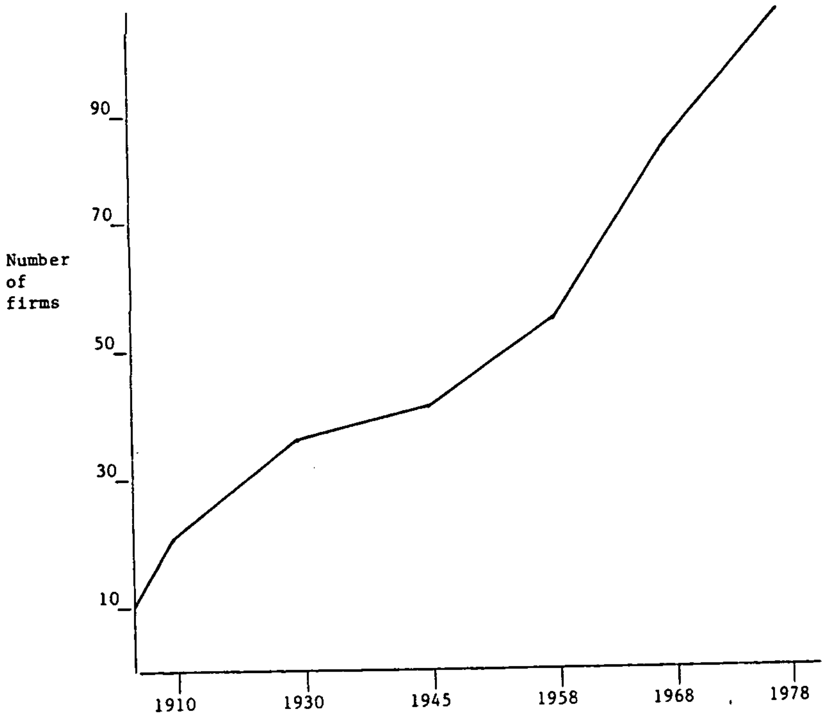
Real Value of U.S. Oil Field Machinery Production and Consumption, and Year-End Inventories as a Percent of Total Production, 1976-1984



Source: U.S. Department of Commerce, Bureau of Census; U.S. Department of Labor, Bureau of Labor Statistics.

Figure 7

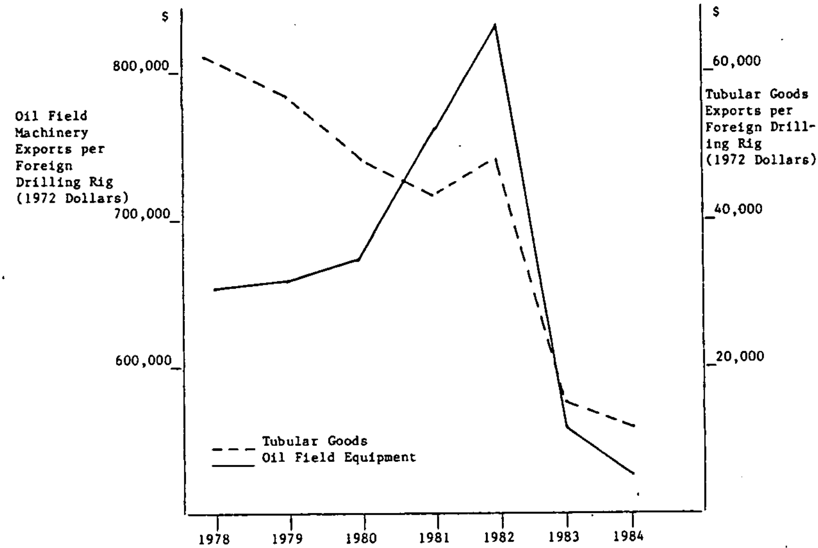
Cumulative Number of Foreign Oil
Field Equipment Manufacturers by Year
of Firm Founding



Source: Dun and Bradstreet.

Figure 8

Real Value of U.S. Oil Field Machinery and
Tubular Goods Exports per Operating Foreign
Rotary Drilling Rig,
1978-1984



Source: Hughes Tool Company; U.S. Department of Commerce, Bureau of Census; U.S. Department of Labor, Bureau of Labor Statistics.

TABLE 20.—U.S. OIL FIELD MACHINERY EMPLOYMENT CHANGE, 1978 TO OCTOBER 1985

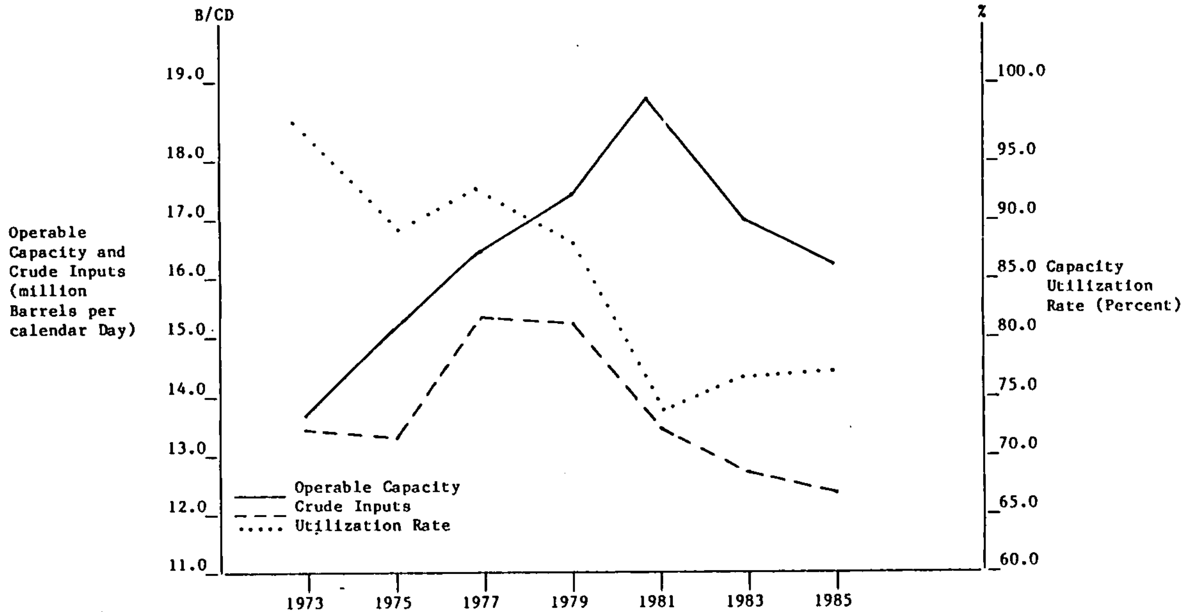
SIC/Industry	October 1985	1983	1981	1978	Average annual percent change		
					1983 to October 1985	1981-83	1978-81
3533 Oil field machinery	61,800	71,700	122,300	77,300	−6.9	−20.7	19.4

Source: U.S. Department of Commerce, Bureau of Census; U.S. Department of Labor, Bureau of Labor Statistics.

