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SOCIAL SECURITY AND PENSIONS: PROGRAMS OF EQUITY AND SECURITY

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LETTERS OF TRANSMITTAL

NOVEMBER 28, 1980.

To the Members of the Joint Economic Committee:

Transmitted herewith is a staff study, printed separately, and technical papers which together form Volume 8 of the Special Study on Economic Change (SSEC).

Volume 8 is entitled "Social Security and Pensions: Programs of Equity and Security" and is one of 10 areas on different aspects of the economy published by the SSEC. The SSEC was initiated in 1978 under the direction of the former Chairman of the Joint Economic Committee, Representative Richard Bolling, then Vice Chairman Senator Hubert H. Humphrey, and the former Ranking Minority Member, Senator Jacob K. Javits. It is intended to identify major changes in the economy and to analyze their implications for policymakers. The successful completion of this Study will, I believe, help provide an economic agenda for the United States for the decade of the 1980's.

The views expressed in the technical papers are exclusively those of the authors and do not necessarily represent the views of the Joint Economic Committee or of individual members. The staff study was approved by the Chairman's Special Study Review Committee formed by the Chairman, Representative Bolling, Ranking Minority Member Representative Clarence J. Brown, and Senator Javits.

Sincerely,

LLOYD BENTSEN,
Chairman, Joint Economic Committee.

NOVEMBER 24, 1980.

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

DEAR MR. CHAIRMAN: Transmitted herewith is a staff study, printed separately, and technical papers entitled "Social Security and Pensions: Programs of Equity and Security," which constitute Volume 8 of the Special Study on Economic Change (SSEC).

The SSEC was initiated under the leadership of former Chairman of the Joint Economic Committee, Representative Richard Bolling, Vice Chairman Senator Hubert H. Humphrey, and former Ranking Minority Member, Senator Jacob K. Javits. The Study is divided into 10 substantive areas, which together chart major changes in the economy and analyze their implications for policymakers. Volume 8 dis-

cusses the growing importance to the economy of retirement income systems including social security, public pensions, and private pensions.

A sluggish economy, low productivity growth, inflation, unemployment, and an aging population are now straining the resources of these programs. The study recommends greater emphasis on private pensions, earnings, and individual savings to foster economic growth and to ease the burden on social security. It suggests a revision of government and industry retirement policies to increase productivity and reduce the total costs of pensions. The study also recommends an examination of the role of public and private pension funds in capital formation and economic growth.

It should be understood that the views expressed in the technical papers are exclusively those of the authors and do not necessarily represent the views of the Joint Economic Committee or of individual members. The staff study was approved by the Chairman's Special Study Review Committee formed by the Chairman, Representative Bolling, Ranking Minority Member Representative Clarence J. Brown, and Senator Javits.

Sincerely,

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

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OASI AND THE U.S. ECONOMY: A MODEL AND SOME LONG-RUN PROJECTIONS

By Frank T. Denton, Byron G. Spencer, and Christine H. Feaver*

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I. INTRODUCTION

The economic implications of the U.S. social security system have received considerable attention in recent years and have been the subject of much discussion. The system transfers large amounts of money through a tax-benefit mechanism and the effects of the transfers on levels of private saving have been a matter of concern and investigation. The possibility that aggregate savings are reduced substantially by taxing income from the productive sector of the economy and transferring it to groups with little or no propensity to save has been given emphasis. So, too, has the possibility that old-age insurance—and social security programs in general—have an influence on work incentives. Early contributions by Feldstein (1974), Munnell (1974), and others sparked a debate on these issues which has continued for many years, and which so far shows no signs of coming to an end. At the very least, the debate has had the effect of increasing public awareness of the issues and of stimulating greater interest among economists in the study of how social security programs interact with the macroeconomy.

Interest in the social security system and its macroeconomic implications has been enhanced by two other developments of recent years. One is the persistently higher rate of inflation, with its consequences both for the payment obligations of public and private pension plans and for the adequacy of benefit levels. The other is an increasing

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awareness of demographic changes and their implications for the structure of the population in future decades. The U.S. birth rate fell sharply in the 1960's and the low levels that have characterized the 1970's imply a future reduction of labor force growth and a proportionate shift in population toward the older end of the age spectrum. These changes suggest that the proportion of national income required to support the elderly will increase while the rate of economic growth will decline, and thus have provided further cause for concern.

This paper is intended as a contribution to the debate about the macroeconomic implications of the social security system and to the understanding of how the system may interact with the economy and the population in future decades. The paper is concerned especially with the Old-Age and Survivors Insurance (OASI) program. The approach is to construct an integrated model of the economic-demographic-OASI system and to use this model in projections or simulations, for the period between now and the middle of the next century, under alternative assumptions. That is a very long span of time, but many of the issues involved require that one look far into the future. The children born in the "baby boom" of the 1940's and 1950's will not retire until well into the 20th century, and the children of the 1970's and 1980's not until the fourth and fifth decades of that century.

A basic economic-demographic model is developed in Chapter II. This model couples a detailed representation of the population with a broad-based representation of the macroeconomy. The economic component of the model is in the neoclassical growth-model tradition. Long-run growth paths are the subject of principal concern in applications of the model, and features of the economy which bear principally on the short run are therefore ignored. Careful attention is given to the linkage of the population with the supply side of the economy through a detailed treatment of the labor force and allowance for productivity differences among age-sex groups.

A model of OASI is embedded in the larger economic-demographic model, as discussed in Chapter III. The representation of OASI is necessarily a simplified one; the actual OASI system has many legislative and administrative complexities which are necessarily ignored in a macromodel such as the present one. Wherever appropriate, though, we have made use of detailed data and estimates compiled by the Social Security Administration. We have sought also to verify the consistency of our projections with those of the SSA, where possible.

The adaptation of the complete economic-demographic-OASI model for projection purposes is discussed in Chapter IV. The discussion deals with the establishment of parameter values, the choice of assumptions for projection purposes, and other matters. As noted therein, the strategy involves the choice of a particular set of parameter values and assumptions to be regarded as the standard set. A projection based on this set is carried out, and serves as a reference or baseline projection. Changes in particular assumptions or parameters are then introduced, and new projections made. In this way, the model is used to generate a range of possibilities for the future and the sensitivity of the projections to the particular choices of assumptions and parameter specifications is explored.

The reference or baseline projection is discussed in detail in Chapter V. A subset of the larger set of variables is chosen for presentation. Projected changes in population and related variables are considered. So, too, are projected changes in the gross national product, the aggregate capital stock, the savings-output ratio, the average wage level, and other macroeconomic variables of interest. OASI variables discussed include those relating to the covered population, the fully insured population, the ratio of retired workers to total population and to labor force, the average level of benefit, the rate of tax on taxable payroll required to generate OASI benefit payments, and the ratio of OASI taxes to gross national product.

Various alternative projections are discussed in Chapter VI and compared with the baseline projection. The implications of alternative assumptions about future levels of fertility, mortality, labor force participation, and technical progress are explored in this way. The implications of alternative assumptions about the savings and labor force behavior of OASI taxpayers are explored also, with interest centered on how changes in the assumptions alter the rates of growth of the national stock of capital and the gross national product. Hypothetical changes in OASI benefit levels and age requirements are introduced in some of the projection experiments and their effects are analyzed.

The results of the study are drawn together in a final chapter. The principal findings are summarized and their implications noted.

II. A Long-Run Model of the Economic-Demographic System

1. General Features of the Model

The model that we use in this study is very much in the growth-model tradition. It makes no attempt to capture cyclical or other shorter-run movements in the economy but focuses instead on long-run growth paths. This orientation is appropriate for a study designed to provide projections or simulations for periods of many decades.

The model combines and integrates a demographic structure, an economic structure, and a simplified representation of the OASI system. Changes in the size and composition of the population are central to the determination of the long-run evolution of both the economy and the OASI system, and we have therefore deemed it important to model in some detail the relevant demographic processes, their effects on the population age distribution, on the supply of labor, and hence on output, income, and other economic aggregates. This implies separate detailed treatment of fertility, mortality, and immigration. In all cases, population and labor force variables are specified by sex and by single years of age. Thus the model, though concerned primarily with the long run, is able to trace out, with some precision, the year-by-year implications of basic demographic changes for economic growth paths and OASI-related variables.

The representation of the economy is essentially neoclassical.[1] In its pure form, the model assumes full employment and abstracts from all considerations associated with shorter-run fluctuations in aggre-

[1] In many of its basic features, the model is similar to earlier ones developed by the authors in a more theoretical context. See, for example, Denton and Spencer (1973). For an example relating specifically to the analysis of pension plans, see Denton and Spencer (1979).

gate demand. (In applications of the model in simulation experiments it is possible to allow for the fact that unemployment rates may average out at levels in excess of the full-employment level.) Output is treated as if it consisted of a single good which can be used for either consumption or investment and the level of output is determined by a production function in which capital and labor services are the inputs and substitution between them is permissible. Again, therefore, shorter-run considerations are ignored; rigidities in production processes are assumed to be dominated in the long run by technological malleability which allows a given level of output to be produced by any one of an infinity of possible capital-labor combinations. In more specific terms, the aggregate production function is of the Cobb-Douglas type.

In principle, there are interactions in both directions between the population and the economy. The effects of the population on the economy are rather clear in many cases, at least with regard to their general nature, if not their specific form. This is especially true of labor force effects, which are the ones of greatest importance in a supply-oriented long-run growth context: subject to some uncertainty about participation rates, changes in the size of the working-age population can be counted on to have a direct impact on the national labor force, and hence on the level of output and virtually all other macroeconomic variables. In the other direction, though, the effects are far less clear. Changes in income may induce changes in fertility rates. They may also induce changes in mortality rates, via their impact on health-care expenditures. However, little is really known about effects such as these. There has been much speculation; for example, Richard Easterlin has offered an interesting theory which makes long-run fertility cycles endogenous through the operation of a feed-back loop from fertility to labor supply to relative wages and back to fertility.[2] For purposes of this study, though, we have shied away from incorporating such relationships, in light of their speculative nature and the limited time available for the study. Instead, we have elected to allow for the effects of demographic changes by controlling them directly in simulation experiments. That is to say, we postulate different patterns of fertility changes, or of changes in mortality rates, and determine experimentally their economic effects, assuming a one-way direction of causality. In short, the population influences the economy in our model, but the economy does not influence the population.

The model makes no attempt to deal with price variations or the general phenomenon of monetary inflation. All variables are expressed in real terms, a characteristic that is in keeping with the model's long-run growth orientation. Implicit in the model are relative prices of productive factors, but that is all. As noted, output is treated as if it consisted of a single good. The model is specified more or less within a conventional national accounting framework, and in this framework one may choose to think of the output, income, and expenditure variables as representing constant-dollar or price-deflated aggregates.

The purpose of the paper is to throw light on long-run interactions of the Old-Age and Survivors Insurance system with the U.S. econ-

[2] See Easterlin (1966, 1968) for his initial development of this theory. Easterlin and others have elaborated and explored the theory further in a number of subsequent papers. For a simulation analysis of the implications of a mechanism such as that postulated by Easterlin, see Denton and Spencer (1975, Chapter 3).

omy and population. Parameter values and all exogenous inputs are therefore specified with a view to capturing, as best one can, essential U.S. growth-related characteristics and prospects. However, we would stop well short of asserting that the economy depicted in the model should be regarded as a realistic representation of the actual and highly complex economy of the United States. It is a relatively simple structure that we have specified on the economic side. As noted, many features which would be important in a short or medium-term analysis have been ignored—and for good reason, we think. To realize the uncertainty involved in trying to foresee the performance of the U.S. economy over the next 75 years one need only consider how well its performance over the past 75 might have been anticipated by someone at the beginning of the present century. Faced with such uncertainty, we have concentrated on the most basic features of the economic system. We have deliberately kept the economic structure as uncomplicated as possible and have been parsimonious in our specification of economic parameters. We have given particular attention to the model's long-run properties, and this has meant specifying relatively simple proportionality relationships in a number of cases to avoid nonsensical results as the economy moves along its growth path over a period of many decades. We are painting with a broad brush, as befits our objectives.

2. The Model in Detail

The equations of the model are set forth in an attached listing, together with definitions of the variables which appear in the equations. For convenience we have grouped the equations under 18 headings and we shall discuss each group in turn. As listed, there are 59 equations altogether. (In practice, there are many more if the age-sex disaggregation of population and labor force variable are taken into account.) A few equations which are implicit in others have been included, to facilitate understanding of the model. We shall discuss the first 17 groups of equations in this chapter. The 18th group relates to the OASI system *per se*, and this we shall discuss in the next chapter.

(1) Fertility.—Fertility rates are determined by single years of age for women in the range from 14 to 50. Based on earlier work by the authors,[3] the cumulative rates up to each age (CFERT) are represented by a Gompertz function, as indicated in equation (1.1). The age-specific rates (FERT) are obtained by differencing this function, as in equation (1.4). Rates are set to zero for women younger than 14 or older than 50, as implied by equations (1.2) and (1.3).

The Gompertz function is associated with the fertility rates for a particular year. It involves three parameters (a_0, a_1, a_2), each of which bears a subscript t to indicate that it is variable over time.[4] In designing simulation experiments with the model one can allow for changes in the level and age distribution of fertility by varying these parameters. However, we have found it more convenient to control them indirectly by relating them to three other parameters which have a more natural interpretation. In particular, we redefine the fertility distribution in terms of total lifetime fertility (TLF), the median age

[3] See Denton and Spencer (1974).

[4] The Gompertz function incorporates also a parameter j_0 representing some specified reference age (e.g., 24). However, this parameter is chosen merely for convenience and has no effect on the fertility rates calculated from the function.

of mothers at childbirth (MAM), and the interquartile range of ages of mothers at childbirth (IRA). These derived parameters are related to the original ones in equations (1.5), (1.6), and (1.7). In practical applications of the model, the procedure that we have adopted is to assign values to TLF, MAM, and IRA for each year, and then to solve equations (1.5), (1.6), and (1.7) to find the corresponding values of (α_0, α_1, and α_2). The equations are nonlinear and require solution by some appropriate iterative method, but aside from that the translation of the one set of parameters into the other is straightforward.

(2) Births.—With age-specific fertility rates given, the total number of births (TBIRTH) is determined by applying these rates to the female population in the childbearing range, as in equation (2.1). The population variables (POP, with the subscript 2 attached to indicate females) relate to July 1 of each year, whereas the fertility rates apply to the 12 months preceding July 1. To allow for aging over the 12-month period, the population of year t is averaged with that of year t–1, as indicated. The number of births having thus been determined, the numbers of males and females ($BIRTHS_1$ and $BIRTHS_2$) are then calculated by the application of a sex-ratio parameter (s).

(3) DEATHS.—For the population other than newborn infants, the numbers of deaths (DEATHS) for each sex at each age are obtained by applying age-sex-specific mortality rates (d) to the various age-sex cohorts. (The mortality rates are more precisely defined as the proportions of persons of given ages at the start of a year who die over the course of the year.) The rates are allowed to vary through time, and accordingly bear t subscripts. In the case of children born within the preceding 12 months, the mortality rates are applied to the numbers of births. The rates are redefined appropriately to allow for the fact that the births would have been distributed over the 12 months and that newborn children in the population would have been alive for only half a year, on average, by the end of the period. The equations in which deaths are determined are (3.1) and (3.2). As elsewhere in the model, the calculations are made for all ages up to the highest one for which life-table mortality rates are available (jmax); there are assumed to be no persons living beyond that age.

(4) Net immigration.—Net total annual immigration (MIGTOT) is treated as an exogenous input into the model. It is assumed that net immigration has a constant age-sex distribution, and the allocation of the total is effected in equation (4.1) by the application of a set of fixed distribution parameters (m). (It is perhaps worth noting that assuming the net distribution to be constant implies either (1) that immigrants and emigrants have the same age-sex distributions or (2) that the totals of immigrants and emigrants are always in the same proportion to each other.)

(5) Population.—For all ages but the youngest one, the population of each age and sex is obtained by allowing for aging, subtracting deaths, and adding net immigration. The population under one year of age is obtained by subtracting deaths from the number of births over the preceding 12 months and adding net immigration. These calculations are represented by equations (5.1) and (5.2). Equation (5.3) then determines the total population by summing over all age and sex categories.

(6) Labor force and employment.—The labor force (LF) is calculated in equation (6.1) by applying participation rates (p) to the eligible population, the calculation being done separately for each sex and for each age from 16 up. The eligible population is calculated by adjusting the total population of each sex and age by the ratio of noninstitutional to total population (n). The age-sex-specific participation rates are allowed to vary through time.

The labor force having been calculated, employment (EMP) is then determined, in equation (6.2), under the assumption of given unemployment rates (u). As noted previously, the theory underlying the model assumes full employment, and the rates should be consistent with this assumption. However, that does not mean that the rates for different ages and sexes should all be at the same minimum level: the full-employment rate for one group may differ from the full-employment rate for another, and the model allows for this. (In addition, the full-employment assumption itself is relaxed somewhat in applications of the model to allow for the fact that the economy would be unlikely to be operating at full capacity over any long period of time, and that the average growth path would therefore differ somewhat from the full employment path, under realistic assumptions.)

The total labor force (LFTOT) and total employment (EMPTOT) are obtained by summing over age and sex categories. These calculations are represented by equations (6.3) and (6.4).

(7) Domestic production.—The gross domestic product (GDP) is assumed to be generated by a single aggregate production function, as implied by equation (7.1). There are two aggregate inputs into this function—capital and labor inputs, as defined below. The function itself is of the Cobb-Douglas type.

The production function, as written, involves two parameters, β and a. The parameter β is a distribution parameter, under the assumptions of the model: it determines the proportionate distribution of total GDP between labor and capital. The parameter a represents the state of technology. Technical progress is allowed for, and a bears a time subscript to reflect this. (For simplicity, technical progress is assumed to be entirely neutral in the Hicks sense in this model.) Production is subject to constant returns to scale, and the function therefore is homogeneous of degree one in its two input variables.

(8) Technical progress.—Technical progress is assumed to take the form indicated in equation (8.1). There is nothing to prevent the rate of technical progress (r) from being varied through time in a simulation application of the model but for simplicity we assume here that it is constant. The variable t has value 0 in some initial year and a_0 represents the value of a in that year.

(9) Factor inputs.—The input of capital services into the production process (KAPIN) is assumed to be proportional to the total fixed capital stock in the economy (KSTOCK), as indicated in equation (9.1). In essence, the proportionality assumption implies simply an appropriate choice of scaling factor or of units in which to measure capital services.

The calculation of labor input is more involved. Provision is made for differences in productivity among different age-sex categories to capture better the implications of changes in the age-sex structure of

the labor force. (Inexperienced young workers may be less productive than persons who have been in the labor force for 10 years, for example.) A relative productivity measure (k) is attached to each age-sex cohort, and employment in the cohort is weighted accordingly. Aggregate labor input (LABIN) is then calculated as the sum, over age and sex, of productivity-weighted employment. The calculation is made explicit in equation (9.2).

For convenience, we assume that factor markets operate under competitive conditions, and that rates of return are therefore equal to marginal products. In the case of labor, this implies that marginal product equals the wage rate for a given age and sex, and on this basis it is easily demonstrated that the productivity weights are proportional to the wage rates. That is to say, $k_{ij}/k_{pq}=WAGE_{ij}/WAGE_{pq}$ for sexes i, p and age j, q. Aside from the choice of an appropriate scaling factor, weighting employment by the k's is thus equivalent to weighting it by wage rates.

(10) Factor income and wage rates.—The assumption of competitive factor markets, and the derivative assumption that rates of return are equal to marginal products, are used explicitly to distribute the gross domestic product between labor and capital, in equations (10.1) and (10.2). As noted already, the distribution is determined by the parameter β of the production function. The average wage rate—the average over all age and sex categories (AVWAGE)—is determined in equation (10.3) and the age-sex-specific wage rates (WAGE) are determined in equation (10.4). That GDP is equal to the sum of labor income (YLAB) and property income (YPROP) is implicit in equations (10.1) and (10.2) but it is made explicit in equation (10.5).

The definitions of factor incomes in the model differ from conventional national accounting definitions. YLAB, which we refer to as "labor income", implicitly includes the return to self-employed persons for their labor services, as well as the return to employees. In national accounting terms, it represents compensation of employees (including wages, salaries, and supplements) plus some fraction of the income of proprietors. All other domestically generated components of income are then assigned to YPROP, which we refer to as "property income." Included in the latter are corporate profits, rental income, and the portion of proprietors' income that is not attributable to their labor services. Output (GDP) is defined in gross terms, it should also be noted, so that YPROP represents property income before any deduction for depreciation of capital assets.

(11) Gross national product.—The production function in the model generates the U.S. gross domestic product. To move from that to the gross national product, it is necessary to make provision for the determination of factor payments received from the rest of the world (FPR). A simple proportionality relationship is assumed: FPR is taken to be a constant fraction η of GNP, as indicated in equation (11.1). GNP is then obtained as the sum of GDP and FPR, in equation (11.2), or equivalently, as a constant $(1-\eta)^{-1}$ times GDP.

(12) Government purchases of goods and services.—The expenditure on goods and services (GOV) of all levels of government combined—Federal, State, and local—is assumed to grow at the same rate as the GNP, this assumption being embodied in equation (12.1). The factor of proportionality relating GOV to GNP is ζ. In applications of the model, ζ could be allowed to vary over the simulation period, if

this seemed desirable, but in the absence of good reasons for doing otherwise, we assume it is constant. Also the model could easily be modified to make separate provisions for Federal and for State and local government expenditures, but this also seems not to be necessary, given the intended uses of the model.

(13) Net exports of goods and services.—A simple proportionality assumption is made here also. Net exports of goods and services (XNET) are assumed to be a constant proportion (θ) of GNP.

(14) Saving.—There are two equations in the economic section of the model. The first is the production equation discussed above; the second is the private savings equation (14.1).

Gross private saving (SAVEP) is linked to GNP, exclusive of the portion of GNP claimed by government. In the absence of considerations relating to Old-Age and Survivors Insurance, private saving would be treated as a constant proportion of (GNP–GOV) and hence, by virtue of equation (12.1), as a constant proportion of GNP alone. However, a critical question to be addressed with the model is that of the effects of OASI on private savings, and hence on the rates of capital accumulation and economic growth. With this in mind, we therefore make allowance for different propensities to save associated with OASI benefits and taxes. Specifically, we provide for a propensity γ_1 to save out of private income generally, a propensity γ_2 to save out of OASI benefits (BEN), and a propensity γ_3 to dissave associated with OASI taxes (TAX). The arguments in support of this treatment are (1) that OASI benefits are received by people whose income situations and consumption patterns may differ markedly from those of others in the population, and (2) that the taxes paid by OASI taxpayers may, to some extent, be regarded by them as forced saving, and hence as a substitute for some portion of other saving that they might have made with their retirement years in mind. Specifying separate propensities makes possible the exploration, by simulation, of the implications of alternative hypotheses about differential saving behavior.

To move from private saving to total saving requires that provision be made for government deficits or surpluses. We define a variable DEF to represent the total deficit (or surplus, if negative) of all levels of government combined, plus a balancing item required to equate total gross saving and total gross investment. (Gross saving and gross investment are computed separately in the national accounts, and are subject to a statistical discrepancy. We incorporate this discrepancy in DEF.) Equation (14.2) specifies that DEF is related to GNP by a proportionality factor π. (As shown, π is a constant; however, the possibility of allowing it to vary remains open.) Equation (14.3) then expresses total gross saving (SAVING) as gross private saving minus DEF.

(15) Investment.—Total gross investment (INVEST) is equated to total gross saving in equation (15.1). Foreign investment (IFOR) is assumed to be a fraction (λ) of total gross investment, in equation (15.2). Gross domestic investment (IDOM) is determined as the difference between the total and its foreign component, in equation (15.3)—or equivalently, as a proportion ($1-\lambda$) of the total. The calculation of fixed capital stock requires fixed domestic investment (IFIX), rather than total domestic investment, which includes inven-

tory change. Fixed investment is treated as a constant proportion (ξ) of the domestic total, in equation (15.4).

(16) Fixed capital stock.—The private capital stock (STOCKP) is calculated in equation (16.1), as the sum of depreciated fixed private investment. A constant proportional rate of depreciation (δ) is assumed. The capital stock is dated at the beginning of the calendar year, and hence is not affected by current investment. It is assumed that investment does not become productive until the start of the year following the one in which it is made. It is assumed also that new investment is not subject to depreciation until the following year.

The production function represented by equation (7.1) generates the total output of the economy and requires the input of services from the entire fixed capital stock, government and private combined. To calculate the government component of the capital stock would require a separation of government expenditure on goods and services into current and capital expenditure components, and this we prefer to avoid. We do so by making the assumption embodied in equation (16.2), namely that the government stock is a constant proportion (ϕ) of the total stock. (At the level of abstraction implicit in the model, that seems to us to be an acceptable assumption. Again, though, it is possible to vary ϕ over the course of a simulation, if there is reason to do so.) The total fixed capital stock can then be calculated directly from the private stock, as in equation (16.3).

(17) Consumption.—Private consumption (CONSUM) is calculated as the difference between GNP and the sum of gross domestic investment, government expenditure on goods and services, and net exports. The calculation is represented by equation (17.1).

III. Incorporation of OASI Into the Model

1. The Basic Approach

The representation of the Old-Age and Survivors Insurance system is necessarily approximate. In a model such as the present one it is neither necessary nor feasible to capture all details of the system, and we make no attempt to do so. The Social Security Administration has published long-range projections which pay closer attention to the complexities of the system.[5] Our own interest is principally in the interaction of OASI with the economy and the population at a macrolevel, and how OASI aggregate payments and other major OASI variables would be affected by differences in the macroenvironment in which the system is embedded. We are interested to some extent also in exploring the effects of hypothetical changes in the OASI parameters themselves, but only in broad terms.

A basic question that arises in connection with the modeling of OASI in the present context is how best to treat surpluses or deficits. In the short or medium term, tax rates and other provisions of the Old-Age, Survivors, and Disability Insurance System as a whole are determined by statute.[6] In the long-run, though, statutory provisions are subject to change and may better be viewed as endogenous within

[5] See Bayo, Ritchie, and Faber (1978).

[6] For discussion of relevant statutory provisions and some of their implications, see Snee and Ross (1978) and Robertson (1978).

the model, at least in some degree. The authors of the SSA have made a similar point: "The cost estimates are based on the assumption that the present statutory provisions and regulations affecting the OASDI system will remain unchanged. However, when considering the long-range actuarial status of the system, it is important to recognize that the law is likely to change as society itself changes in response to future economic and demographic developments." [7]

There are two possible general approaches to the treatment of OASI surpluses or deficits in long-run modeling and simulation. One is to assume that they will be eliminated as they arise by the adjustment of tax rates; the other is to hold the tax rates constant, and simply let the surpluses or deficits accumulate, thus providing information about the implications of maintaining a given set of rates. (Of course, there are intermediate positions as well, but we focus on these two approaches in their pure form.) Under the first assumption, OASI becomes strictly a "pay-as-you-go" system and, if administrative expenses are ignored, BEN and TAX are equal to each other. Under the second, the deficits or surpluses must be treated explicitly: They must elicit a response in the government accounts by affecting the level of the trust fund associated with OASI, by causing a change in the level of non-OASI taxes, by altering the general government deficit position, or by some combination of these three possibilities. If current-account deficits are allowed for—associated either with trust-fund adjustments or with general government-deficit adjustments—this could be handled by letting the DEF variable be affected in the model. There would then be an effect on total saving, through the operation of equation (14.3), and hence on investment and on the economy at large. If, on the other hand, OASI deficits are to be covered out of general government tax revenue, one might argue that the results would not differ greatly from those of the case in which earmarked OASI taxes were adjusted: ignoring (as an approximation) the differences in the average saving propensities of general taxpayers and OASI taxpayers, the effect on the macroeconomy would be equivalent to that of assuming OASI to be on a pay-as-you-go basis.

We have adopted the pay-as-you-go assumption in specifying the OASI component of our model. This is the simplest assumption, and perhaps the most realistic one for the long run. OASI deficits or surpluses are thus ignored. Administrative expenses of the OASI system are assumed to be caught up in the general government accounts, and BEN and TAX are set equal. The system acts purely as a means of transferring income from the working population to OASI recipients within each year. The system generates no investable surpluses and no deficits which might lead to borrowing.

The OASI component receives from the rest of the model inputs relating to population, employment, and earnings. It calculates the taxable earnings base for OASI purposes, the number of OASI retired-worker beneficiaries, their average and aggregate benefit levels, the aggregate combined OASI benefit level, the levels of OASI taxes and tax rates, the number of persons insured, and the number in covered employment. The OASI system has an impact on the general economy through the effects that BEN and TAX have on the level of private savings. Informally, it may have an impact also through effects on

[7] Bayo, Ritchie, and Faber (1978, page 5).

labor force participation rates. The model contains no formal link between OASI and labor force participation, but linkage can be introduced by an appropriate choice of assumptions in a simulation experiment.

2. The Equations of the OASI Component

The Old-Age and Survivors Insurance equations constitute group (18) in the list of equations of the model. There are 15 equations listed in the OASI group, but many more if account is taken of the age-sex disaggregation of population-related variables and benefit levels.

The covered population (COVPOP) is determined in equation (18.1), for each age 16 or over, and separately for each sex. The covered population represents the population in covered employment, as defined for OASI purposes. Coverage rates (COVRAT) are specified and applied to the total population (POP) in each age-sex category.

The insured population (INPOP) is determined in equation (18.2), again by age and sex. This represents the number of people classified as fully insured for OASI purposes. It includes persons who are currently employed and paying OASI taxes, persons who are not paying OASI taxes currently but who have built up credits previously and are not yet of retirement age, and persons classified as beneficiaries. The calculation is effected by the application of insured-population ratios (INRAT) to the total population of each age and sex.

The number of retired workers (RW), as defined for OAI purposes, is calculated in equation (18.3). Age-sex-specific ratios of retired workers to insured population (RWRAT) are applied to the insured population. The calculations are made for all cohorts from the minimum age at which retired-worker status is possible (jmin) to the maximum age of life (jmax). Under present regulations the minimum age is 62, but the model provides for the possibility of varying this age in a simulation experiment.

The total covered population (COVTOT), the total insured population (INTOT), and the total number of retired workers (RWTOT) are determined in equations (18.4), (18.5), and (18.6). The totals are obtained by summing age and sex categories.

The average annual levels of OAI benefit per retired-worker recipient (PEN) are determined in equations (18.7), (18.8), and (18.9). The determination involves three separate stages. At the first stage, a reference age (j*) is specified, and the benefit level for retired workers of this age is calculated in equation (18.7). The calculation assumes that the benefit level can be represented as an appropriate fraction (FRACT) of the overall average annual wage (AVWAGE). A separate calculation is made for each sex. In practice, 65 is chosen as the reference age, except in simulations involving experimentation with different OAI retirement-age provisions.

The second stage in the determination of benefit levels pertains to ages in the neighborhood of the reference age. Under current provisions, an individual may become a retired worker (i.e., a benefit recipient) as early as age 62 or as late as age 70. (There is no incentive to delay the receipt of benefits beyond age 70, although in practice

there are small numbers of cases in which this occurs.) We therefore define a range of ages from three years below the reference age to five years beyond it, and regard this as the potential retirement range for OAI purposes. Within this range, the benefit levels are assumed to bear constant ratios (RATIO) to the reference-age level. As elsewhere, all calculations are made separately for males and females.

The third stage pertains to ages beyond the potential retirement range (i.e., ages $j^* + 6$ and older). For these ages, the average benefit level for each cohort is assumed to remain constant for as long as the cohort has any survivors. The benefit level for age j in year t is thus equal to the level for age j–1 in year t–1. Benefit levels are fixed in real terms, it should be noted; they are assumed to be adjusted for price changes, and hence invariant to the rate of inflation. However, they are not adjusted for changes in real wages that occur after a cohort has moved beyond the potential retirement age range.

The foregoing procedures for determining average benefit levels are merely an approximation to the much more complicated actual OAI procedures. However, they appear to be an adequate approximation. Calculations based on them accord quite well with those of the Social Security Administration projections referred to previously, when comparable demographic and other assumptions are made. This provides some additional support for the view that the approximation is adequate.

Average retired-worker benefit levels having been determined for all relevant cohorts, these are then combined with the numbers of retired workers to obtain total retired-worker benefit payments (RWBEN). The calculation of the total is effected in equation (18.10). The overall average annual OAI benefit payment per retired worker, disregarding age-sex differences (AVBEN), is then calculated in equation (18.11).

Calculation of OASI taxes requires prior calculation of the earnings base on which the taxes are to be levied. We have found it convenient in this regard to adopt the concept of "taxable payroll" employed by the Social Security Administration in its analysis and projections. The taxable payroll is defined as "the amount which, when multiplied by the combined employer-employee tax rate, yields the total amount of taxes paid by employers, employees, and the self-employed." [8] Equation (18.12) treats the taxable payroll (TAXPAY) as a fraction (τ) of total labor income (YLAB), the latter having been generated by equation (10.1).

A single overall OASI tax rate is assumed for purposes of the model. The tax rate (TRATE) is calculated in equation (18.13) as the sum of two components. The first is the rate (RWBEN/TAXPAY) required to yield the required retired-worker benefits. The second is the component required to yield other types of OASI benefits (payments to dependents of retired workers and all payments to survivors of deceased workers). The latter component (XRATE) is treated as exogenous within the model.