Processing.—Like the manufacture of oil field machinery, the processing phase of the U.S. oil industry suffers from the effects of growing competition in a shrinking market. As Figure 9 demonstrates, the refined products industry has been characterized since 1981 by a sharp reduction in crude distillation capacity from nearly 19 million BCD to under 16 million BCD, steadily falling crude oil inputs, and a capacity utilization rate consistently under 80 percent. Much of the refined products industry's current ill health is attributable to a diminishing consumer and industrial demand for refined products. (See Figure 10.) Since the late 1970's, the demand for refined products, especially finished gasoline, distillate and residual fuel oil, has declined steadily. At the same time, although crude oil imports have dropped significantly since the last 1970's, imports of refined products have increased and are capturing an ever-larger share of the domestic refined products market. (See Figure 11.) Imports of finished gasoline in particular, are on the rise.

Figure 9

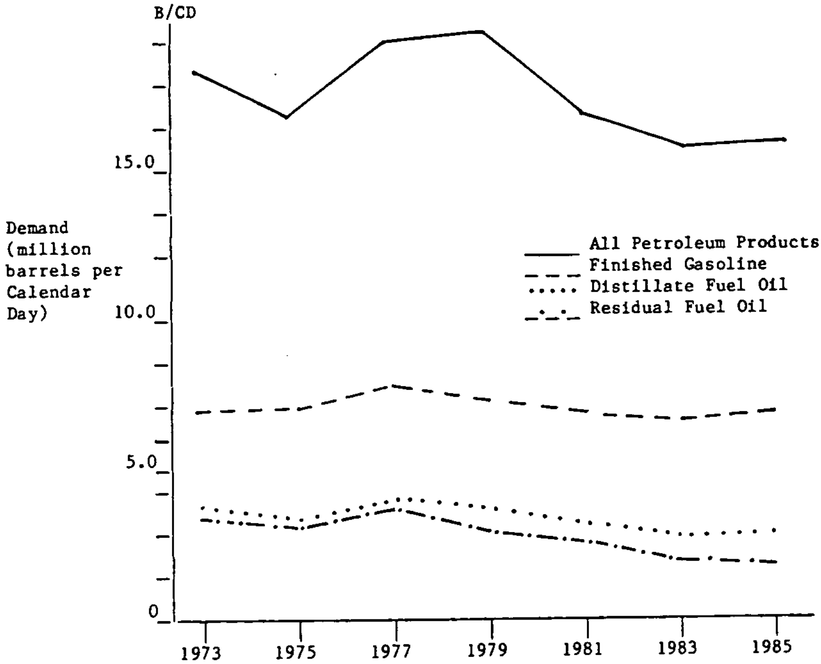
U.S. Refinery Operable Capacity, Crude Inputs
and Utilization Rate, 1973-1985



Source: U.S. Department of Energy, Energy Information Administration.

Figure 10

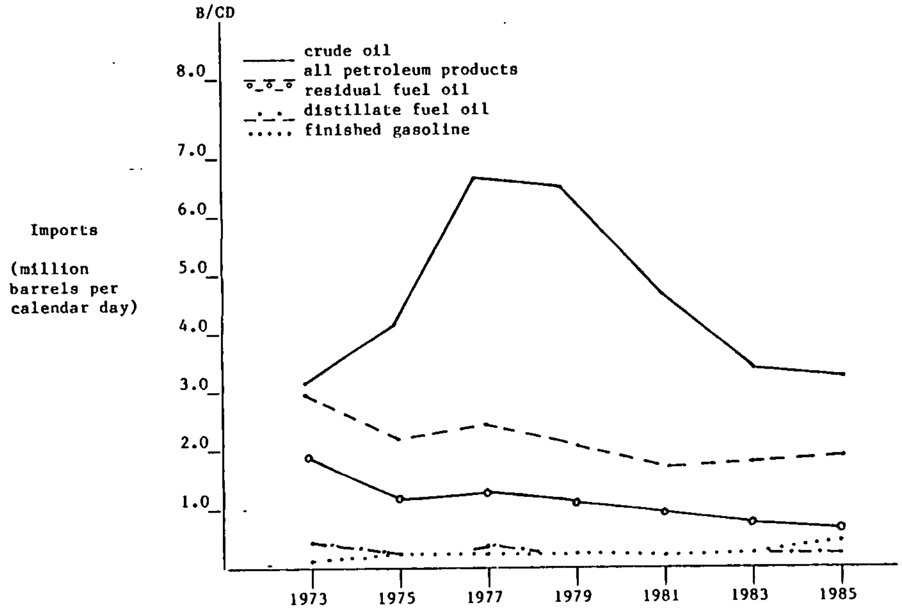
U.S. Demand for All Petroleum Products, Finished Gasoline, Distillate Fuel Oil and Residual Fuel Oil, 1973-1985



Source: U.S. Department of Energy, Energy Information Administration.

Figure 11

U.S. Imports of Crude Oil, All Petroleum Products, Finished Gasoline, Distillate Fuel Oil and Residual Fuel Oil, 1973-1985



Source: U.S. Department of Energy, Energy Information Administration.