Total OASI taxes (TAX) are calculated by applying the combined tax rate to the taxable payroll, in equation (18.14). Imposing the pay-as-you-go assumption, total OASI benefit payments (BEN) are then determined by equating them to total OASI taxes, in equation (18.15).

[8] Bayo, Ritchie, and Faber (1978, page 6).

IV. Use of the Model in Projection Experiments

1. Projection Strategy

The model is intended for use in projections or simulations of the economic-demographic-OASI system over long periods. An initial set of conditions is chosen. Values are assigned to the parameters and to the exogenous variables. The model is embedded in a computer program which moves the system forward in time, year by year, and thus generates the system's time path for as many years as are required. Alternative assumptions can be made about future values of exogenous variables, and for each set of assumptions a new time path generated. Values of the parameters can be varied too, and the sensitivity of results to the particular values chosen can be explored.

The results generated by the model can be thought of either as simulations or as conditional projections—conditional on the given assumptions. The aim is to provide insights into future possibilities and we have tried to make the model as realistic as possible through appropriate choice of parameter values. In applications of the model, we have tried also to make realistic assumptions about initial conditions and about future levels of fertility, mortality, and other exogenous inputs. However, some of the runs that we have done are deliberately artificial in nature, and are designed to throw light on the implications of particular types of effects that OASI might have on the economy. Thus, for example, we have done runs in which OASI is eliminated entirely to allow comparisons of hypothetical economic growth paths with and without OASI. We have done runs too in which OASI benefit levels are increased or decreased markedly, and runs in which the age of eligibility is raised or lowered substantially. Such runs are intended for analytical purposes. To emphasize the experimental or analytical motivation behind many of the runs, we use the term *projection experiments*, although for convenience of exposition we sometimes refer simply to *projections*. Niceties of language aside, there can be no pretense of forecasting what actually will happen in the coming decades; the goal is merely to suggest a range of alternatives and to indicate how the workings of the economic-demographic-OASI system may affect the future.

The period that we have chosen for the projection experiments extends to the year 2050. The projections take off from the year 1977, and the projection period is thus just short of three-quarters of a century. The model generates results for each year of this period, but short-term comparisons are to be discouraged. In displaying results, we therefore follow the practice of showing them only at five-year or 10-year intervals.

The number of projection experiments that could be conducted with the model is virtually unlimited and restraint is necessary to keep the results within reasonable bounds. The basic procedure that we have adopted involves choosing a standard set of assumptions and parameter values. An initial projection is then made, based on the standard set, and this serves as a reference or baseline projection. Other projections, based on alternative assumptions, are compared with the initial one. In any given projection, only one, or at most a few of the assumptions or parameter values are altered, the standard ones being retained in all other cases.

2. The Choice of Initial Conditions

The initial conditions are those of 1977, the latest year for which a full range of required data was available when the study began. The economic variables have their actual 1977 values, based on national accounts and other data. (All income, expenditure, and related variables are in 1972 dollars in the initial year, as they are throughout the projection period.) The 1977 population was computed by the Social Security Administration, based on Bureau of the Census estimates adjusted for OASDHI geographic coverage and for some categories of persons outside the country. The population estimates incorporate adjustments for undercount made by the Bureau of the Census and additional age detail provided by the Social Security Administration. Estimates of the labor force are from the Current Population Survey, with the armed forces included. Employment and unemployment estimates are also from the CPS. The values of all OASI variables are from Social Security Administration sources, published or unpublished.

3. Parameters of the General Economy

The standard values for the parameters of the general economy were derived in a number of ways. Econometric procedures were used in some cases but the nature of the model made straightforward econometric estimation inappropriate or infeasible in many others.

A value for the parameter β of the production function was chosen after a search over a range of plausible values. The production function was fitted to historical time series and the resulting mean-square errors were examined for alternative values of β. However, the response surface was relatively flat and provided little guidance. In the end, a value of 0.3 was judged reasonable and was adopted as the standard value.

The rate of technical progress (r) is defined, for purposes of the model, to include all changes in productivity other than those associated with changes in factor ratios and changes in the age-sex composition of employment. We have estimated this rate at about 1.5 percent per annum for the period 1953–77 and have adopted this figure as the standard value of r throughout the projection period.

The age-sex-specific productivity weights (k) were estimated from average earnings data for 1976, on the assumption that relative earnings levels reflect relative levels of marginal productivity.[9] Age-group earnings series were derived separately for men and women, with level of education held constant. Single-age values were then found by interpolation to provide complete male and female age-earnings profiles.

The rate of depreciation of capital stock (δ) was estimated from historical private stock and investment series. The stock series, as estimated and published by the Bureau of Economic Analysis,[10] does not assume a constant proportional rate of depreciation, as we have found it convenient to do for our purposes. What we did therefore was to estimate, by least squares, the value of δ that would most nearly yield the BEA constant-dollar stock series when applied to annual

[9] Earnings data are from U.S. Bureau of the Census (1978).
[10] See Musgrave (1976).

historical investment, year by year. Estimation based on data for the period 1953–77 resulted in a value of .063 for δ, and yielded a close approximation to the published stock series.

A number of the economic parameters represent simple ratios among national accounts income or expenditure variables. These include η, τ, θ, π, λ, and ξ. Historical series of the ratios were plotted and examined, and values were chosen which could be judged to represent long-run relationship among the variables involved. Actual values of the ratios were used for 1977 and 1978, the parameters taking on their long-run values commencing in 1979.

The parameter c in equation (9.1) represents the ratio of capital services to capital stock. It is not observable, but in effect represents a choice of units in which to measure the services. With the Cobb-Douglas form of production function, c is of no practical consequence; it can be thought of as caught up in the scale parameter a, as is evident if equation (9.1) is substituted into equation (7.1).

The three propensities to save ($\gamma_1,\gamma_2,\gamma_3$) are of central importance for use of the model to assess savings and economic growth effects of OASI. The standard assumptions are that there is no saving of OASI benefit income ($\gamma_2=0$), and that the propensity to dissave associated with OASI taxes is the same as the propensity to save out of general income ($\gamma_3=\gamma_1$). The latter is equivalent to assuming that payments by OASI taxpayers are, in fact, treated as taxes. An alternative assumption of interest is that the payments are treated as forced savings, and therefore may have a larger effect on aggregate private savings than they would under the standard assumption. The implications of this alternative assumption are explored in one of the projection experiments.

Historical ratios of private saving to GNP–GOV were examined and an appropriate long-run value chosen. With this overall ratio given, and the assumption $\gamma_2=0$ and $\gamma_3=\gamma_1$, a value of γ_1 was then determined. The standard value of γ_1 was calculated to be .2097.

The parameter ϕ represents the ratio of private capital stock to total capital stock. The assumption of proportionality which this parameter represents is a convenient simplification for our purposes. However, there seems to be no reliable way of establishing a value for the parameter based on available data. Fortunately, if the proportionality assumption is maintained, the actual value of ϕ has no effect when the Cobb-Douglas production function is employed. (That this is the case can be verified by substitution of equation (16.3) into (9.1) and of (9.1) into (7.1).)

4. Demographic Parameters and Assumptions

The standard assumptions and parameter values on the demographic side of the model have been chosen to accord as closely as possible with those adopted by the Social Security Administration in its standard set of projections (Alternative II of the three sets of projections reported in Bayo, Shiman, and Sobus [1978]). To allow for differences in methodology, some experimentation was necessary to get a good match between the SSA assumptions and ours, but the end result is a standard set of population projections which agree very closely with those of the SSA right through the projection period.

Under the standard assumptions, the total fertility rate rises from about 1.8 in 1977 to an ultimate level of 2.1, which is about equal to the natural replacement rate (i.e., the rate required for the population just to replace itself in the long run). Our version of this assmption is that the parameter TLF rises by uniform increments to 2.1 by the year 1997, and remains at that level thereafter. It is assumed too that there is some increase in the age of mothers at childbirth: MAM, the median age, rises from 25.0 in 1977 to 25.8 in 1997, and then remains constant. The dispersion of ages, as represented by IRA, is assumed not to change from its most recent observed level. As historical background for the setting of these assumptions, the cumulative fertility function represented by equation (1.1) was fitted to age-fertility data for selected years in the period 1940–1977 and the corresponding series of TLF, MAM, and IRA were calculated and inspected.

The sex ratio at birth(s) is the one used in the SSA projections. The assumption is 105 males per 100 females.

The standard mortality assumptions are identical to those of the SSA. Age-sex-specific mortality rates are projected to the year 2050 on these assumptions, and the rates for intervening years are calculated by geometric interpolation. The mortality rates for 2050 are published by the SSA, along with the population projections, and we do not reproduce the rates here. By way of summary, though, we note that the assumptions imply an increase of about 1 year in the life expectancy of a 60-year-old male between 1977 and 2050, and an increase of about 2½ years for a 60-year-old female. The anticipated changes are relatively small by comparison with historical experience in the present century, but the expectation of much slower declines in mortality is a reasonable one.

Adopting again the SSA assumptions, net immigration is 400,000 per annum throughout the project period and the age-sex distribution of the net total is held constant. The distribution proportions are based on data published with the SSA projections.

In some of the projection experiments reported in Chapter VI, we have varied the assumptions about fertility levels. For two of these experiments, we have adopted the alternative assumptions proposed by the SSA, which involve somewhat higher and somewhat lower ultimate total fertility rates. In doing so, we have again sought to match, as closely as possible, the SSA alternative population projections (Alternatives I and III). Results for three of our projections—the standard one and two others—thus achieve a substantial degree of comparability with the SSA projections, although the types of results reported differ considerably, as do the objectives which motivated the two sets of projections.

5. Labor Force Parameters and Assumptions

The projected labor force participation rates (p) are based on projections by the Bureau of Labor Statistics (BLS)[11] supplemented by unpublished data furnished by BLS, and adjusted to bring the projections into line with actual 1978 figures that are now available. The BLS projections allow for changes until the year 2000, with no further

[11] See Flaim and Fullerton (1978).

changes thereafter. Our standard assumptions incorporate our adjusted version of the BLS "moderate-growth" series. (Single-age rates were calculated by interpolation from the group rates.) The noninstitutional population ratios (n) are based on data published by the Bureau of the Census.[12] These ratios are held constant throughout the projection period.

The overall U.S. unemployment rate was 7.0 percent in 1977 and 6.0 percent in 1978. Our standard assumption is that the rate will fall to 5.0 percent by 1985, and remain there for the rest of the projection period. (This is also the SSA assumption.) The transition takes place uniformly between 1978 and 1985.

The unemployment rates for individual ages and sexes are set at levels consistent with the overall rate. A set of regression equations was estimated from data for the 15-year period 1963–77, with the unemployment rates for individual age-sex groups treated as functions of the overall rate and a linear time trend. These equations were then used to calculate group rates for each projection year. (To avoid the risks associated with the extrapolation of linear trends, the time variable was fixed at its 1977 level in these calculations.) Single-age rates were derived from the group rates by interpolation.

6. Old-Age Insurance Parameters

The standard values of the population-related parameters in the OASI component of the model are based on values projected by the SSA.[13] These include the ratios of covered to total population (COVRAT), of insured to total population (INRAT), and of retired workers to insured population (RWRAT).

The reference retirement age (j*) is taken to be 65 in the standard case. The ratio of average benefits received by persons of this age to the average annual wage (FRACT) is calculated for males in 1977 and 1980, and the 1980 male ratio is then maintained throughout the balance of the projection period. The 1977 and 1980 ratios for females are based on the observed relationships between the male and female ratios in 1976, this being the lastest year for which age-sex benefit data were available at the time the calculations were made.[14] The male and female values of FRACT are .2150 and .1600, respectively, in 1980. It is assumed, because of increasing lifetime labor force activity of women, that the male-female gap will close somewhat; we have allowed it to be reduced by half by the year 2000, with no further change thereafter. This yields an ultimate FRACT value for females of .1875.

The 1977 and 1980 FRACT values were chosen in such a way that the resulting retired-worker component of the tax rate was equal to the actual ratio of retired-worker benefits to taxable payroll in 1977 and to the SSA projected level in 1980. (Values of FRACT for 1978 and 1979 were established by interpolation. No further adjustments were made after 1980, but the rates which were generated in our standard projection run were compared with the SSA projected rates throughout the projection period, and the two sets of rates were found to be close; our rate is 11.1 percent by 2050, compared with 11.3 percent

[12] See U.S. Bureau of the Census (1977).
[13] Bayo, Ritchie, and Faber (1978).
[14] See Social Security Administration (1976).

in the SSA projection, and the correspondence in other years of the projection period is quite close also.

The ratios (RATIO) of average retired-worker benefits at ages in the neighborhood of the reference retirement age to the average at that age are based on the 1976 age-sex benefit data from the SSA. These ratios are maintained throughout the projection period. Separate calculations are made for males and females at each age.

A value of .6108 was established for the ratio (τ) of taxable payroll to labor income and this value was maintained throughout the projection period. It may be noted that the definition of labor income (YLAB) is a special one in the context of the model: It includes the implicit return to labor for self-employed workers, but not the return to capital that may be implicit in their income. It thus has no direct counterpart in historical data, and had to be generated by the model.

7. A Summary Statement of the Standard Parameter Values and Assumptions

The set of parameter values and assumptions specified for the standard or baseline projection experiment was discussed in the preceding several sections. For convenience, we provide the following summary statement, omitting parameters which are of little or no significance for the projections. Unless otherwise noted, the parameter values specified are the ultimate or long-run ones:

β=.3000	γ_1=.2097	γ_2=.0000	γ_3=.2097
ζ=.2000	η =.0055	θ =.0061	λ =.0037
ξ=.9538	π =.0054	δ =.0630	τ =.6108

Fertility: TLF rises to 2.1 by 1997; MAM rises to 25.8 by 1997.
Mortality: continuing declines; assumptions same as SSA.
Net immigration: 400,000 per year; same age-sex distribution as SSA.
Technical progress: r=1.5 percent per annum.
Labor force participation rates: BLS "moderate-growth" series adjusted for discrepancies between 1978 actual and projected rates.
Retirement reference age: j*=65.
COVRAT: series projected by SSA.
INRAT: series projected by SSA.
RWRAT: series projected by SSA.
FRACT: males .2150; females .1600, rising to .1875 by the year 2000.
RATIO: based on 1976 SSA ratios.

V. A Baseline Projection

We begin with a projection experiment based on the standard assumptions and parameter values. The results are presented in table 1. The model generates more variables than are shown in the table but the ones chosen are the most important ones and serve adequately to define the evolution of the economic-demographic-OASI system over the 73 years of the projection period. Results are displayed in the form of indexes or ratios. Base values are shown for 1977, the initial year; projected values are shown at five-year intervals from 1980 to 2000, and at 10-year intervals from 2000 to 2050. As stated earlier, all income, expenditure, and related variables are expressed in real terms. This

initial projection may be regarded as providing a standard or baseline set of results with which the results of other projections can be compared. We consider the results for each variable in turn.

Total population (POPTOT).—The total population rises continuously throughout the projection period, under the standard assumptions. The average rate of growth over the 73 years as a whole is 5.8 percent per decade, but the rate is declining over almost all of the period. The population increases by 8.6 percent in the decade 1980–90; by 2040–50, the percentage increase is only 2.2. percent.

Birth rate (TBIRTH/POPTOT).—The crude birth rate rises slightly until the mid-1980's, as a result of the assumed modest rise in fertility levels and of changes in the age structure of the population which shift more women into the childbearing ages. From 15.2 live births per 1000 total population in 1977, the rate rises to 16.0 per thousand in 1985. The latter represents the highest level in the projection period. By the year 2000 the rate has fallen to 14.1, and by 2050 it is 13.6.

Proportion of older people in the population (POP65+/POPTOT).—Aging of the population is a predominant characteristic of demographic change over the projection period. With relatively low fertility rates and some further reductions of mortality, the proportion of population in the 65-and-over range increases markedly. From 10.7 percent in 1977, it rises to 12.4 percent by 1995. It falls slightly in the succeeding five years, but then starts to move up sharply, reaching a maximum of 18.4 percent in 2030. By the end of the projection period the proportion is 17.7 percent, or about two-thirds more than the proportion at the start of the period.

Dependency ratio (POP65+/LFTOT).—The ratio of the population 65 and over to the labor force affords a rough measure of the degree of dependency implied by the size of the elderly population. This ratio is relatively constant for several decades. However, in the second and third decades of the next century it increases very sharply. By the year 2030, the population 65 and over is equal to 39.3 percent of the labor force, compared with 23.1 percent in 1977. By the year 2050, the ratio is still as high as 37.5 percent.

Labor force (LFTOT).—The rate of growth of the labor force declines markedly in the 1980's and the 1990's. The rate rises slightly at the very end of the century, but then falls again. In the final decade of the projection period, the labor force grows by only 2.3 percent compared with 14.7 percent in the decade 1980–90. Much slower growth of the labor supply is thus a dominant characteristic of the long-run economic outlook, as reflected in the baseline projection. The ultimate levelling off of participation rates plays a role, but in the main the slower growth is a consequence of the assumptions about fertility levels and their implications for future numbers of youthful labor market entrants.

Labor input into production (LABIN).—Labor input, as defined in the model, incorporates an allowance for age-sex effects on productivity levels. The average age of the labor force increases over the projection period, as the proportion of people in the young ages drops, and the average productivity level therefore rises. This acts in some degree to offset the slower rates of growth of the labor force, and LABIN grows somewhat more than LFTOT over the projection pe-

riod: the labor input index rises to 136.3 by the year 2000 and to 150.3 by the year 2050, compared with 130.8 and 145.6 for the labor force index. However, the slowdown of the rate of growth of the working-age population remains the dominant long-run influence on labor supply.

Capital stock (KSTOCK).—Net capital accumulation continues throughout the projection period at a rapid pace, under the standard assumptions about savings behavior and the other standard assumptions. The capital stock doubles by the late 1990's and increases more than eightfold by the middle of the 20th century.

Capital-labor ratio (KAPIN/LABIN).—Associated with the increasing stock of capital is a shift toward more capital-intensive production. The capital-labor ratio rises continuously and rapidly. It doubles by the early years of the next century, and by the middle of the century it is more than five times as great as at the beginning of the projection period.

Total gross national product (GNP).—With increases in both capital and labor inputs, and an assumed rate of technical progress of 1.5 percent per annum, the real gross national product grows by about 126 percent from 1977 to 2000, and by another 231 percent between 2000 and 2050. By the end of the projection period it has thus increased almost 7½ fold.

Gross national product per capita (GNP/POPTOT).—On a per capita basis, the real GNP also increases continuously, reaching an index level for 189.8 by the year 2000, and a level of 523.7 by 2050.

Consumption per capita (CONSUM/POPTOT).—The level of private consumption per capita rises at just about the same rate as per capita GNP. The per capita consumption index in 2050 is 524.1, compared with the per capita GNP index of 523.7.

Average wages (AVWAGE).—The average real wage rises continuously. Initially, the rates of increase are much lower than the rates of increase of per capita GNP, owing principally to the effects on the latter variable of changes in the age composition of the population. However, in the longer term the two variables move in close accord.

Savings ratio (SAVING/GNP).—Under the standard assumptions, annual savings rise from 13.7 percent of GNP in 1977 to a level of 15.5 percent in 1980. (This is a substantial increase, but the latter level is more consistent with longer-term historical experience than the former one; actual future ratios in particular years may, of course, be affected by shorter-term influences.) The projected savings ratio is perfectly stable until the end of the present century. It then drops, but only slowly, and by only half a percentage point in total: by 2030 it has leveled off at 15.0 percent.

Covered population (COVTOT).—The projections of covered population are based on the Social Security Administration projections of coverage ratios and on our projections of population. The result is a COVTOT series which moves roughly in accord with projected labor force growth. The rates of growth differ in particular periods, but the differences are not large. The total covered population is projected to grow by some 30 percent by 2000, and by 48 percent by 2050.

Insured population (INTOT).—The projections of the population classified as fully insured for OASI purposes are also based on SSA projected ratios, combined with our own population projections. (The

latter, it has been noted, agree quite closely with the SSA standard set of projections.) In the long run, the insured population grows considerably more rapidly than the covered population, or than the population as a whole. By 2000, the insured population has increased by about 36 percent; by 2050, it has increased by some 73 percent.

Ratio of retired workers to population (RWTOT/POPTOT).—Persons classified as retired workers for Old-Age Insurance purposes constitute 7.7 percent of the total population at the beginning of the projection period. The ratio rises in every interval until 2030, at which point it stands at 17.2 percent. It then falls, but only slightly: by 2050 the ratio is 16.8 percent. The major cause of the marked increase is the change in population age structure, a fact that is immediately evident from a comparison of changes in the RWTOT/POPTOT and POP65+/POPTOT series.

Ratio of retired workers to labor force (RWTOT/LFTOT).—The ratio of retired workers to labor force constitutes a measure of old-age dependency more directly related to social security considerations than the ratio of population 65 and older to labor force that was discussed above. The two ratios differ as to level, but both reflect the same long-run effects of demographic change. The RWTOT/LFTOT ratio rises somewhat more rapidly than the POP65+/LFTOT series, and as the projection period progresses the two series tend to converge. By the end of the period they are quite close.

Average OAI benefit (AVBEN).—The overall average OAI benefit received by retired workers is affected by changes in wage rates, changes in the age composition of the retired-worker population, and other influences. Under the standard assumptions, AVBEN declines slightly from 1977 to 1980, and rises continuously thereafter. The AVBEN index is 147.9 in the year 2000 and 441.8 in the year 2050. The increases in AVBEN are consistent with the increases in the average wage level, in the long run. However, characteristics of the initial age distribution of benefit levels have some effect on the rates of change in the early part of the projection period, and the AVBEN series therefore behaves rather differently from the AVWAGE series in the beginning. Primarily because of these early effects, the AVBEN index is some 12 percent lower than the AVWAGE index in both 2000 and 2050.

OASI tax rate (TRATE).—The combined OASI taxes are equivalent to total OASI benefit payments under the pay-as-you-go assumption of the model. TRATE is defined as the ratio of OASI taxes to taxable payroll, and thus constitutes a measure of the burden of the OASI program in relation to the base on which the taxes are levied. TRATE is 9.1 percent in 1977. From 1980 to 2000 it is relatively stable, in the neighborhood of 8½ percent. However, it rises quite sharply in the first three decades of the 20th century, an event that is consistent with the concomitant sharp rise in the RWTOT/LFTOT ratio. TRATE reaches a peak of 14.2 percent in 2030, and then declines slightly. By 2050 it stands at 13.4 percent. The long-run outlook is therefore for an increase of about one-half in the ratio of OASI taxes to taxable payroll, under the standard assumptions.

Ratio of OASI taxes to GNP (TAX/GNP).—A second measure of burden is the ratio of OASI taxes to the gross national product. This ratio is lower than TRATE, of course, but its pattern of behavior through time is similar. OASI taxes represent 3.9 percent of GNP in 1977 and 3.7 percent in 1980. From 1985 to 2000, the ratio is con-

stant at 3.6 percent. It then rises, reaching a maximum of 6.0 percent in the year 2030. A modest decline brings it down to 5.7 percent by 2050. As with TRATE, the projections thus imply a long-run increase in the TAX/GNP ratio of the order of one-half. All of the increase is projected to occur in the first three decades of the next century; during the balance of the present century, the outlook is for stability in both the TAX/GNP and TRATE measures.

VI. Projection Experiments Based on Alternative Assumptions

The baseline results of Projection Experiment 1 were discussed in some detail in the previous chapter. In the present chapter, we discuss the results of a number of other experiments designed to provide information about particular types of effects or the consequences of particular assumptions that one might make concerning the future. These experiments are numbered from 2 to 18 and results for them are reported in table 2. For convenience, the corresponding results for Experiment 1 are repeated in table 2, as well. Nine variables have been chosen, a subset of the 20 for which values are shown in table 1. We discuss each experiment in turn.

Experiment 1 (baseline projection).—This is the projection experiment discussed in the previous chapter. All nine of the selected variables are reported for this experiment. For the subsequent ones, variables are shown only if their values change; otherwise they are understood to have the same values as in Experiment 1.

Experiment 2 (OASI eliminated, no work incentive effects).—This experiment is designed to throw light on the effects of OASI on capital accumulation and the rate of economic expansion. The experiment is purely artificial and conducted entirely for analytical purposes. It is assumed that OASI is eliminated completely in 1978, with effects on savings but none on labor force participation rates. The result is an increase in the ratio of savings to GNP, by comparison with the baseline ratio of Experiment 1. The ratio is higher by seven-tenths of a percentage point in the period 1980–2000, and by somewhat more than that in subsequent decades; in the period 2030–2050, the increase is 1.2 percentage points. With higher levels of savings, the capital stock grows at a faster pace; by the year 2000, the KSTOCK index is 5.6 percent higher in Experiment 2 than in Experiment 1, and by the year 2050, it is 11.1 percent higher. The increases in capital stock are reflected in higher GNP levels, of course, but the effects are proportionately smaller, by virtue of the fact that capital is only one of the inputs into production: by the end of the projection period, GNP is only 3.2 percent above the baseline level. The elimination of OASI thus has a comparatively minor effect on the productive capacity of the economy, under the assumptions of this experiment.

Experiment 3 (OASI eliminated, with work incentive effects).—This experiment is the same as the previous one except that the elimination of OASI is assumed to induce an increase in the labor force participation rates of persons beyond or approaching normal retirement age. All persons over the age of 50 are affected. Specifically, it is assumed that the age schedule of participation rates is shifted by five years: 70-year-olds now have the rates that 65-year-olds used to have; 65-year-olds have the rates of 60-year-olds; and so on. The

result is a sharp increase in the size of the labor force: the total labor force is higher by 5.2 percent in 1980, by 5.3 percent in 2000, and by 7.4 percent in 2050. The scale of economic activity increases commensurately; by 2050, the GNP is 7.7 percent higher than in Experiment 2, and 11.1 percent higher than in Experiment 1. The implication is that if OASI does have as substantial an effect on work incentives as we have assumed in this experiment, the effects on the labor supply may be of more consequence for long-run output and income levels than the effects on savings.

Experiment 4 (forced-savings assumption).—The standard assumption is that the propensity to dissave associated with OASI taxes is the same as the propensity to save out of general income ($\gamma_3=\gamma_1$). This is equivalent to assuming that OASI payments are, in fact, treated as taxes. An alternative assumption—the one that we make in the present experiment—is that the payments are treated as forced savings: every dollar taxed away for OASI purposes results in a dollar less of private savings. This assumption implies $\gamma_3=1$. However, it is important to note that if γ_3 is increased, γ_1 must be increased also, for the two parameters taken together must be such as to generate actual historical levels of private savings. The values of the two parameters may thus be varied experimentally, but subject to an empirical constraint.[15] When γ_3 is set to 1 in the model, the required long-run value of γ_1 is .2491, compared with the standard value of .2097, when γ_3 and γ_1 are equal. The net result of these two parameter changes is actually to *raise* the overall savings ratio slightly in the period up to the year 2000, compared with the baseline ratio. After 2000, OASI taxes increase as a fraction of GNP, and the assumption of forced savings starts to have the dominant effect: in 2010 the savings ratio is back to its baseline level, and from 2020 on it is below that level. The GNP is 0.6 percent above the baseline level in 2000 but 3.8 percent below it by 2050. In sum, alternative assumptions about the savings behavior of OASI taxpayers yield different results in different periods, if account is taken of the constraint on the savings propensities implied by historical data. The long-run effects on GNP are not negligible, but neither are they inordinately large, given the length of the projection period.

Experiment 5 (slower technical progress).—The standard assumption is that the rate of technical progress is 1.5 percent per annum. In this experiment, the rate is lowered to 1.0 percent. The economy now expands more slowly, of course. By the year 2000, GNP is about 13 percent below its baseline level, and by 2050 it is 38 percent below. The OASI tax rate is increased, but not markedly. TRATE is 8.7 percent in the year 2000, compared with 8.6 percent in the baseline case, and 13.9 percent in 2050, compared with 13.4 percent. The ratio of OASI taxes to GNP behaves in a similar fashion: By 2050, TAX/GNP is up to 5.9 percent from its baseline level of 5.7 percent.

[15] One may view the situation as follows: We are uncertain as to how the world actually works and we make alternative assumptions. If it is a world in which $\gamma_3=\gamma_1$, then historical data imply that the two parameters must have a particular value, and the projections trace the future consequences on that basis. If, on the other hand, it is a world in which $\gamma_3=1$, historical data imply a different value for γ_1, and a different set of future consequences. In practice, what we do when γ_3 is set to 1 is to adjust the γ_1 parameter in 1977 so that the model will generate actual 1977 private savings. The values of γ_1 in subsequent years are then adjusted by the same amount as the 1977 value.

Experiment 6 (faster technical progress).—Similar results are obtained in this experiment, though opposite in direction. The rate of technical progress is increased to 2.0 percent per annum, and the rate of economic growth rises commensurately. By 2050 GNP is 62 percent above its baseline level. The burden of OASI is reduced somewhat, as evidenced by lower levels of TRATE and TAX/GNP, but again the effects are not pronounced. At most, the TAX/GNP ratio is reduced by only two-tenths of a percentage point, and that not until the final two decades of the projection period. All in all, one concludes that while the rate of technical progress is critical in the determination of the rate of economic growth, it does not have a major impact on the proportion of income that must be transferred in order to pay for OASI benefits. (Of course, the benefit levels themselves rise more rapidly, inasmuch as these are linked to a more rapidly rising level of wages.)

Experiment 7 (lower fertility).—We assume a modest drop in the total fertility rate in this experiment. In the baseline experiment, the rate rises to 2.1 per thousand; in this one it falls to 1.7 by 1977, and then remains at that level. (An ultimate level of 1.7 is adopted to accord with the Social Security Administration assumption in its "Alternative III" projections.) This has the effect of reducing the future labor force. The effect is quite small in the early decades, but by 2010 it is starting to become much more prominent. By 2050 the labor force is only slightly more than three-quarters of its baseline level. This has the effect of reducing substantially the aggregate GNP. However, the population is reduced also, and the proportion of dependent children is lowered. Accordingly, per capita GNP is some 3 or 4 percent above its baseline level by the turn of the century, and the gap is maintained thereafter. With a higher ratio of older people to total population, and a lower fraction of the population in the labor force, the OASI burden increases. The increases do not occur until two decades into the next century, but they then become quite substantial. By 2050, OASI taxes represent 7.0 percent of the GNP, compared with only 5.7 percent in the baseline case.

Experiment 8 (higher fertility).—An increase in fertility has all the opposite effects. We assume now that the total fertility rate rises to 2.3 per thousand by 1997, and then remains constant. (This accords roughly with the SSA "Alternative I" assumption.) GNP per capita falls below the baseline levels. Effects on the labor force are not noticeable until the beginning of the century, but thereafter they become pronounced, and the total labor force grows at a much more rapid pace. The OASI tax burden is reduced, starting in 2010. By 2050, the ratio of TAX to GNP is 5.2 percent, compared with the baseline ratio of 5.7 percent.

Experiment 9 (much higher fertility).—To bring out more clearly the effects of fertility changes, we assume in this experiment that the total fertility rate rises to 3.0 per thousand by 1997. (Such a rate would be far higher than the rates of recent years, but still well below the levels attained in the 1940's and the 1950's.) This assumption results in much faster labor force growth in the next century but a greater drop in per capita income, in consequence of the larger fraction of children in the population. The OASI tax burden is reduced sharply, starting in the second decade of the century. By 2050,

the TAX/GNP ratio is only 4.0 percent. Even so, the tax ratios from 2010 on are all higher than they were up until the year 2000, it may be noted, thus underscoring the fact that the relative burden of OASI is likely to rise in the long run, even under quite different assumptions about the demographic future. The higher fertility assumption and the lowering of TAX/GNP induces a modest increase in the ratio of savings to GNP: The ratio in 2050 is 15.4 percent, compared with 15.0 in the baseline case.

Experiment 10 (lower mortality).—In this experiment, the annual percentage rate of decline in the mortality rate is increased by one-half for every age of each sex. This has the long-run effect of increasing the proportion of elderly people in the population, of course, and of raising the ratio of retired workers to population. But the effects are comparatively minor. RWTOT/POPTOT is 17.5 percent in 2050, compared with the baseline ratio of 16.8 percent. The OASI tax burden is increased, as must be the case, but the increases are relatively small, given the marked change in mortality assumptions from which they derive. The ratio of TAX to GNP is at no point increased by more than two-tenths of a percentage point.

Experiment 11 (higher mortality rates).—Mortality rates are now assumed to decline at only one-half the annual percentage rates of decline that are associated with the standard assumptions. Again, the effects are not large. The proportion of elderly people falls, and with it the OASI tax burden. But the change in the TAX/GNP ratio never exceeds two-tenths of a percentage point.

Experiment 12 (lower labor force participation rates).—The standard assumptions about participation rates correspond to those underlying the Bureau of Labor Statistics "moderate-growth" projections (adjusted by us for observed differences between the 1978 actual and projected levels). We now substitute for these the BLS "low-growth" assumptions. The labor force now grows at substantially slower rates in the earlier decades of the projection period, and the GNP increases less rapidly. With a smaller income base, the OASI tax burden is increased. However, the increases are relatively small. The TAX/GNP ratio is above its baseline level by three-tenths of a percentage point in 2030, but by no more than one or two-tenths in every other year for which results are reported in table 2.