In response to diminishing competitiveness in the domestic refined products market and characterized by reduced, yet still excessive, capacity and low utilization rates, the refining industry has contracted rapidly and severely since 1981. This contraction has been accomplished principally through closures of refineries in every region of the country. Since 1981, 111 refineries with a total capacity in excess of 2.5 million BCD have been shut down. (See Table 21.) While 53 of the shut-down refineries are located in the Southwest, another 37 are located along the East Coast and in the Midwest. Moreover, as Figure 9 indicates, despite the closure of over 100 refineries, plus capacity reductions totalling nearly 500,000 BCD among operable refineries, the refining industry remains plagued by excess capacity and a relatively low utilization rate, suggesting that additional shutdowns and capacity reductions are inevitable. Not surprisingly, the employment consequences of refining industry contraction have been severe: since 1981, 48,000 petrochemical and refining industry workers have lost their jobs. (See Table 22.) Moreover, because of the steadily declining demand for refined products plus the growing foreign presence in the domestic refined products market, it is likely that the processing phase of the oil industry will employ fewer than 100,000 workers by the turn of the century.

Distribution.—As a consequence of a significantly reduced overall level of oil industry activity, particularly with respect to production and processing, employment in the pipeline transportation of crude oil and gas has declined 13.8 percent since 1981. (See Table 23.)

TABLE 21.—LOCATION AND CAPACITY OF U.S. REFINERIES SHUTDOWN SINCE JAN. 1, 1981

District/Refinery	Location	Capacity [1]	Date shutdown	Years in operation
PAD District I:				
Amoco Oil Co	Baltimore, MD	15,000	March 1982	25+
Ashland Oil Inc	Buffalo, NY	64,000	December 1984	36+
ATC Petroleum Inc	Wilmington, NC	11,900	December 1981	8
ATC Petroleum Inc	Newington, NH	13,400	December 1981	7
Elk Refining Co., Division	Falling Rock WV	5,600	December 1982	25+
Manatee Energy Co	Port Manatee, FL	28,400	October 1981	2
Mobil Oil Corp	Buffalo, NY	43,000	July 1981	25+
Quaker State Oil Refining Corp	Emlenton, PA	0	December 1983	25+
Seminole Refining Inc	St. Marks, FL	15,000	April 1982	25+
Total		196,300		
PAD District II:				
Amoco Oil Co	Sugar Creek, MI	104,000	June 1982	25+
Amoco Oil Co	Wood River, IL	104,000	October 1981	25+
Ashland Oil Inc	Findlay, OH	20,400	December 1984	36+
Ashland Oil Inc	Louisville, KY	25,200	December 1984	36+
Champlin Petroleum Co	Enid, OK	53,800	December 1984	25+
Conoco Inc	Wrenshall, MN	23,500	September 1981	5
CRA, Inc	Scottsbluff, NE	5,600	June 1982	25+
Dillman Oil Recovery Inc	Oblong, IL	1,200	February 1982	4
Dow Chemical U.S.A.	Bay City, MI	20,000	September 1981	25+
E-Z Serv Refining Inc	Shallow Water, KS	9,500	February 1982	25+
Energy Cooperative Inc	East Chicago, IN	126,000	June 1982	25+
Energy Development	Crossville, IL	1,000	April 1981	22
Gulf Oil Corp	Toledo, OH	50,300	November 1981	25+

TABLE 21.—LOCATION AND CAPACITY OF U.S. REFINERIES SHUTDOWN SINCE JAN. 1, 1981—Continued

District/Refinery	Location	Capacity [1]	Date shutdown	Years in operation
Hudson Refining Co., Inc	Cushing, OK	19,000	November 1983	6
Indiana Refining Inc	Princeton, IN	5,000	February 1981	23
Industrial Fuel & Asphalt of Indiana Inc.	Hammond, IN	7,600	June 1982	25+
Mid-America Refining Co., Inc	Chanute, KS	3,000	July 1982	25+
Mobil Oil Corp	Augusta, KS	50,000	September 1983	25+
Northland Oil & Refining Co	Dickinson, ND	5,000	February 1982	7
Oklahoma Refining Co	Cyril, OK	12,750	December 1984	36+
Oklahoma Refining Co	Thomas, OK	11,600	December 1984	4
Okmulgee Refining Co	Okmulgee, OK	25,000	December 1984	25+
Phillips Petroleum Co	Kansas City, KS	80,000	September 1982	25+
Texaco Inc	Lockport, IL	72,000	October 1981	25+
Texas American Petrochemical Inc.	West Branch, MI	11,500	February 1981	25+
Tonkawa Refining Co	Arnett, OK	12,000	September 1984	16
Toaco Corp	Duncan, OK	47,000	December 1984	35
Wireback Oil Co	Plymouth, IL	1,800	March 1981	25+
Total		907,750		
PAD District III:				
Adobe Refining Co., Division of Funding Systems Refining Corp.	La Blanca, TX	5,200	December 1981	25+
Bayou State Oil Corp	Hosston, LA	3,000	March 1982	25+
Brio Refining Inc	Friendswood, TX	12,500	December 1982	4
Bronco Refining Co	Houston, TX	2,250	July 1982	1
Carbonit Refining Co	Hearne, TX	11,000	December 1982	6
Caribou-Four Corners Inc	Farmington, NM	2,200	August 1982	19
Celeron Oil & Gas Co	Mermentau, LA	11,000	August 1982	6
Clinton Manges	Palestine, TX	6,000	July 1982	25+
Copano Refining Co	Ingleside, TX	11,100	February 1982	4
Dorchester Refining Co	Mount Pleasant, TX	26,500	December 1982	36+
Dow Chemical USA	Freeport, TX	190,000	June 1982	1
Eagle Refining Corp	Jacksboro, TX	1,800	July 1982	1
Eddy Refining Co	Houston, TX	3,250	November 1984	36+
Erickson Refining Corp	Port Neches, TX	30,000	August 1983	4
Evangeline Refining Co	Jennings, LA	4,500	December 1982	25+
GHR Energy Corp	Good Hope, LA	300,000	September 1983	15
Giant Industries Inc	Farmington, NM	13,500	November 1982	7
Gulf Oil Corp	Venice, LA	28,700	December 1981	13
Hill Petroleum Co	Krotz Springs, LA	57,400	November 1984	6
Independent Refining Corp	Winnie, TX	50,000	August 1983	23
Lake Charles Refining Co	Lake Charles, LA	28,000	February 1982	2
Listo Refining Co	Donna, TX	3,500	December 1982	4
Longview Refining Co	Longview, TX	14,000	April 1982	25+
Mallard Resources Inc	Gueydan, LA	7,400	December 1983	4
Marion Corp	Theodore, AL	25,000	September 1983	15
McTan Refining Corp	St. James, LA	19,300	August 1983	6
Mid-Gulf Energy Corp	Ingleside, TX	39,400	May 1984	6
Natchez Refining Co	Natchez, MS	16,000	September 1982	2
Petraco-Valley Oil Refining Co	Brownsville, TX	12,300	December 1983	5
Pioneer Refining Ltd	Nixon, TX	15,000	December 1983	9
Placid Oil Co	Mont Belvieu, TX	8,500	July 1982	2
Port Petroleum Inc	Stonewall, LA	3,200	February 1984	4
Quintana Petrochemical Co	Corpus Christi, TX	33,300	September 1984	30
Quitman Refining Co	Quitman, TX	6,600	June 1982	4
Rio Grande Crude Refining	Brownsville, TX	9,500	June 1982	3
Rio Grande Recovery Systems Inc.	Brownsville, TX	1,000	February 1982	2
Schulze Processing Inc	Tallulah, LA	1,760	August 1982	4