Experiment 13 (higher labor force participation rates).—Higher participation rates produce effects opposite in direction but similar in magnitude. Adopting the BLS "high-growth" assumptions, the labor force increases more rapidly in the earlier decades, and the level of per capita GNP is raised. A larger tax base reduces the OASI burden and the TAX/GNP ratio is lowered. The maximum reduction, four-tenths of a percentage point, occurs in 2040.

Experiment 14 (lower benefit rates).—This experiment and the three which follow investigate the effects of hypothetical changes in the parameters of the OASI system. In this one, it is assumed that all benefits are cut in half, commencing in 1979. (The reduction of benefits applies to all retired workers, including those who retired in earlier years; the assumption is obviously unrealistic and the experiment is conducted purely for analytical purposes.) The effects on TRATE and on the TAX/GNP ratio are virtually proportional: both are reduced by about 50 percent from the time that the change is introduced. With a smaller fraction of aggregate income transferred to OASI

recipients, the savings ratio is raised somewhat above the baseline levels—from 15.5 percent of GNP to 15.9 percent in 1980, and from 15.0 to 15.6 in 2050. However, the consequences for the aggregate and per capita levels of GNP are quite minor; the GNP is increased by less than 2 percent by the end of the projection period, and by smaller proportions along the way.

Experiment 15 (higher benefit rates).—All benefits are increased by one-half in this experiment. Again the effects on the OASI ratios are virtually proportional: both TRATE and TAX/GNP rise by 50 percent. The savings ratio falls by about as much as it increased in the previous experiment, and the GNP decreases, but only slightly.

Experiment 16 (earlier eligibility for benefit).—The benefit rates are restored to their standard levels in this experiment, but the age of eligibility for retired-worker benefit is assumed to be reduced by three years, beginning in 1979. The assumption is given effect by lowering j^*, the retirement reference age, from 65 to 62. (The RATIO parameters of equation (18.8) are shifted by three years also.) It is assumed that this change induces a change in labor force behavior, and the participation rates for persons over the age of 50 are shifted by three years: the 51-year-olds now have the participation rates that 54-year-olds would have had, the 52-year-olds have the 55-year-old rates, and so on. (The retired-worker, insured-population, and covered-population ratios are shifted in a corresponding fashion.) The consequences for the OASI tax burden are as expected: Both TRATE and TAX/GNP increase by about one-sixth from the time of the change, in part because of the increased numbers of retired-worker beneficiaries, and in part because of the reduction of the working population, and hence of the OASI tax base. The savings ratio drops a little, and GNP falls below the baseline level by about 6 percent by the end of the projection period.

Experiment 17 (later eligibility for benefit).—This is the reverse of the previous experiment. The age of eligibility for retired-worker benefits is raised by three years, and j^* is shifted accordingly, from 65 to 68. The age schedule of labor force participation rates is shifted also by three years for all persons over 50, with the result that the total labor force increases. TRATE and TAX/GNP are lowered by about a sixth, SAVING/GNP is raised slightly, and the overall level of GNP is some 5 percent above its baseline level by the end of the projection period. The results for this experiment and the previous one are not perfectly symmetric, but the degree of asymmetry is small.

Experiment 18 (slow growth, heavy burden).—This final experiment is based on a combination of assumptions chosen to yield a slow rate of economic expansion and a heavy OASI burden. Fertility levels are set at the lower levels of Experiment 7 and mortality rates at the lower levels of Experiment 10. The slower rate of technical progress of Experiment 5 and the forced-savings behavior of Experiment 4 are assumed. The consequences of this set of assumptions are major ones, as one might expect. The population grows much more slowly than in the baseline case, and the levels of GNP per capita are much lower—some 41 percent lower, by the end of the projection period. The savings ratio is somewhat above the baseline levels in the first several decades, but by 2010 it has fallen below, and by 2050 it is substantially below—11.7 percent of GNP, compared with 15.0 in the baseline case. The OASI tax burden is increased, although the increases become substan-

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tial only in the later decades. By 2050, TRATE and TAX/GNP are greater than their baseline levels by roughly one-third.

VII. Summary Statement of Principal Conclusions

The paper has been concerned with interactions among the Old-Age and Survivors Insurance system and the overall U.S. economy and population. An integrated economic-demographic-OASI model was developed and used in projections to the middle of the next century. A standard set of assumptions and parameter values was established, and an initial projection was made based on this standard set. The initial projection was regarded as a baseline projection. A variety of alternative projection experiments were then conducted and the results compared with those of the baseline projection. The experiments were designed to explore the effects of OASI on long-run economic growth prospects and the sensitivity of projection results to changes in demographic and other assumptions. They were designed also to throw light on the manner in which the OASI tax burden might be different in different circumstances.

We discussed the results of the baseline projection and the other projection experiments in some detail in the last two chapters. In this concluding chapter we offer a summary statement of what we judge to be the most important general findings:

(1) The tax burden of the OASI system is projected to increase under virtually all the assumptions with which we have experimented, excluding only those in which the parameters of the OASI system itself are changed. However, the increase will not commence until a decade or so into the next century. For the balance of the present century, the combined OASI tax rate and the ratio of taxes to gross national product are projected to be quite stable.

(2) The extent to which the projected OASI burden rises in the next century depends on the particular assumptions that are made about the future. Under the most unfavorable set of assumptions with which we have experimented, OASI taxes increase from 3.9 percent of GNP in 1977 to 7.7 percent in 2050, and the combined rate of tax on taxable payroll increases from 9.1 percent to 18.0 percent. Based on these two measures, the burden thus roughly doubles over the 73-year period. Under the more favorable set of assumptions which underly the baseline projection, the burden increases by about one-half.

(3) The existence of the OASI system has some inhibiting effects on economic growth and income levels, if one accepts what appears to be the plausible assumption that little or nothing is saved out of OASI benefit payments by those who receive them. When OASI was eliminated in one of the projection experiments, the ratio of national savings to GNP rose immediately, and remained above its baseline level throughout the projection period. However, the effects were by no means spectacular. The savings ratio increased by .7 of one percent of GNP. Disregarding work incentive effects, GNP was higher than its baseline level by less than 2 percent in the year 2000, and by just over 3 percent in 2050.

(4) When the foregoing experiment was repeated with allowance for work incentive effects among the retired and preretirement populations, the effects on national output were increased substantially. The combined effect of a higher savings ratio and a larger labor force was

to raise GNP above its baseline level by about 7 percent in 2000 and about 11 percent in 2050. The assumptions about how labor force behavior is affected by the existence of OASI are just that—assumptions—but the results do suggest that work incentive effects may be as important or more important than savings effects, from the point of view of economic growth and levels of income.

(5) The particular assumptions that one makes about differences in the savings behavior of OASI taxpayers have a bearing on the projected rates of growth. However, the effects are not as predictable as might have been supposed. When the assumption that OASI payments are treated as forced savings was introduced for experimental purposes, so that savings by OASI taxpayers were reduced, the overall national savings ratio actually rose above the baseline levels until the year 2010, after which it fell below them. The reason, as discovered in Chapter VI, is that if dissaving associated with OASI taxes is assumed to be greater, savings out of general income must also be assumed to be greater in order that consistency with historical data be maintained, and the model be capable of generating actual historical levels of national savings. The net effect of these two assumptions differs in direction between the first three decades or so of the projection period and the subsequent decades. The accumulated effect on the level of GNP is relatively small, taking the projection period as a whole: By 2050, the forced-savings assumption causes GNP to be only about 4 percent below its baseline level.

(6) The burden of OASI taxes is affected by a number of basic economic and demographic factors. The burden is greater, in the long run, the slower is the rate of technical progress, the lower is the level of fertility, the lower are mortality levels, and the lower are labor force participation rates. Of these several factors, the level of fertility is quantitatively the most important. Any substantial rise in fertility levels could reduce markedly the OASI tax burden in the next century, although it would have little effect during the remainder of the present one. On the other hand, the burden is unlikely to be affected much even by quite substantial differences in the rates of decline of mortality.

(7) Changes in the parameters of the OASI system itself obviously can have major effects on the tax burden. The burden would increase in response to a rise in benefit levels or a lowering of the age of eligibility for retired-worker benefits; conversely, it would be lowered by a reduction of benefit levels or an increase in age of eligibility. However, the experiments suggest that overall economic growth rates would not be markedly affected. When all benefit rates are increased by one-half, the level of GNP in 2050 is reduced by only 2 percent. When the age of eligibility is lowered by three years, the GNP drops by somewhat more—6 percent in 2050—primarily as a consequence of assumed work disincentive effects. All in all, and given the length of time spanned by the projection period, the economic system does not seem to be especially sensitive to the OASI rules or parameters.

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Equations of the Model

(1) Fertility

(1.1) $$\text{CFERT}_{jt}=\alpha_{0t}(\alpha_{1t})^{(\alpha_{2t})^{j-i_0}} \qquad (j=14,\ \ldots,\ 50)$$

(1.2) $$\text{CFERT}_{jt}=0 \qquad (j<14)$$

(1.3) $$\text{CFERT}_{jt}=\text{CFERT}_{50,t} \qquad (j>50)$$

(1.4) $$\text{FERT}_{jt}=\text{CFERT}_{j+1,t}-\text{CFERT}_{jt}$$

(1.5) $$\text{TLF}_t=\alpha_{0t}(\alpha_{1t})^{(\alpha_{2t})^{50-i_0}}$$

(1.6) $$\text{MAM}_t=(\ln \alpha_{2t})^{-1}\ln\left\{\frac{\ln\left[.5(\alpha_{1t})^{(\alpha_{2t})^{50-i_0}}\right]}{\ln\ \alpha_{1t}}\right\}$$

(1.7) $$\mathrm{IRA}_t=(\ln \alpha_{2t})^{-1} \ln \left\{\frac{\ln [.75(\alpha_{1t})^{(\alpha_{1t})^{50-i_0}}]}{\ln [.25(\alpha_{1t})^{(\alpha_{1t})^{50-i_0}}]}\right\}$$

(2) Births

(2.1) $$\mathrm{TBIRTH}_t=\sum_{j=14}^{50} \mathrm{FERT}_{jt}[1/2(\mathrm{POP}_{2jt}+\mathrm{POP}_{2,\,j-1,\,t-1})]$$

(2.2) $$\mathrm{BIRTHS}_{1t}=\left(\frac{s}{1+s}\right) \mathrm{TBIRTH}_t$$

(2.3) $$\mathrm{BIRTHS}_{2t}=\left(\frac{1}{1+s}\right) \mathrm{TBIRTH}_t$$

(3) Deaths

(3.1) $$\mathrm{DEATHS}_{ijt}=d_{ijt}\mathrm{POP}_{i,j-1,\,t-1} \quad (i=1,\,2;\,j=1,\,\ldots,\,j\max)$$

(3.2) $$\mathrm{DEATHS}_{i0t}=d_{i0t}\mathrm{BIRTHS}_{it} \quad (i=1,\,2)$$

(4) Net immigration

(4.1) $$\mathrm{MIG}_{ijt}=m_{ij}\mathrm{MIGTOT}_t \quad (i=1,\,2;\,j=0,\,\ldots,\,j\max)$$

(5) Population

(5.1) $$\mathrm{POP}_{ijt}=\mathrm{POP}_{i,j-1,t-1}-\mathrm{DEATHS}_{ijt}+\mathrm{MIG}_{ijt} \quad (i=1,\,2;\,j=1,\,\ldots,\,j\max)$$

(5.2) $$\mathrm{POP}_{i0t}=\mathrm{BIRTHS}_{it}-\mathrm{DEATHS}_{i0t}+\mathrm{MIG}_{i0t} \quad (i=1,\,2)$$

(5.3) $$\mathrm{POPTOT}_t=\sum_{i=1}^{2}\sum_{j=0}^{j\max} \mathrm{POP}_{ijt}$$

(6) Labor force and employment

(6.1) $$\mathrm{LF}_{ijt}=p_{ijt}n_{ij}\mathrm{POP}_{ijt} \quad (i=1,\,2;\,j=16,\,\ldots,\,j\max)$$

(6.2) $$\mathrm{EMP}_{ijt}=(1-u_{ij})\mathrm{LF}_{ijt} \quad (i=1,\,2;\,j=16,\,\ldots,\,j\max)$$

(6.3) $$\mathrm{LFTOT}_t=\sum_{i=1}^{2}\sum_{j=16}^{j\max} \mathrm{LF}_{ijt}$$

(6.4) $$\mathrm{EMPTOT}_t=\sum_{i=1}^{2}\sum_{j=16}^{j\max} \mathrm{EMP}_{ijt}$$

(7) Domestic production

(7.1) $$\mathrm{GDP}_t=a_t(\mathrm{KAPIN}_t)^{\beta}(\mathrm{LABIN}_t)^{1-\beta}$$

(8) Technical progress

(8.1) $$a_t=a_0(1+r)^t$$

(9) Factor inputs

(9.1) $$\mathrm{KAPIN}_t=c\mathrm{KSTOCK}_t$$

(9.2) $$\mathrm{LABIN}_t=\sum_{i=1}^{2}\sum_{j=16}^{j\max} k_{ij}\mathrm{EMP}_{ijt}$$

(10) Factor income and wage rates

(10.1) $$\text{YLAB}_t=(1-\beta)\,\text{GDP}_t$$

(10.2) $$\text{YPROP}_t=\beta\text{GDP}_t$$

(10.3) $$\text{AVWAGE}_t=\text{YLAB}_t/\text{EMPTOT}_t$$

(10.4) $$\text{WAGE}_{ijt}=k_{ij}(\text{YLAB}_t/\text{LABIN}_t) \qquad (i=1,\ 2;\ j=16,\ \ldots,\ j\text{max})$$

(10.5) $$\text{GDP}_t=\text{YLAB}_t+\text{YPROP}_t$$

(11) Gross national product

(11.1) $$\text{FPR}_t=\eta\text{GNP}_t$$

(11.2) $$\text{GNP}_t=\text{GDP}_t+\text{FPR}_t=\left(\frac{1}{1-\eta}\right)\text{GDP}_t$$

(12) Government purchases of goods and services

(12.1) $$\text{GOV}_t=\zeta\text{GNP}_t$$

(13) Net exports of goods and services

(13.1) $$\text{XNET}_t=\theta\text{GNP}_t$$

(14) Saving

(14.1) $$\begin{aligned}\text{SAVEP}_t&=\gamma_1[\text{GNP}_t-\text{GOV}_t-(\text{BEN}_t-\text{TAX}_t)]+\gamma_2\text{BEN}_t-\gamma_3\text{TAX}_t\\&=\gamma_1[(1-\zeta)\,\text{GNP}_t-(\text{BEN}_t-\text{TAX}_t)]+\gamma_2\text{BEN}_t-\gamma_3\text{TAX}_t\end{aligned}$$

(14.2) $$\text{DEF}_t=\pi\text{GNP}_t$$

(14.3) $$\text{SAVING}_t=\text{SAVEP}_t-\text{DEF}_t$$

(15) Investment

(15.1) $$\text{INVEST}_t=\text{SAVING}_t$$

(15.2) $$\text{IFOR}_t=\lambda\text{INVEST}_t$$

(15.3) $$\text{IDOM}_t=\text{INVEST}_t-\text{IFOR}_t=(1-\lambda)\text{INVEST}_t$$

(15.4) $$\text{IFIX}_t=\xi\text{IDOM}_t$$

(16) Fixed capital stock

(16.1) $$\text{STOCKP}_t=\sum_{j=0}^{\infty}(1-\delta)^j\text{IFIX}_{t-j-1}=(1-\delta)\,\text{STOCKP}_{t-1}+\text{IFIX}_{t-1}$$

(16.2) $$\text{STOCKG}_t=\phi\text{KSTOCK}_t$$

(16.3) $$\text{KSTOCK}_t=\text{STOCKP}_t+\text{STOCKG}_t=\left(\frac{1}{1-\phi}\right)\text{STOCKP}_t$$

(17) Consumption

(17.1) $$\text{CONSUM}_t=\text{GNP}_t-\text{IDOM}_t-\text{GOV}_t-\text{XNET}_t$$

(18) Old-age and survivors insurance

(18.1) $$\text{COVPOP}_{ijt}=\text{COVRAT}_{ijt}\text{POP}_{ijt} \qquad (i=1,\ 2;\ j=16,\ \ldots,\ j\text{max})$$

(18.2) $$\text{INPOP}_{ijt}=\text{INRAT}_{ijt}\text{POP}_{ijt} \qquad (i=1,\ 2;\ j=16,\ \ldots,\ j\text{max})$$

$$\text{RW}_{ijt}=\text{RWRAT}_{ijt}\text{INPOP}_{ijt} \quad (i=1,\ 2;\ j=j\text{min},\ \ldots,\ j\text{max}) \tag{18.3}$$

$$\text{COVTOT}_t=\sum_{i=1}^{2}\sum_{j=16}^{j\text{max}}\text{COVPOP}_{ijt} \tag{18.4}$$

$$\text{INTOT}_t=\sum_{i=1}^{2}\sum_{j=16}^{j\text{max}}\text{INPOP}_{ijt} \tag{18.5}$$

$$\text{RWTOT}_t=\sum_{i=1}^{2}\sum_{j=j\text{min}}^{j\text{max}}\text{RW}_{ijt} \tag{18.6}$$

$$\text{PEN}_{ij^*t}=\text{FRACT}_{it}\text{AVWAGE}_t \quad (i=1,\ 2) \tag{18.7}$$

$$\text{PEN}_{ijt}=\text{RATIO}_{ij}\text{PEN}_{ij^*t} \quad (i=1,\ 2;\ j=j^*-3,\ \ldots,\ j^*+5;\ \text{RATIO}_{ij^*}=1) \tag{18.8}$$

$$\text{PEN}_{ijt}=\text{PEN}_{i,j-1,t-1} \quad (i=1,\ 2;\ j=j^*+6,\ \ldots,\ j\text{max}) \tag{18.9}$$

$$\text{RWBEN}_t=\sum_{i=1}^{2}\sum_{j=j\text{min}}^{j\text{max}}\text{PEN}_{ijt}\,\text{RW}_{ijt} \tag{18.10}$$

$$\text{AVBEN}_t=\text{RWBEN}_t/\text{RWTOT}_t \tag{18.11}$$

$$\text{TAXPAY}_t=\tau\text{YLAB}_t \tag{18.12}$$

$$\text{TRATE}_t=\text{RWBEN}_t/\text{TAXPAY}_t+\text{XRATE}_t \tag{18.13}$$

$$\text{TAX}_t=\text{TRATE}_t\text{TAXPAY}_t \tag{18.14}$$

$$\text{BEN}_t=\text{TAX}_t \tag{18.15}$$

Definitions

(All income, expenditure, and related variables are in real terms; all flow variables are annual.)

Greek Symbols

α	Parameter in cumulative fertility function (α_0, α_1, α_2).
β	Distribution parameter in production function.
γ	Propensity to save (γ_1, γ_2, γ_3).
δ	Annual rate of depreciation of capital stock.
ζ	Ratio of GOV to GNP.
η	Ratio of FPR to GNP.
θ	Ratio of XNET to GNP.
λ	Ratio of IFOR to INVEST.
ξ	Ratio of IFIX to IDOM.
π	Ratio of DEF to GNP.
τ	Ratio of TAXPAY to YLAB.
ϕ	Ratio of STOCKG to KSTOCK.

Latin Symbols

a	Scale parameter in production function.
a_0	Base value of a.
AVBEN	Average annual OAI benefit per retired worker.
AVWAGE	Average annual wage, both sexes and all ages combined.
BEN	Total OASI benefit payments.
BIRTHS	Live births of given sex.
c	Ratio of KAPIN to KSTOCK.
CFERT	Cumulative fertility rate: sum of age-specific rates up to given age.
CONSUM	Private consumption.
COVPOP	Covered population: persons of given sex and age with OAI taxable earnings during a year.
COURAT	Ratio of COVPOP to POP.
COVTOT	Total covered population: COVPOP summed over both sexes and all ages.

d	Mortality rate: the proportion who die during a one-year interval of given sex and age at the start of the interval; for the youngest age, the proportion of live-born babies who die before the end of the interval.
DEATHS	Deaths of persons of given sex and age.
DEF	Government deficit (all levels of government combined) plus statistical discrepancy between gross saving and gross investment.
EMP	Annual average number of persons employed of given sex and age.
EMPTOT	Total annual average employment: EMP summed over both sexes and all ages.
FERT	Age-specific fertility rate: number of live births per woman of given age.
FPR	Factor payments received from the rest of the world.
FRACT	Ratio of PEN to AVWAGE at reference retirement age (j^*) for persons of given sex.
GDP	Gross domestic product.
GNP	Gross national product.
GOV	Government purchases of goods and services.
i	Subscript indicating sex (1 for male, 2 for female).
IDOM	Gross domestic investment.
IFIX	Gross fixed domestic investment.
IFOR	Foreign investment.
INPOP	Insured population: persons of given sex and age classified as fully insured for OAI purposes at middle of calendar year.
INRAT	Ratio of INPOP to POP.
INTOT	Total insured population: INPOP summed over both sexes and all ages.
INVEST	Total gross investment.
IRA	Interquartile range of ages of mothers at childbirth.
j	Subscript indicating age.
j^*	Reference retirement age (e.g., $j^*=65$).
j_0	Reference age in cumulative fertility function ($j_0=24$).
$j$max	Maximum age at which there are living persons.
$j$min	Minimum age at which a person can have OAI retired-worker status.
k	Productivity weight for employed persons of given sex and age.
KAPIN	Input of capital services into production.
KSTOCK	Total fixed capital stock at start of calendar year.
LABIN	Input of labor services into production.
LF	Annual average labor force of given sex and age.
LFTOT	Total annual average labor force: LF summed over both sexes and all ages.
m	Ratio of MIG to MIGTOT.
MAM	Median age of mothers at childbirth.
MIG	Net immigration of given sex and age.
MIGTOT	Total net immigration.
n	Fraction of population of given sex and age defined as eligible for labor force participation (noninstitutional population).
p	Labor force participation rate for given sex and age.
PEN	Average annual OAI benefit payment per retired worker of given sex and age.
POP	Population of given sex and age at middle of calendar year.
POPTOT	Total population: POP summed over both sexes and all ages.
r	Annual rate of technical progress (rate of increase of the parameter a).
RATIO	Ratio of PEN at given age to PEN at reference retirement age (defined only for persons in the neighborhood of the reference retirement age).
RW	Number of retired workers: persons of given sex and age classified as OAI retired-worker beneficiaries at middle of calendar year.
RWBEN	Benefit payments to retired workers.
RWRAT	Ratio of RW to INPOP.
RWTOT	Total number of retired workers: RW summed over both sexes and all ages.

s	Sex ratio at birth: ratio of liveborn males to liveborn females.
SAVING	Total gross saving.
SAVEP	Gross private saving.
STOCKG	Government fixed capital stock at start of calendar year.
STOCKP	Private fixed capital stock at start of calendar year.
t	Subscript or variable indicating time, in years.
TAX	Total OASI taxes (employers, employees, and self-employed, combined).
TAXPAY	Taxable payroll: amount of labor income subject to OASI tax, including labor income from self-employment.
TBIRTH	Total number of live births.
TLF	Total lifetime fertility rate: the level of CFERT at age 50.
TRATE	OASI tax rate (employers, employees, and self-employed, combined) : ratio of TAX to TAXPAY.
u	Unemployment rate for given sex and age.
WAGE	Annual wage for persons of given sex and age.
XNET	Net exports of goods and services (exports minus imports).
XRATE	Component of OASI tax rate associated with benefit payments other than payments to retired workers.
YLAB	Labor income from domestic production.
YPROP	Property income from domestic production.

TABLE 1.—RESULTS OF PROJECTION EXPERIMENT 1

[Baseline projection under standard assumptions]

Variable	Year in projection period										
	1977	1980	1985	1990	1995	2000	2010	2020	2030	2040	2050
POPTOT	100.0	102.5	106.9	111.3	115.3	118.9	125.4	131.5	136.1	139.4	142.5
TBIRTH/POPTOT	15.2	15.5	16.0	15.6	14.8	14.1	14.1	13.8	13.5	13.6	13.6
POP65+/POPTOT	10.7	11.0	11.7	12.2	12.4	12.3	12.7	15.6	18.4	18.3	17.7
POP65+/LFTOT	23.1	22.9	23.2	23.9	24.5	24.2	25.4	32.5	39.3	38.9	37.5
LFTOT	100.0	107.4	116.6	123.2	126.8	130.8	136.7	137.4	138.5	142.3	145.6
LABIN	100.0	107.7	117.6	125.5	131.3	136.3	142.3	142.3	142.8	146.8	150.3
KSTOCK	100.0	111.3	135.2	163.7	196.5	233.5	320.2	418.8	527.5	661.9	837.7
KAPIN/LABIN	100.0	103.4	114.9	130.5	149.7	171.3	225.1	294.3	369.4	450.9	557.2
GNP	100.0	113.7	138.2	164.9	193.7	225.6	296.6	373.1	465.2	589.2	746.2
GNP/POPTOT	100.0	111.0	129.3	148.2	168.0	189.8	236.6	283.8	341.9	422.6	523.7
CONSUM/POPTOT	100.0	110.3	128.5	147.3	167.0	188.7	235.4	283.4	342.5	423.1	524.1
AVWAGE	100.0	104.5	115.9	130.7	148.8	168.1	211.4	264.8	327.7	403.9	500.0
SAVING/GNP	13.7	15.5	15.5	15.5	15.5	15.5	15.4	15.2	15.0	15.0	15.0
COVTOT	100.0	109.5	116.9	122.6	125.8	130.3	138.2	139.9	141.0	144.6	148.3
INTOT	100.0	106.9	116.4	124.3	130.3	135.8	148.2	158.3	165.0	169.9	173.4
RWTOT/POPTOT	7.7	8.3	9.2	9.9	10.2	10.3	11.3	14.5	17.2	17.1	16.8
RWTOT/LFTOT	16.7	17.2	18.3	19.5	20.1	20.2	22.5	30.1	36.6	36.3	35.7
AVBEN	100.0	98.4	104.9	115.9	130.7	147.9	188.8	241.3	298.2	359.7	441.7
TRATE	9.1	8.6	8.4	8.5	8.6	8.6	9.3	12.0	14.2	13.8	13.4
TAX/GNP	3.9	3.7	3.6	3.6	3.6	3.6	4.0	5.1	6.0	5.9	5.7

Note: POP65+ is the population 65 and over. All other variables are as defined in the list of definitions which accompanies the list of equations. All ratios are in percentage form except the crude birth rate (TBIRTH/POPTOT) which is expressed per 1,000 population. All other variables are expressed as indexes with value 100 in 1977. The 1977 figures are based on actual data.

TABLE 2.—SELECTED RESULTS OF VARIOUS PROJECTION EXPERIMENTS

Experiment: Variables	Year in projection period										
	1977	1980	1985	1990	1995	2000	2010	2020	2030	2040	2050
Experiment 1—Baseline projection under standard assumptions:											
POPTOT	100.0	102.5	106.9	111.3	115.3	118.9	125.4	131.5	136.1	139.4	142.5
LFTOT	100.0	107.4	116.6	123.2	126.8	130.8	136.7	137.4	138.5	142.3	145.6
RWTOT/POPTOT	7.7	8.3	9.2	9.9	10.2	10.3	11.3	14.5	17.2	17.1	16.8
KSTOCK	100.0	111.3	135.2	163.7	196.5	233.5	320.2	418.8	527.5	661.9	837.7
GNP	100.0	113.7	138.2	164.9	193.7	225.6	296.6	373.1	465.2	589.2	746.2
GNP/POPTOT	100.0	111.0	129.3	148.2	168.0	189.8	236.6	283.8	341.9	422.6	523.7
SAVING/GNP	13.7	15.5	15.5	15.5	15.5	15.5	15.4	15.2	15.0	15.0	15.0
TRATE	9.1	8.6	8.4	8.5	8.6	8.6	9.3	12.0	14.2	13.8	13.4
TAX/GNP	3.9	3.7	3.6	3.6	3.6	3.6	4.0	5.1	6.0	5.9	5.7

TABLE 2.—SELECTED RESULTS OF VARIOUS PROJECTION EXPERIMENTS—Continued

Experiment: Variables	Year in projection period										
	1977	1980	1985	1990	1995	2000	2010	2020	2030	2040	2050
Experiment 2—OASI eliminated, no work incentive effects:											
KSTOCK	100.0	112.4	139.0	170.4	206.2	246.5	340.7	450.5	576.7	732.3	930.5
GNP	100.0	114.0	139.3	166.9	196.5	229.3	302.2	381.4	477.8	607.4	770.1
GNP/POPTOT	100.0	111.3	130.3	150.0	170.4	192.9	241.0	290.0	351.1	435.6	540.5
SAVING/GNP	13.7	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2
Experiment 3—OASI eliminated, with work incentive effects:											
LFTOT	100.0	113.0	122.8	129.6	133.4	137.7	145.8	148.4	149.2	152.3	156.4
KSTOCK	100.0	113.2	142.1	175.9	214.3	257.2	358.2	479.5	619.1	787.0	1,000.3
GNP	100.0	118.7	145.7	175.0	206.1	241.0	321.6	411.4	515.3	652.1	829.3
GNP/POPTOT	100.0	115.9	136.3	157.2	178.8	202.7	256.5	312.8	378.6	467.6	582.0
SAVING/GNP	13.7	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2
Experiment 4—Forced savings assumption ($\gamma_3 = 1$, r_1 adjusted accordingly):											
KSTOCK	100.0	111.5	136.4	166.3	200.2	238.4	326.7	416.0	495.4	593.9	740.9
GNP	100.0	113.8	138.5	165.7	194.8	227.0	298.4	372.4	456.6	570.4	719.2
GNP/POPTOT	100.0	111.0	129.6	148.9	168.9	191.0	238.0	283.2	335.5	409.1	504.8
SAVING/GNP	13.7	15.7	15.8	15.8	15.7	15.7	15.4	14.3	13.3	13.5	13.7
TRATE	9.1	8.6	8.4	8.5	8.6	8.6	9.3	12.0	14.3	13.9	13.5
TAX/GNP	3.9	3.7	3.6	3.6	3.6	3.6	4.0	5.1	6.1	5.9	5.7
Experiment 5—Slower technical progress ($r = 0.01$):											
KSTOCK	100.0	111.2	133.6	158.9	186.5	215.9	279.5	343.8	406.3	476.8	563.1
GNP	100 0	112.0	132.3	153.3	174.4	196.7	241.9	284.4	331.1	391.2	461.9
GNP/POPTOT	100.0	109.3	123.8	137.8	151.3	165.5	193.0	216.3	243.3	280.6	324.2
SAVING/GNP	13.7	15.5	15.5	15.5	15.5	15.5	15.4	15.1	14.9	15.0	15.0
TRATE	9.1	8.7	8.5	8.6	8.7	8.7	9.5	12.2	14.5	14.2	13.9
TAX/GNP	3.9	3.7	3.6	3.7	3.7	3.7	4.0	5.2	6.2	6.1	5.9
Experiment 6—Faster technical progress ($r = 0.02$):											
KSTOCK	100.0	111.5	136.8	168.8	207.3	252.9	367.8	512.0	688.0	923.7	1,253.1
GNP	100.0	115.5	144.2	177.4	215.0	258.7	363.6	489.6	653.7	887.5	1,205.4
GNP/POPTOT	100.0	112.7	134.9	159.5	186.5	217.7	290.1	372.3	480.4	636.5	846.0
SAVING/GNP	13.7	15.5	15.5	15.5	15.5	15.5	15.4	15.2	15.0	15.0	15.1
TRATE	9.1	8.6	8.3	8.4	8.4	8.4	9.1	11.8	13.9	13.4	13.0
TAX/GNP	3.9	3.7	3.5	3.6	3.6	3.6	3.9	5.0	5.9	5.7	5.5
Experiment 7—Lower fertility (TLF falls to 1.7):											
POPTOT	100.0	102.4	106.4	109.8	112.5	114.5	117.3	118.5	117.2	113.8	109.3
LFTOT	100.0	107.4	116.6	123.2	126.8	130.3	132.7	127.5	121.3	116.2	110.8
RWTOT/POPTOT	7.7	8.3	9.2	10.1	10.4	10.6	12.1	16.1	19.9	20.9	21.4
KSTOCK	100.0	111.3	135.2	163.7	196.5	233.5	318.7	410.1	500.3	597.3	710.1
GNP	100.0	113.7	138.2	164.9	193.7	225.3	292.2	356.5	423.1	502.8	594.2
GNP/POPTOT	100.0	111.0	129.9	150.2	172.1	196.7	249.1	300.9	361.1	441.9	543.6
SAVING/GNP	13.7	15.5	15.5	15.5	15.5	15.5	15.4	15.1	14.8	14.8	14.8
TRATE	9.1	8.6	8.4	8.5	8.6	8.6	9.5	12.7	15.8	16.3	16.5
TAX/GNP	3.9	3.7	3.6	3.6	3.6	3.6	4.0	5.4	6.7	6.9	7.0
Experiment 8—Higher fertility (TLF rises to 2.3):											
POPTOT	100.0	102.5	107.1	112.0	116.7	121.1	129.5	138.4	146.4	154.0	162.0
LFTOT	100.0	107.4	116.6	123.2	126.8	131.1	138.8	142.3	147.3	156.3	165.0
RWTOT/POPTOT	7.7	8.3	9.2	9.9	10.1	10.1	11.0	13.8	16.0	15.5	14.9
KSTOCK	100.0	111.3	135.2	163.7	196.5	233.5	320.9	423.1	541.2	694.9	904.8
GNP	100.0	113.7	138.2	164.9	193.7	225.8	298.8	381.5	486.6	634.4	828.6
GNP/POPTOT	100.0	111.0	128.9	147.3	166.0	186.5	230.7	275.6	332.3	412.0	511.5
SAVING/GNP	13.7	15.5	15.5	15.5	15.5	15.5	15.4	15.2	15.0	15.1	15.1
TRATE	9.1	8.6	8.4	8.5	8.6	8.6	9.2	11.7	13.5	12.8	12.3
TAX/GNP	3.9	3.7	3.6	3.6	3.6	3.6	3.9	5.0	5.7	5.4	5.2
Experiment 9—Much higher fertility (TLF rises to 3):											
POPTOT	100.0	102.6	108.1	114.5	121.5	128.7	144.4	164.6	187.4	214.5	247.4
LFTOT	100.0	107.4	116.6	123.2	126.9	132.1	145.9	159.8	180.0	210.2	243.9
RWTOT/POPTOT	7.7	8.3	9.1	9.7	9.7	9.5	9.8	11.6	12.5	11.1	10.1
KSTOCK	100.0	111.3	135.2	163.7	196.5	233.6	323.6	438.0	589.2	814.5	1,157.3
GNP	100.0	113.7	138.2	164.9	193.7	226.4	306.3	410.6	563.3	802.6	1,150.5
GNP/POPTOT	100.0	110.9	127.9	144.0	159.4	175.9	212.1	249.5	300.5	374.2	465.1
SAVING/GNP	13.7	15.5	15.5	15.5	15.5	15.5	15.4	15.3	15.2	15.3	15.4
TRATE	9.1	8.6	8.4	8.5	8.6	8.5	8.9	10.7	11.6	10.2	9.3
TAX/GNP	3.9	3.7	3.6	3.6	3.6	3.6	3.8	4.6	4.9	4.3	4.0
Experiment 10—Lower mortality (rates of decline increased by half):											
POPTOT	100.0	102.5	106.9	111.4	115.5	119.2	125.9	132.4	137.5	141.3	144.8
LFTOT	100.0	107.4	116.6	123.2	126.9	130.9	137.0	137.8	139.0	143.0	146.5
RWTOT/POPTOT	7.7	8.3	9.2	10.0	10.3	10.4	11.5	14.8	17.6	17.7	17.5
KSTOCK	100.0	111.3	135.2	163.7	196.6	233.5	320.3	419.1	528.0	662.7	839.0
GNP	100.0	113.7	138.2	165.0	193.8	225.8	297.0	374.0	466.8	591.8	750.3
GNP/POPTOT	100.0	111.0	129.2	148.1	167.8	189.4	235.9	282.5	339.6	418.7	518.1
SAVING/GNP	13.7	15.5	15.5	15.5	15.5	15.5	15.4	15.1	14.9	15.0	15.0
TRATE	9.1	8.6	8.4	8.5	8.6	8.6	9.4	12.2	14.5	14.2	14.0
TAX/GNP	3.9	3.7	3.6	3.6	3.7	3.7	4.0	5.2	6.2	6.1	5.9