TABLE 21.—LOCATION AND CAPACITY OF U.S. REFINERIES SHUTDOWN SINCE JAN. 1, 1981—Continued

District/Refinery	Location	Capacity [1]	Date shutdown	Years in operation
Sentry Refining Inc	Corpus Christi, TX	25,000	February 1982	4
Shepard Oil Co	Jennings, LA	10,000	February 1982	4
Shore, Inc	Kilgore, TX	550	July 1983	3
Sooner Refining Co	Darrow, LA	8,000	February 1982	2
South Hampton Refining Co	Silsbee, TX	18,100	December 1984	24
Southern Union Refining Co	Monument, NM	5,400	October 1981	25+
Southern Union Refining Co	Lovington, NM	36,100	November 1984	8
Southland Oil Co	Yazoo City, MS	5,500	July 1981	25+
Tesoro Petroleum Corp	Carrizo Springs, TX	26,100	December 1984	27
T & S Refining Co	Jennings, LA	10,500	March 1982	2
Texas Refining Co	Midland, TX	2,500	June 1981	1
Texas Standard Refining Inc	Houston, TX	1,800	October 1981	(S)
Thriftway Oil Co	Graham, TX	1,184	November 1983	25+
Tipperary Refining Co	Ingleside, TX	7,300	March 1982	4
Warrior Asphalt Co	Holt, AL	5,500	December 1984	30
Wickett Refining Co	Wickett, TX	8,000	February 1982	25+
Total		1,185,214		
PAD District IV:				
Caribou-Four Corners Inc	Woods Cross, UT	8,400	December 1984	21
C & H Refinery Inc	Lusk, WY	180	February 1982	25+
Glacier Park Co	Osage, WY	10,000	March 1982	4
Glenrock Refinery Inc	Glenrock, WY	6,000	September 1981	5
Husky Oil Co	Cody, WY	11,500	September 1982	25+
Sage Creek Refining Co	Cowley, WY	1,000	June 1982	17
Silver Eagle Oil Inc	La Barge, WY	1,500	August 1983	91
Southwestern Refining Co	La Barge, WY	1,040	August 1981	7
Texaco Inc	Casper, WY	21,000	July 1982	25+
Total		60,620		
PAD District V:				
Anchor Refining Co., Inc	McKittrick, CA	9,000	February 1984	6
Arizona Fuels Corp	Fredonia, AR	6,000	September 1983	11
ECO Petroleum Inc	Long Beach, CA	0	March 1984	8
Denenno-Kerdoon	Compton, CA	10,000	August 1983	6
Marlex Oil & Refining Co	Los Angeles, CA	21,100	March 1984	7
Powerine Oil Co	Santa Fe Springs, CA	44,120	August 1984	34
Quad Refining Corp	Bakersfield, CA	7,000	October 1981	2
Road Oil Sales Inc	Bakersfield, CA	6,000	December 1981	9
Sabre Oil & Refining Inc	Bakersfield, CA	10,000	November 1982	10
Tosco Corp	Bakersfield, CA	38,800	November 1984	33
United Independent Oil Co	Tacoma, WA	730	March 1982	7
U.S.A. Petrochemical Corp	Ventura, CA	24,000	December 1984	7
Total		176,750		
U.S. total		2,526,634		

[1] Barrels per calendar day.

Source: U.S. Department of Energy, Energy Information Administration.

TABLE 22.—U.S. PETROCHEMICAL AND REFINING EMPLOYMENT CHANGE, 1978 TO OCTOBER 1985

SIC/Industry	October 1985	1983	1981	1978	Average annual percent change		
					1983-October 1985	1981-83	1978-81
2865 Cyclic crudes and intermediates	30,600	33,300	37,200	36,700	−4.1	−5.2	0.5
291 Petroleum refining	132,000	158,200	172,800	164,100	−8.3	−4.2	1.8
295 Paving materials	28,300	26,000	28,900	32,300	4.4	−5.0	−3.5
Total	190,900	217,500	238,900	233,100	−12.2	−9.0	0.8

Source: U.S. Department of Commerce, Bureau of Census; U.S. Department of Labor, Bureau of Labor Statistics.

TABLE 23.—U.S. PIPELINE INDUSTRY EMPLOYMENT CHANGE, 1978 TO OCTOBER 1985

SIC/Industry	October 1985	1983	1981	1978	Average annual percent change		
					1983 to October 1985	1981-83	1978-81
46 Pipelines	18,800	20,700	21,800	19,600	−4.6	−6.9	3.7

Source: U.S. Department of Commerce, Bureau of Census; U.S. Department of Labor, Bureau of Labor Statistics.