TABLE 2.—SELECTED RESULTS OF VARIOUS PROJECTION EXPERIMENTS—Continued

Experiment: Variables	Year in projection period										
	1977	1980	1985	1990	1995	2000	2010	2020	2030	2040	2050
Experiment 11—Higher mortality (rates of decline reduced by half):											
POPTOT	100.0	102.5	106.8	111.2	115.1	118.6	124.8	130.6	134.7	137.5	140.1
LFTOT	100.0	107.4	116.6	123.1	126.8	130.7	136.5	136.9	137.9	141.5	144.5
RWTOT/POPTOT	7.7	8.3	9.2	9.9	10.1	10.1	11.1	14.2	16.7	16.4	16.1
KSTOCK	100.0	111.3	135.2	163.7	196.5	233.5	320.1	418.4	526.9	661.0	836.0
GNP	100.0	113.7	138.1	164.9	193.6	225.4	296.1	372.2	463.6	586.5	741.8
GNP/POPTOT	100.0	111.0	129.3	148.3	168.2	190.1	237.3	285.1	344.3	426.6	529.6
SAVING/GNP	13.7	15.5	15.5	15.5	15.5	15.5	15.4	15.2	15.0	15.0	15.1
TRATE	9.1	8.6	8.4	8.5	8.5	8.5	9.2	11.8	13.8	13.3	12.9
TAX/GNP	3.9	3.7	3.6	3.6	3.6	3.6	3.9	5.0	5.9	5.7	5.5
Experiment 12—Lower labor force participation rates (BLS low assumption):											
LFTOT	100.0	106.6	112.8	117.5	121.3	125.6	130.6	130.8	131.9	135.7	138.8
KSTOCK	100.0	111.3	134.4	161.2	191.8	226.5	308.0	400.1	501.7	628.3	794.5
GNP	100.0	113.1	135.0	159.3	186.5	217.1	283.5	355.1	442.5	560.5	709.6
GNP/POPTOT	100.0	110.4	126.3	143.2	161.7	182.6	226.2	270.0	325.2	401.9	498.0
SAVING/GNP	13.7	15.5	15.5	15.5	15.4	15.4	15.4	15.1	14.9	15.0	15.0
TRATE	9.1	8.7	8.5	8.8	8.9	8.8	9.7	12.5	14.8	14.3	14.0
TAX/GNP	3.9	3.7	3.6	3.7	3.8	3.8	4.1	5.3	6.3	6.1	5.9
Experiment 13—Higher labor force participation rates (BLS high assumption):											
LFTOT	100.0	108.4	120.2	129.0	134.3	140.0	146.8	147.8	148.9	152.9	156.5
KSTOCK	100.0	111.4	136.0	166.2	201.6	242.0	337.1	445.5	564.7	710.6	900.6
GNP	100.0	114.4	141.2	170.7	202.6	238.2	315.6	399.1	498.1	630.9	799.8
GNP/POPTOT	100.0	111.7	132.1	153.4	175.7	200.4	251.8	303.5	366.0	452.4	561.3
SAVING/GNP	13.7	15.5	15.5	15.5	15.5	15.5	15.4	15.2	15.0	15.1	15.1
TRATE	9.1	8.6	8.2	8.2	8.2	8.2	8.8	11.3	13.4	13.0	12.7
TAX/GNP	3.9	3.7	3.5	3.5	3.5	3.5	3.8	4.8	5.7	5.5	5.4
Experiment 14—Lower benefit rates (all rates reduced by half in 1979):											
KSTOCK	100.0	111.9	137.1	167.0	201.4	240.0	330.4	434.5	551.9	696.9	883.8
GNP	100.0	113.9	138.7	165.9	195.1	227.5	299.4	377.3	471.6	598.4	758.3
GNP/POPTOT	100.0	111.1	129.8	149.1	169.2	191.3	238.8	286.9	346.5	429.1	532.2
SAVING/GNP	13.7	15.9	15.9	15.9	15.9	15.9	15.8	15.7	15.6	15.6	15.6
TRATE	9.1	4.3	4.2	4.2	4.3	4.3	4.7	6.0	7.1	6.9	6.7
TAX/GNP	3.9	1.8	1.8	1.8	1.8	1.8	2.0	2.5	3.0	2.9	2.9
Experiment 15—Higher benefit rates (all rates increased by half in 1979):											
KSTOCK	100.0	110.8	133.3	160.4	191.7	227.0	310.0	403.1	503.3	627.4	792.2
GNP	100.0	113.6	137.6	163.9	192.2	223.7	293.7	368.9	458.7	579.9	733.8
GNP/POPTOT	100.0	110.8	128.7	147.3	166.7	188.2	234.3	280.5	337.1	415.8	515.0
SAVING/GNP	13.7	15.1	15.1	15.1	15.1	15.1	15.0	14.6	14.3	14.4	14.4
TRATE	9.1	13.0	12.6	12.8	12.9	12.9	14.0	18.0	21.3	20.7	20.2
TAX/GNP	3.9	5.5	5.4	5.4	5.5	5.5	5.9	7.6	9.1	8.8	8.6
Experiment 16—Earlier eligibility for benefit (j* lowered to 62 in 1979):											
LFTOT	100.0	103.5	112.5	119.1	122.6	126.1	130.4	130.2	131.9	135.8	138.6
RWTOT/POPTOT	7.7	10.1	11.1	11.8	12.0	12.1	14.0	17.7	20.0	19.7	19.7
KSTOCK	100.0	110.5	132.3	158.8	189.6	224.4	304.6	393.2	491.5	616.7	779.3
GNP	100.0	110.2	133.4	159.1	186.6	216.6	281.4	351.0	438.5	556.0	702.7
GNP/POPTOT	100.0	107.5	124.8	143.0	161.8	182.2	224.5	266.9	322.2	398.7	493.2
SAVING/GNP	13.7	15.3	15.4	15.4	15.4	15.4	15.2	14.9	14.8	14.8	14.8
TRATE	9.1	10.2	9.9	9.9	9.8	9.8	11.3	14.7	16.6	15.9	15.9
TAX/GNP	3.9	4.3	4.2	4.2	4.2	4.2	4.8	6.2	7.0	6.8	6.7
Experiment 17—Later eligibility for benefit (j* raised to 68 in 1979):											
LFTOT	100.0	110.9	120.4	127.2	130.9	135.1	142.5	144.2	145.0	148.5	152.2
RWTOT/POPTOT	7.7	6.7	7.4	8.1	8.5	8.6	9.0	11.6	14.4	14.7	14.0
KSTOCK	100.0	112.0	137.7	168.1	202.8	241.7	333.8	441.4	560.7	704.3	891.8
GNP	100.0	116.7	142.4	170.3	200.1	233.4	309.7	393.2	490.2	619.5	786.2
GNP/POPTOT	100.0	113.9	133.2	153.0	173.5	196.4	247.0	299.0	360.2	444.3	551.8
SAVING/GNP	13.7	15.6	15.6	15.6	15.6	15.6	15.5	15.4	15.2	15.2	15.2
TRATE	9.1	7.3	7.1	7.2	7.4	7.5	7.7	9.7	11.9	11.9	11.3
TAX/GNP	3.9	3.1	3.0	3.1	3.1	3.2	3.3	4.1	5.1	5.1	4.8
Experiment 18—Slow growth, heavy burden (lower fertility and mortality $\gamma_3=1$, $r=0.01$):											
POPTOT	100.0	102.4	106.4	109.9	112.7	114.8	117.9	119.4	118.5	115.6	111.4
LFTOT	100.0	107.4	116.6	123.2	126.9	130.4	132.9	127.9	121.8	116.9	111.5
RWTOT/POPTOT	7.7	8.3	9.2	10.1	10.5	10.7	12.3	16.4	20.4	21.6	22.3
KSTOCK	100.0	111.3	134.7	161.1	189.5	219.5	281.9	330.5	352.6	365.2	384.6
GNP	100.0	112.0	132.7	154.0	175.3	197.5	239.7	270.8	294.1	319.1	346.5
GNP/POPTOT	100.0	109.4	124.7	140.1	155.5	172.0	203.3	226.9	248.2	276.2	310.9
SAVING/GNP	13.7	15.7	15.8	15.7	15.7	15.6	15.2	13.8	12.3	11.9	11.7
TRATE	9.1	8.7	8.5	8.6	8.8	8.8	9.8	13.2	16.7	17.6	18.0
TAX/GNP	3.9	3.7	3.6	3.7	3.7	3.8	4.2	5.6	7.1	7.5	7.7

SOCIAL SECURITY AND PRIVATE SAVING: ANALYTICAL ISSUES, ECONOMETRIC EVIDENCE, AND POLICY IMPLICATIONS

By Michael J. Boskin and Marc Robinson*

CONTENTS

ABSTRACT

The social security system, despite enormous accomplishments and gradual reform, is in serious trouble today. It has not kept up with rapidly changing economic, social and demographic conditions and faces a long-run funding crisis of immense proportions. Of currently legislated retirement benefits amounting to about $4 trillion, only about 80 percent will be covered by expected future tax revenues. A long-run deficit the size of the privately-held national debt has developed. This has occurred largely due to the rapidly changing age structure of the population: when the post-World War II baby boom generation retires, the ratio of retirees to workers will increase about 70 percent. Further, an explosion in early retirement and dramatic gains in the life expectancy of the elderly have combined to increase the average retirement period about 30 percent in the last three decades. Our currently depressed private saving rate, combined with the longer retirement period and impending increase in the ratio of retirees to workers, creates a prospect of a major economic crisis in supporting the retirement consumption of our elderly citizens in the early part of the next century.

The enormous growth of social security—benefits (adjusted for inflation) have quadrupled since 1960 and are now the second largest item on the Federal budget—together with several of its structural features now require any analysis of social security to be made in the

*Department of Economics, Stanford University, and National Bureau of Economic Research, Inc. We would like to thank Robert Barro and Laurence Kotlikoff for their comments, and Michelle Matel for assistance, without implicating them in what remains.

larger context of its interaction with the overall economy. The benefits and taxes potentially affect, and in turn are affected by, many of the most fundamental private economic decisions in our economy. Among the most important would be decisions concerning private saving for retirement, retirement itself, private bequests, support of elderly parents by children, employment decisions of firms, and the development of private pension plans.

This paper reviews in detail the crucial question of the extent to which social security might affect private saving. Since social security is financed on a pay-as-you-go basis (with current taxes funding current benefits) no real capital formation occurs. The expectation of future social security benefits during retirement may reduce the incentive to save privately for one's own retirement. Since this private saving would have been available to finance investment, the aggregate capital stock and national income would be reduced if social security curtailed private saving.

There are, on the other hand several potential offsets to this social security "wealth" effect. Social security may affect private intergenerational intrafamily transfers of income. Recipients of social security, realizing their benefits are financed by the taxes paid by their children's generation, might increase their own bequests in various forms to offset the effect of social security. Also, by enabling people to retire earlier, social security might induce them to save more to cover their income needs over the longer retirement period.

Social security provides a different type of asset than is available privately. It is backed by government collateral; it has different tax, liquidity, survivorship, and other characteristics. This may well alter the structure of returns to all assets in such a way as to affect both the amount and composition of private saving.

These and other analytical considerations, working in offsetting directions on the incentives created by social security for private saving, make the issue essentially an empirical one. Numerous studies have been conducted to estimate the effect of social security on private saving. In a series of papers, Martin Feldstein has concluded that the initial offset of private saving by social security is close to dollar for dollar. His estimates imply that the large unfunded social security benefits have curtailed capital formation by amounts sufficient to have caused a several percentage point reduction in annual national income.

Several other authors, using different data, estimation methods, and definitions of variables or sample periods, have come to mixed conclusions regarding this social security effect. Some studies support the Feldstein conclusion; others find no evidence to support it. Partly for that reason, and also to clarify some particular statistical and data objections raised in these studies, we have reexamined the U.S. aggregate time series data to estimate the extent of the social security effect on private saving. While such data suffer from some problems—as do all available data with which to study this question—we have improved measures of some of the variables. In general, we find Feldstein's original conclusion of a substantial social security-induced decrease in private savings is supported by our reestimation of the basic equations for alternative sample periods and variable definitions.

Our conclusion is that social security probably has led to a decrease of substantial magnitude in private saving. While this likely has been

partially offset by private intrafamily intergenerational transfers of resources, our meager direct knowledge concerning such transfers suggest that they are quite a bit lower than would be necessary to offset the direct social security effect.

This paper points out some vital emerging issues:

The trends in saving, life expectancy and retirement pointing toward a problem for financing retirement consumption early in the next century;

The closely-related long-run social security funding crisis; and

The role social security itself may be playing (perhaps inadvertently) in the capital formation problem in the United States.

The policy options open to dealing with each of these issues are many; they range from structural reform of the social security system through changes in tax incentives for saving and investment to aggregate government fiscal policy shifts toward surpluses. None of these will be easy to implement. The longer we delay beginning to deal with them, the narrower our range of options will become.