Causes of Structural Change in the Oil Industry

The composition and conditions characterizing the U.S. oil industry offer compelling evidence of an industry passing through the final phase of its life-cycle: a high level of merger and acquisition activity, loss of competitiveness in export markets and diminishing competitiveness in domestic markets, business failures and plant closings rather than business start-ups and plant expansions, decling output and falling employment. Although some of the oil industry's relative decline is attributable to the diminishing appetites and changing preferences of consumer and industrial market of crude oil and refined products, it is a consequence mainly of technological changes that are altering traditional patterns of petroleum production and distribution. It is important to recall at this point the stimulus of the industry life-cycle is the process by which a technological innovation becomes standardized and then diffused to competing regions that may have a comparative advantage in that industry with respect to resource endowments, labor costs or even the willingness of government to intervene. Indeed, it is such a process that explains recent events in the oil industry.

In the production phase of the industry, rising oil prices throughout the 1970's and into the early 1980's, coupled with the diffusion of an increasingly standardized oil and gas extraction technology throughout the world, stimulated a flurry of drilling activity. Apart from pure market motivations, political impulses also played a role in increasing oil and gas production activity: both developed and developing countries viewed oil and gas production as a means to energy self-sufficiency (hence an end to the need to spend hard-currency reserves on petroleum imports) and as a potential source of foreign currency earnings. Not surprisingly, as drilling activity rose, new fields were opened and the supply of crude oil in the world market increased dramatically. But, while rising crude oil prices stimulated oil and gas production, they also inspired conservation among consumer and industrial users of energy products, particularly in the developed economies. Thus, a steadily diminishing worldwide demand for crude oil and refined products proceeded in tandem with rising crude oil and refined products output.

By 1981, the gap between supply and demand had widened sufficienty that the world was glutted with crude oil, and prices began a free-fall that continues. It is impossible at this point to determine how far prices will continue to fall, although there apparently remains a considerable potential for additional price drops: reliable industry sources estimate that North Sea production can continue at roughly 80 percent capacity down to a price of $5 per barrel, while Saudi Arabia can reportedly produce profitably at roughly $3 per barrel. What is crystal clear, however, is that oil prices are unlikely to reverse and trend upward, although some volatile fluctuations should be anticipated. Indeed, it is likely that, for the long-term, oil prices will remain well below $20 per barrel. The principal reason for this is that many countries are now capable of producing oil; in other words, every time the price of crude oil ratchets upward by some increment, a larger number of countries finds it profitable to produce and the added incremental supply of oil functions effectively to return the price to its former level. The addition of so many "swing producers" to the oil market since 1981 is a direct consequence of technological diffusion and almost certainly rules out any possibility that the market could be "re-cartelized" in an effort to drive prices higher. The prospect of relatively low crude oil prices for the foreseeable future also precludes a recovery of the U.S. oil and gas extraction and oil field equipment industries.

In the processing phase of the U.S. oil industry, a similar set of forces is at work. Simply put, the technology for producing basic petrochemical feedstocks and simple, large volume, refined products has become standardized and diffused throughout the world. Increasingly, the U.S. refined products industry retains a comparative advantage only in the manufacture of complex, specialized and high value-added lubricating oils or other products with a fairly limited market. While rising imports of foreign refined products, particularly gasoline, may be attributable partly to the recent relative strength of the U.S. dollar, a much more important factor is the inability of U.S. refiners to compete with refiners in the Middle East and Caribbean. Moreover, over the last four years, the Middle Eastern and Caribbean nations have been adding refining capacity that is highly automated, comparatively efficient and, more than likely, will boost their share of the U.S. refined products market. Further, it is important to note that entry into the refined products market is, for many developing countries, an integral part of ambitious industrialization plans; thus, many governments are subsidizing their countries' refining operations.

Events of the past four years indicate clearly that the U.S. oil industry is in long-term structural decline. As in steel, autos and agriculture, it is unlikely that the oil industry will disappear completely from the American industrial landscape. But it will continue to shrink in size and importance, and its survival will depend ultimately on its ability to remain innovative and provide highly specialized products or services to small niches in the marketplace.

IMPLICATIONS OF OIL INDUSTRY DECLINE

Despite misperceptions that the implications of falling oil prices and, more generally, the distress of the U.S. oil industry, are principally regional, there are mixed consequences for the national economy as well that deserve careful examination.

For the national economy as a whole, falling oil prices carry some important advantages: each $1.00 decrease in the price of oil is thought to reduce the inflation rate approximately two-tenths of one percent and increase gross national product by one-tenth of one percent. Lower oil prices may also result in lower interest rates, as suggested by recent declines in yields on Treasury securities. There is, however, a very subtle, but important, tradeoff between marginal improvements in the aggregate performance of the overall economy and contractions in industries or sectors within the national economy that supply goods and services to the oil industry. As Tables 24 and 25 demonstrate, the U.S. oil industry has very strong backward and forward linkages to a range of manufacturing, transportation, service and trade industries: it is a major purchaser of billions of dollars of goods and services for industries outside of the energy sector, while industry wages inject substantial purchasing power into the economy. Thus, a contraction of the oil industry inevitably entails losses of varying magnitude and severity for a range of industries throughout the economy. The ambiguity of this tradeoff precludes a conclusive judgment of the eventual impact of falling oil prices on the national economy, although it should be noted that the U.S. economy achieved spectacular growth during a period when oil prices averaged $27 to $28 per barrel.

TABLE 24.—U.S. OIL INDUSTRY BACKWARD LINKAGES TO THE NATIONAL ECONOMY: PURCHASES OF GOODS AND SERVICES

[In millions of dollars, 1977]

SIC/Industry	SIC 131,2 crude petroleum, natural gas	SIC 291 petroleum refining
131,2 Crude petroleum, natural gas		$60,031.7
15,17 Building contractors	$2,671.3	772.5
265 Paperboard containers		183.0
281 Industrial inorganic chemicals		2,565.9
2843 Surface active agents		341.4
286 Industrial organic chemicals	383.8	
289 Miscellaneous chemical products		256.2
291 Petroleum refining	210.6	
3312 Blast furnaces, steel mills	412.6	
3411 Metal cans		221.3
3494 Valves, pipe fittings	255.7	
3499 Miscellaneous fabricated metal		131.4
3519 Internal combustion engines	143.6	
3533 Oil field machinery	190.3	
3561,3 Pumps and pumping equipment	118.5	144.2
3599 Miscellaneous machinery	129.6	
3621 Motors and generators	120.8	
40 Railroad transportation		189.0

TABLE 24.—U.S. OIL INDUSTRY BACKWARD LINKAGES TO THE NATIONAL ECONOMY: PURCHASES OF GOODS AND SERVICES—Continued

[In millions of dollars, 1977]

SIC/Industry	SIC 131,2 crude petroleum, natural gas	SIC 291 petroleum refining
42 Trucking and warehousing		296.1
44 Water transportation		447.3
45 Air transportation		114.0
46 Pipelines		1,917.6
48 Communication		159.6
491 Electric services	$486.5	$588.7
492 Gas production and distribution	195.0	1,503.1
493 Sanitary services		132.9
50,51 Wholesale trade	345.0	1,155.9
58 Eating and drinking places	279.1	214.9
60 Banking	203.9	383.0
63 Insurance carriers		104.4
65,6 Real estate	4,511.5	229.5
731 Advertising		729.4
737 Computer and data processing services	177.5	137.0
7394 Equipment leasing	171.6	149.1
769 Miscellaneous repair services		219.7

Source: U.S. Department of Commerce, Bureau of Economic Analysis.

TABLE 25.—AVERAGE WEEKLY EARNINGS OF U.S. OIL INDUSTRY PRODUCTION WORKERS, OCTOBER 1985

SIC/Industry	Average weekly earnings
131,2 Crude pertroleum, natural gas	$551.69
138 Oil and gas field services	454.03
3533 Oilfield machinery	473.20
2865 Cyclic crudes and intermediates	601.17
291 Petroleum refining	664.88
295 Paving and roofing materials	501.42
46 Pipelines	
All nonagricultural	303.62
All manufacturing	388.28
All services	263.71

Source: U.S. Department of Labor, Bureau of Labor Statistics.

Moreover, any short-term advantages that accrue to the economy must be weighed against the prospect of a much higher level of political and economic vulnerability. Perhaps the greatest benefit of rising crude oil prices throughout the 1970's was that subsequent increases in domestic drilling activity lessened the United States' dependence on foreign sources of crude oil. Indeed, the United States' vulnerability to interrupt crude oil imports during the early and mid-1970's allowed the OPEC nations, particularly Saudi Arabia, to exert a disproportionate influence on American economic, foreign and military policies. There is a danger that falling oil prices, and the resultant substitution of comparatively inexpensive foreign crude oil for domestically produced oil by consumers, could once again place the United States in a position of vulnerability. This concern is heightened by the fact that the capital requirements for re-opening a closed domestic oil well are almost equal to those for an initial drilling venture. This, coupled with sharp day-to-day fluctuations in oil prices and greater uncertainty among lenders, virtually precludes the rapid and efficient re-opening of closed wells in the event of a national emergency.

Among subnational regional economies, the variable impacts of lower oil prices are more pronounced. Generally, for state and regional economies whose dependence on oil is limited principally to the consumption of refined products, lower oil prices may be a stimulus to growth. Still, the Northeast's and Midwest's recent economic recovery, particularly with respect to manufacturing, has proceeded in a climate of relatively high oil prices. For state and regional economies that depend more on oil production than consumption, however, lower oil prices result unambiguously in the contraction of basic industries, reduced output, and a significantly subdued overall level of economic activity.

Texas, like all energy producing states, has been hard-hit by the decline in oil prices. In retrospect, the state's comparatively rapid economic growth during the late 1970's was an outcome principally of escalating oil prices. Higher oil prices, particularly in the aftermath of the Iranian revolution, prompted a flurry of drilling activity in Texas; the subsequent demand for drilling rigs, oil field machinery, drilling pipe and valve, and instruments stimulated rapid employment growth in the state's manufacturing sector. Because of its strong supply and demand linkages to other sectors of the economy (see Table 26), as well as the comparatively high wages received by its workers, the oil industry also supported the rapid expansion of services, trade and other tertiary sectors.

TABLE 26.—TYPE II EMPLOYMENT AND INCOME MULTIPLIERS FOR SELECTED INDUSTRIES IN TEXAS, 1979

Industry	Type II employment multiplier	Type II income multiplier
Crude petroleum	11.68	2.36
Oil and gas field services	2.54	2.09
Oil field machinery	2.53	2.08
Organic chemicals	7.85	5.10
Petroleum refining	14.31	8.04
Pipelines	4.3	3.11
All manufacturing	2.70	2.50
Services	1.43	1.68

Source: Texas Department of Water Resources.

The approximate $10 per barrel decrease in crude oil prices to $25.10 per barrel between 1981 and early January 1986 was accompanied by a virtual halving of Texas' active drilling rigs from the 1981 peak of roughly 1,300. As a consequence, the one-strong demand for drilling-related manufactured goods has dried up, prompting the contraction of the state's manufacturing sector. (See Table 27.) Since 1981, in fact, Texas has suffered a net loss of 118,000 manufacturing jobs in addition to the 33,000 jobs lost in the drilling industry. (See Table 28). Employment and output growth in the state's non-industrial sectors has also slowed considerably, with the greatest weakness in financial services where many banks and savings and loans, in sharp contrast to the oil-driven boom years, carry a large volume of non-performing assets and post lower earnings or net losses.

TABLE 27.—CHANGE IN MINING EMPLOYMENT, UNITED STATES AND TEXAS, 1980 TO SEPTEMBER 1985 AND 1970–80

[In thousands]

	September 1985	1983	1981	1980	1970	Average Annual percent change: September 1985	1981–83	1980–81	1970–80
United States	971	957	1,139	1,027	623	0.7	−8.0	10.9	6.5
Texas	263	263	296	242	104	0.0	−5.6	22.3	13.3

Source: U.S. Department of Labor, Bureau of Labor Statistics; Texas Employment Commission.

TABLE 28.—CHANGE IN MANUFACTURING EMPLOYMENT, UNITED STATES AND TEXAS, 1980 TO SEPTEMBER 1985 AND 1970–80

[In thousands]

	September 1985	1983	1981	1980	1970	Average annual percent change: September 1983–85	1981–83	1980–81	1970–80
United States	19,513	18,497	20,170	20,285	19,367	2.7	−4.1	−0.5	0.5
Texas	997	964	1,115	1,057	734	1.7	−6.8	5.5	4.4

Source: U.S. Department of Labor, Bureau of Labor Statistics; Texas Employment Commission.

Oil-related job and income losses in the industrial sectors have returned Texas to the ranks of the "low-income" states; after rising to slightly over 102 percent of the national average in 1982, Texas' per capita personal income fell two points below the national norm in 1984. (See Table 29.) Finally, in sharp contrast to previous years, and at a time when most states are boasting substantial budget surpluses, Texas faces a severe fiscal crisis, precipitated by its dependence on oil and gas severance taxes and the structural inability of its tax system to respond to the dramatic changes in its economy. With the Texas Comptroller currently projecting a revenue shortfall of $2 to $3 billion for the fiscal 1988–89 biennium, taxing and spending issues are sure to dominate the next legislative session. Texas' fiscal problems are made more severe by the fact that it receives a disproportionately small share of federal monies. (See Table 30.)

TABLE 29.—*Per Capita Personal Income as Percent of National Average, Texas, 1970–84*

[In percent]

Texas:	
1984	98.3
1983	99.1
1982	102.3
1980	99.4
1970	91.6

Source: U.S. Department of Commerce, Bureau of Economic Analysis.

TABLE 30.—PER CAPITA FEDERAL OUTLAYS FOR PROCUREMENT, GRANTS AND DIRECT PAYMENTS TO INDIVIDUALS, UNITED STATES AND TEXAS, FISCAL YEAR 1984

	Procurement	Direct payments to individuals	Grant awards
United States	$750	$1,385	$459
Texas	669	1,143	318

Source: U.S. Department of Commerce, Bureau of Census.

The events of the past four years suggest three benchmarks useful in gauging the probable impacts on Texas of the more recent sharp declines in oil prices. Generally, each dollar decrease in the yearly average oil price costs Texas:

—25,000 jobs;

—$3 billion in gross state output; and

—$100 million in state and local tax revenue.

Three oil price scenarios warrant consideration: (1) impacts to the Texas economy if the yearly average oil price stabilizes at approximately $20 per barrel; (2) impacts in the case of a further deterioration of prices to an average of $18 per barrel; and (3) impacts of $15 per barrel oil.

Scenario 1: $20. A stabilization of oil prices at an average of $20 per barrel, down roughly $5 from the 1985 average would:

—cost Texas roughly 125,000 jobs, reducing expected total nonagricultural employment growth by approximately one third of the next three years; and

—remove approximately $15 billion in purchasing power from the state economy, sharpening Texas' recent declines in gross state output.

Scenario 2: $18. A further deterioration of oil prices to a yearly average of $18 per barrel, a decrease of $7 from the 1985 average would:

—cost Texas 175,000 jobs, reducing expected total nonagricultural employment growth by approximately 50 percent per year for three to five years; and

—remove approximately $21 billion in purchasing power from the state economy.

Scenario 3: $15. $15 per barrel oil, a drop of $10 would:

—cost Texas 250,000 jobs over the next three to five years, likely resulting in an overall contraction of nonagricultural employment; and

—remove $30 billion in purchasing power.

Several additional and more general impacts apply in varying magnitudes to each of the scenarios. First, industrial sector job losses occurring as a result of the latest round of oil price cuts are likely to involve white collar workers or small business failures rather than the customary blue collar cutbacks. The just-announced layoffs by ARCO in Dallas may be the first of many on the administrative side of the oil and gas business. Furthermore, nonindustrial sectors may increasingly experience underemployment or layoffs as they adapt to the more subdued level of economic activity. Second, lower oil prices will expose further weaknesses in the state's financial institutions. For those institutions heavily exposed in energy, non-performing assets are likely to rise and earnings likely will fall. Large losses should not come as a surprise, nor should the continual downgrading of many institutions' debt ratings. Finally, the state's fiscal condition will worsen considerably and deficits will remain a chronic problem until the tax structure is modified to de-emphasize its present reliance on the energy sector.

Similar circumstance characterize Oklahoma and Louisiana, which are also heavily dependent on a healthy oil industry. Since the sharp decline in oil prices in 1982, Oklahoma has lost approximately 30,000 manufacturing jobs plus several thousand oil and gas extraction jobs. Like Texas, Oklahoma also faces a severe fiscal crunch: recently, Governor Nigh ordered an immediate general freeze on hiring and state purchases because of a projected budget shortfall of $467 million. Louisiana has suffered an even more severe economic contraction because of a dependence not only on oil and gas extraction, but also on refining and petrochemicals. In addition to the thousands of jobs lost in oil production, many thousands more have disappeared in the state's huge oil processing plants in Lake Charles, Baton Rouge and New Orleans. Indeed, the entire Texas-Louisiana Gulf Coast "Petrocrescent," stretching from the Houston Ship Channel to New Orleans, is one of the most economically depressed regions in the country.

Finally, while the Southwest economy is disproportionately dependent on oil and gas, because of the oil industry's strong linkages to other sectors and industries in the national economy, communities *outside* the Southwest will also experience, in varying degrees, economic dislocations due to oil industry contraction.

IV. POLICY RESPONSES TO STRUCTURAL CHANGE IN THE U.S. OIL INDUSTRY

As the data and analysis in the preceding chapter demonstrate, the U.S. oil industry has entered a period of long-term structural decline charcterized by decreasing competitiveness in domestic and foreign markets for crude oil, oil field equipment and refined products. Because of the oil industry's strong backward and forward linkages to other industries, and because of still stronger linkages to several regional and local economies, its contraction has resulted in serve dislocations of workers and investment. Traditionally, such problems—industrial and regional decline—have been met with *ad hoc* policy responses by federal, state and/or local government. The auto, steel and agricultural industries have been the beneficiaries of considerable federal assistance, for example. At the same time, the experiences of other distressed industries and communities demonstrate clearly that such policies, however skillfully designed and implemented, cannot reverse industrial decline and local economic contraction. What is required, therefore, is a policy response designed to alleviate the more severe consequences of the process of industrial change without obstructing that process or imposing unacceptable and unjustified costs on taxpayers and consumers. Thus far, the policy's attention has focused mainly on the several proposals for an oil import fee and on the maintenance of existing tax and regulatory relief provisions for the oil and gas industry.

THE OIL IMPORT FEE

The consequences of an oil import fee are most significant to the oil industry and to subnational regional and state economies that depend heavily on oil and gas extraction. First, however, it is important to place such a measure within the context of the broad and long tradition of governmental assistance to distressed industries. Within this tradition, an oil import fee represents a comparatively passive measure that does not require the additional expenditure of federal monies at a time when the federal budget deficit has achieved a record high.

For the oil industry, an import fee would have a beneficial impact over all, though its consequences differ for the production and processing phases of the industry. For oil and gas extraction, an import fee would serve not only to slow the long-term decline in crude oil prices, but also, and more importantly, to mitigate the volatile fluctuations that have characterized oil prices since the end of 1985. Volatile fluctuations in oil prices, sometimes on the order of $2 per day, frustrate lenders and drillers who must pledge their future production as collateral in order to secure working capital. A rapid result from an import fee would probably be the stabilization of the currently plunging rig count. Over the long-term, an import fee would serve to stimulate drilling modestly, despite the long-term downward trend in oil prices. A stable rig count, in turn, would allow the industry to soak up the currently excessive inventories of drilling equipment, stabilizing the depressed machinery industry. Certainly, over the long-term, an import fee would not halt or reverse the structural forces that are changing the production phase of the oil industry, but it would *slow* the process of decline sufficiently to allow drillers and manfacturers greater time in which to carve out new niches in the market or diversify.

For the processing phase of the industry, an import fee probably means a modestly higher price for crude inputs, although given the current state of the industry and its long-term prognosis, such a concern is largely a moot issue. Particularly as refiners move increasingly to relatively specialized, high value-added and demand-inelastic products, and out of basic petrochemical feedstocks, fuel oils and finished gasoline, crude oil costs will be of diminishing economic consequence.

The regional impacts of an import fee would be more pronounced. Effectively, such a fee would serve to mitigate the severe dislocations of workers and investment that currently characterize many parts of the once prosperous Southwest. Indeed, an oil import fee represents an equitable and cost-effective means of assisting delining regions and communities at a time when federal intergovernmental assistance is waning and other forms of federal largesse are threatened by Gramm-Rudman and other budgetary reductions. For energy-consuming states in the Northeast and Midwest, an import fee would likely have little negative impact because: (1) some of the fee would be shifted backward to producers of crude oil and refined products; that is, consumers would not bear all of the burden of an import fee, and (2) empirical evidence indicates that energy costs are an increasingly unimportant influence on manufacturers' production and location decisions.

For the national economy as a whole, an oil import fee would yield benefits and costs. On one hand, an import fee would raise additional federal tax revenue at a time when it is sorely needed. Most initial estimates place the value of such revenue at $40 billion over the next five years, given a $5 per barrel fee. In conjunction with a 15- to 20-cent increase in the gasoline excise tax, tax revenues could rise up to $100 billion. Moreover, the import fee would encourage the stabilization, or slower contraction, of an industry that, as noted in the previous chapter, has strong linkages to non-energy industries throughout the economy. On the other hand, an import fee will likely induce slightly slower overall growth and a marginally higher inflation rate.

Tax and Regulatory Relief

Several tax reform proposals contain provisions calling for the removal of the oil and gas industry's current tax and regulatory relief advantages. Repeal of these preferences, which would effectively increase the tax and regulatory burden on an industry that is clearly distressed, is neither efficient nor equitable public policy. This is an argument applicable more broadly to all distressed industries and to all levels of government. Generally, increasing the tax and/or regulatory burden on a mature or declining industry will serve only to hasten its contraction.

Conclusion

The domestic oil industry has been in the midst of a contraction for the past five years, with the exploration and drilling side of the business suffering the most. With international oil prices continuing to fall, the long-term outlook for this sector is not promising.

Imposition of an oil import fee will not "protect" the domestic drilling industry. The contraction already underway will continue for the foreseeable future. But an import fee, based on a sliding scale that maintains a price in the $18 to $20 range, can help cushion the severe blow currently being felt by thousands of small drilling companies and oil-field service companies as a result of the 50 percent drop in average crude oil prices since last fall.

Finally, the question of energy security must also be posited as a justification for an oil import fee. In response to higher prices in the 1970's, increased domestic production and conservation enabled us to reduce our reliance on foreign sources of supply. From a dependency ratio that exceeded 50 percent a decade ago, we now rely on foreign oil for only about 30 percent of our national needs. If oil prices continue their freefall, we could once again become overly reliant on oil imports as domestic fields are shut-in and domestic production companies go out of business.

REFERENCES

Hecksher, E. "The Effect of Foreign Trade on the Distribution of Income," *Ekonomisk Tidskrift,* 21: 497–512 (1919).

Hirsch, S. *Location of Industry and International Competitiveness.* Oxford: Oxford University Press (1967).

Kuznets, S. *Secular Movements in Production and Prices.* Boston: Houghton Mifflin (1930).

Levitt, T. "Exploit the Product Life Cycle," *Harvard Business Review.* 43: 81–94 (1965).

Losch, A. *The Economics of Location* (1939), 2nd rev. ed. Translation by Wolfgang F. Stolper. New Haven: Yale University Press (1965).

Ohlin, B. *Interregional and International Trade.* Cambridge: Harvard University Press (1933).

Rees, J. "Regional Industrial Shifts in the U.S. and the Internal Generation of Manufacturing in Growth Centers of the Southwest," in W. C. Wheaton, ed., *Interregional Movements and Regional Growth.* Washington, D.C.: Urban Institute (1979).

Rees, J. "Decision Making, the Growth of the Firm and the Business Environment," in F.E.I. Hamilton, ed., *Spatial Perspectives on Industrial Organization and Decision Making.* London: Wiley (1974).

Vernon, R. "International Investment and International Trade in the Product Cycle," *Quarterly Journal of Economics,* 80: 190–207 (1966).

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