1. Introduction

The social security system—perhaps the most popular, and in many ways the most successful, government income-security program in the United States—is in serious trouble today. Although it is the major source of retirement income for millions of Americans, and an important source for millions more, it also imposes the largest part of the tax burden for many American families. Since its inception in the economic disruption of the Great Depression, social security has grown much more rapidly than virtually any other government program. Social security taxes account for about a quarter of all Federal Government revenues, and social security benefit payments amount to over $100 billion per year. Since 1960, benefits (including disability and hospital) have approximately quadrupled after adjusting for inflation.

The social security system has provided substantial income security and relief from poverty for the elderly, and it annually transfers billions of dollars from the younger, wealthier generation of workers to the older, poorer generation of retirees. Despite these accomplishments and some attempts at gradual reform, the system has not kept up with rapidly changing economic, social, and demographic conditions.

Among the most important of these are the explosion in early retirement (a reduction in the elderly male labor force participation rate from about 50 percent to 20 percent since World War II); increased life expectancy of the elderly (about two years since 1960); changing household composition (increasing fraction of single person households); changing labor force patterns (many more two-earner families and later entry due to increased college enrollment); rapid general income growth; and expansion of other government income security programs.

Social security is having substantial adverse, and probably unintended, effects on the overall economy. It faces a long-range funding crisis of stunning proportions, it is being charged with unfair treatment by many groups in the population, and it is being abandoned by many State and local governments and nonprofit organizations.

Social Security is therefore at a crossroads in its history. A variety of commissions, Congress, and the administration have all been considering various proposals to change the system, but most of these suggestions are only stopgap solutions to social security's short-term problems. They do not begin to deal with the basic issues of adverse incentives and the long-term funding crisis.

Perhaps social security's most important feature is its pay-as-you-go financing. Current benefits are paid almost exclusively out of current taxes. Therefore, in the absence of any offsetting private behavior, social security would be paying almost $100 billion annually to the retired population from taxes paid by the younger working population. Since real economic growth averaged approximately 2.5 percent per year in the United States until the last five years or so, real income almost doubled between generations. Therefore, in transferring such a large sum from the current generation of much richer workers to the older generation of much poorer retirees, the system is actually extremely progressive.

Although the system attempts to provide social insurance against undersaving for retirement through compulsory tax contributions, it is difficult to determine the extent to which individuals do undersave. Accurate information at the individual and family levels on private savings and intergenerational transfers is not easily obtainable. Most of the available information covers the period since the massive growth of the social security system, and hence is conditional upon the actual tax and benefit situations of individuals and families and on their perception of their future taxes and benefits. Thus, if social security had substituted for private transfers, we would expect to observe smaller amounts of such transfers, and we would need to be able to compare the current levels with those before the institution and growth of the social security system. Various studies have shown, however, that as a result of poor planning, unanticipated events or inability to save because of low income, a large proportion of the elderly might find themselves destitute in the absence of the social security system.[1]

What sort of return can each generation expect from this implicit forced-saving program? The pay-as-you-go nature of the system prevents the development of a real trust fund and the formation of real capital. Tax contributions by current workers are used to pay benefits to current retirees, with an implied promise that the next generation of workers will pay taxes to finance the retirement years of the current generation of workers. Even if the social security tax rate remains constant, as the tax base grows because of increases in the labor force or in real per-capita income (perhaps due to technological change or inflation), retirees will obviously receive much more than they paid in taxes when they were working. The ratio between the value of the total benefits received and of the total taxes paid discounted to the present can be considered an implicit rate of return on social security taxes.[2] The tax base grows roughly at a rate that is the sum of the

[1] P. Diamond, "A Framework for Social Security Analysis," Journal of Public Economics, vol. 8, December 1977, pp. 275–298 and L. J. Kotlikoff, "Essays on Capital Formation and Social Security, Bequest Formation and Long-Run Incidence," Ph.D. dissertation, Harvard University 1977.

[2] For the first generation of retirees after social security was adopted, of course, the rate of return was extremely high; its members either were not taxed or paid taxes only over a short period of earnings before retirement, but received a substantial transfer during their retirement.

growth rates of the population and of real wages—about 3 to 4 percent on the average over the last half century—but the annual rate of return earned on investment in private capital has apparently substantially exceeded the return on social security taxes. This has led several critics to argue that social security is a bad deal for the young.[3] It is clear that the current slowing in the rate of population growth and the substantial decline in the rate of growth of productivity will make the expected return for current young workers much smaller than it has been for previous generations; and that in the absence of other consequences, the younger population might be better off investing in private capital. However, given the pay-as-you-go nature of the system, we are in a fundamental dilemma: If we decide to shift to a system fully funded through a large trust fund or to some other method of financing benefits (for example, from other taxes), the persons working at that time will have to pay twice—once to finance their own retirement and once to take care of the current retirees.

In brief summary, social security as a forced-saving program has been a mixed success. The benefits are tied only loosely to past earnings and a variety of changes in the economy make the real return lower than could be obtained on alternative investments. However, there is evidence that some of the elderly would undersave even in the absence of social security and therefore that a forced-saving program of some sort is required.

It is not necessarily true, however, that the total income of the elderly as a group or as individuals, has increased by amounts equal to total or per capita social security benefit payments. This is because social security benefits are not paid in a vacuum, but in a broader context of private intrafamily and intergenerational transfer payments and may merely substitute for other income sources such as continued earnings and private transfers of income.

There are two major forms of private intrafamily or intergenerational transfers: Private bequests from parents to children, and private support of elderly parents by children. It is extremely difficult to obtain data on either of these forms of private transfer. Whether because of embarrassment, imperfect memory, secrecy within the family, or some other reason, many respondents to household surveys simply refuse to answer such questions or ignore them; and where internal checks are available, the answers prove to be inconsistent. It is clear that taxpaying Americans as a whole are spending a much larger fraction of their income on public education than they did before enactment of social security legislation, and that this is a social bequest from parents to children in the form of knowledge and skills that will increase future earnings. Simultaneously, a steadily declining proportion of the elderly are living with their children. Therefore, social security may be viewed, at one extreme, simply as a system for the socialization of private intrafamily or intergenerational transfer payments and rearrangements of wealth. Such a system would represent no small accomplishment, since it would presumably increase the certainty that the transfer payments would be made and therefore decrease the psychological dependence across generations within fami-

[3] M. S. Feldstein, "Social Security, Induced Retirement, and Aggregate Capital Accumulation," Journal of Political Economy, vol. 82, July/August 1974, pp. 905–926.

lies. It is by no means clear, however, that social security benefits have offset private intrafamily transfers dollar for dollar. At the other extreme is the view that social security has not displaced private intrafamily transfers at all, but has simply supplemented these other sources of income. In our opinion, the truth lies somewhere between these two extremes, but a definitive answer must await the development of better techniques to gather and analyze data on private intrafamily transfers.

The social security system may well be in competition with private savings and bequests and may thus serve as a substitute for private savings. Since it is financed on a pay-as-you-go basis, however, no real capital accumulation occurs. Substantial evidence is available which indicates that social security may well reduce the supply of private capital.[4] If the promise of future social security benefits has led people to save less privately for their own retirement, and if the amount of this decrease has not been offset by adjustments in private intrafamily intergenerational transfers, then social security has substantially reduced private saving in the United States over the last several decades. Indeed, if the substitution of unfunded government debt for real assets has been dollar for dollar, as one study has suggested,[5] the net effect has been to reduce the private capital stock substantially.

If, however, as mentioned earlier, social security is in part simply a medium for the socialization of private intrafamily intergenerational transfers, then its effects on private savings may be less severe. Moreover, if the system encourages longer retirement periods, the result may be increased saving for retirement. Unfortunately, current information and data simply do not provide a definitive measure of the offset to the large decrease in saving.

The major purpose of this paper is to explore in detail the effect of social security on private saving. This controversial subject is perhaps the most important in understanding the interaction of social security and the overall economy.

2. The Issues at Stake

In the last several years, a controversy has arisen concerning the possibility of an aggregate capital shortage and its potential causes and remedies. One possible factor in reducing aggregate saving and the capital stock has been the rapid growth of unfunded social security benefits. Because the social security system is such a large and important government program, even a small decline in private saving per dollar of promised future social security benefits could cause a large reduction in total private saving. Indeed, currently legislated benefits due to be paid over the next 75 years amount to about $4 trillion (discounted to the present and adjusted for inflation). Despite the large tax increase embodied in the 1977 Social Security Amendments, social security taxes currently legislated are projected to raise about $600 or $700 billion less in present value terms than the currently legislated benefits. Hence, there is a substantial long-term deficit in the social

[4] Ibid. and A. H. Munnell, "The Effect of Social Security on Personal Saving," (Cambridge, Mass.: Ballinger, 1974). For a contrary view see R. Barro, "Are Government Bonds Net Wealth?" Journal of Political Economy, vol. 82, July/August 1974, pp. 1095–1117.

[5] Feldstein, op. cit.

security system (which likely will occur as the ratio of retirees to workers increase dramatically).[6]

Despite the original intent to fund social security through a large trust fund, this goal was quickly abandoned; we now have a system where the current taxes, paid by workers, finance the current benefits, received by retirees. Thus, the social security system is financed on a pay-as-you-go basis. The taxes paid into social security are not made available on capital markets to finance investment and no physical capital accumulation occurs. If, in anticipation of future social security benefits, individuals save less for their own retirement than they otherwise would have, there may be a sharp reduction in the supply of funds available to capital markets to finance new investment. This, in turn, may seriously retard capital formation in the United States.

Each of the propositions described above—the potential presence of a capital shortage, the potential effect of social security on private saving, and the potential effect of private saving on the aggregate capital stock and national income and output—have been the source of much debate in recent years. On both analytical and empirical levels, there have been a variety of arguments concerning the likelihood that these effects are indeed operative and important. These issues are of far more than historical interest since the private saving rate in the United States recently has been plummeting.[7] The long-term deficit in the social security system, caused largely by the rapidly changing age structure of our population, combines with the possible expansion of the rapidly lengthening retirement period to make long-term capital formation and the ability to finance the retirement consumption of future generations a major social issue.[8]

The purpose of this paper is to provide both an overall evaluation of the previously existing literature on this subject, both analytical and empirical, and to present new estimates of the direct effect of social security on private saving. While the subject is often couched in technical, mathematical, and statistical terms, we shall try to highlight the basic issues involved in as nontechnical a way as is consistent with a careful and complete elaboration of the issues and our new results. Toward this end, section 3 presents a review of some of the major contributions to this literature. We discuss, in relatively nontechnical terms, the analytical issues involved and the previously available econometric evidence and debate. As will be readily seen, differences in opinion are still substantial. They reflect both different interpretations of the data and econometric estimates and vastly different assumptions concerning private intrafamily intergenerational offsets to social security which are very difficult to measure.

Section 4 presents a reexamination of the aggregate U.S. time-series data on social security and private saving. These results strongly sup-

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[6] A long-term deficit in social security occurs primarily because of the impending dramatic increase in the ratio of retirees to workers when the baby boom generation retires early in the next century. It should be noted that this deficit is very sensitive to the length of the retirement period; it should be increased or decreased by about one-third if a year is added or subtracted from the length of the retirement period.

[7] The conventionally measured personal saving rate has reached a 30 year low of 4.1 percent of disposable personal income in the third quarter of 1979. However, the conventional measure nets out neither the inflation tax on accumulated saving nor the accumulated capital gains properly.

[8] The retirement period has increased about 30 percent since the end of World War II. See M. J. Boskin (editor), "The Crisis in Social Security," (Institute for Contemporary Studies, 1977).

port the original results of Feldstein (1974): The huge growth of social security has indeed led to a sharp reduction in private saving. We refine and extend the original econometric estimates of Feldstein, and those found in subsequent critiques. These extensions and refinements include:

The consideration of several variables left out of the original debate (such as the changing age and household structure of the population);

A focus on consumption rather than on consumer expenditures in order to achieve a closer accord with the long-term structural issue in question (i.e., more consistent treatment is given to the purchase of consumer durables); and

A sensitivity analysis of the results regarding alternative measures of the relevant variables (such as social security wealth) and alternative sample periods.

Section 5 discusses some of the unresolved (and perhaps unresolvable) issues in this debate. Several issues are addressed: The difficulty in obtaining the relevant data on private intrafamily intergenerational bequests; (2) the form that these bequests take; (3) the changing perceptions of social security as an asset comparable to other assets in private portfolios; and (4) the potential flaws in the data used to estimate the direct effect of social security on private saving.

Finally, section 6 presents a brief summary of the results, conclusions, and implications both for policy and further research.

3. Literature Review

The core of the controversy over whether the enormous growth of the unfunded social security system has affected private saving is generally traced to the seminal paper by Feldstein [1974] and the corresponding paper by Munnell [1974]. This debate is very similar to that concerning the shifting of the burden of the national debt which has been raging in economics for a much longer period. Feldstein [1974] argues that social security has two potentially offsetting effects. First, it induces people to retire earlier than they otherwise would choose since this increases the length of the retirement period, it should lead, *ceteris paribus*, to an increase in planned saving for retirement.[9] Second, unfunded social securtiy is a source of perceived wealth to consumers planning their retirement consumption. They would then substitute this perceived but unfunded wealth (about $4 trillion) for ordinary saving for retirement, hence decreasing aggregate private saving. Feldstein's [1974] empirical results imply that the *net* effect of the growth of unfunded social security wealth is the reduction of private saving almost precisely dollar for dollar of perceived social security wealth. Since private saving results in real capital formation and unfunded social security does not, Feldstein's results strikingly imply that the growth of social security in the United States sharply curtailed capital formation, and therefore, productivity and national income. Feldstein's base estimate is that social

[9] There is now substantial empirical documentation for the induced retirement effect. See M. J. Boskin, "Social Security and Retirement Decisions," Economic Inquiry, vol 15, January 1977, pp. 1–25, and M. J. Boskin and M. Hurd, "The Effect of Social Security on Early Retirement," Journal of Public Economics, vol. 10, December 1978, pp. 367–378.

security caused a 38 percent decrease in the long-run capital stock in the United States. (We shall return to this point.)[9a]

Since the original Feldstein and Munnell papers, there have been a number of responses both supporting and criticizing the analytical apparatus and empirical estimates in Feldstein's paper. Before proceeding to a discussion of more recent emperical results, let us examine some of the major analytical criticisms of the Feldstein proposition.

A. Review of the Analytical Literature

The most important attack on the Feldstein proposition is that of Robert Barro [1974]. In this analytical paper, Barro develops a model of overlapping generations, where the well-being of a representative individual in each generation depends not only on his own lifetime consumption, but also upon the consumption preferences (utility functions) of his heirs. Thus, *all* generations are linked because parents are concerned about the well-being of their children, but their children's well-being depends upon the well-being of *their* children.[10] In such a model, the current observation of substantial positive bequests from the older to the younger generation in the United States has striking implications for interpreting the potential effects of social security upon private saving. Barro notes that the introduction of unfunded social security increases the wealth of the current generation of retirees, but creates a corresponding liability for future generations. Since the current generation could already have chosen to transfer these resources from future generations to themselves by reducing their (positive) bequests, their revealed preference would be to resist the intergenerational redistribution of wealth involved in social security. This can be accomplished via an increase in their bequests by an amount sufficient to insure that their heirs are no worse off than before the introduction or growth of the unfunded social security system. The extra saving for this increased bequest just offsets the decreased saving due to the unfunded liabilities of social security.

Note that Barro's conclusion is diametrically opposed to Feldstein's empirical results: Social Security's direct effect on private saving is exactly offset by private intrafamily intergenerational adjustments; hence, social security has no effect whatsoever on aggregate private saving. While there is undoubtedly some truth to Barro's argument, there are issues that his analysis ignores; in addition, there is a paucity of data on private intrafamily generational bequests upon which to estimate such an offset. Further, Stokey [1979] presents a case in which bequests rather than heirs' utility enters preferences and in some cases the stronger the bequest motive, the greater the effect of social security.[11]

While aggregate bequests are clearly positive, only a small fraction

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[9a] After this paper was completed, an error was discovered in Feldstein's calculation of his social security, wealth variable. Therefore, in the literature review and econometric estimates sections of this paper, those studies using his time series social security wealth variable should no longer be given any weight. While this reduces the empirical support for Feldstein's argument, the remaining analysis and empirical estimates do lend some support to the notion of a partial offset of private saving by social security.

[10] More generally, each generation's utility will depend upon the well-being of its parents as well as its children; hence the potential pattern of private offsets to social security will be quite complicated with population, heterogeneity of income, etc.

[11] N. L. Stokey, "Do Bequests Offset Social Security?" Northwestern University Discussion Paper No. 376, 1979.

of decedents leave even modest direct bequests to their heirs (see Boskin [1977c]). Indeed, with real income growing between generations, Feldstein [April, 1979] argues that many would like to leave negative bequests, which are not enforceable, and hence leave nothing. Even after the imposition of social security, the optimum may be zero bequests for many families. Indeed, Hagens [1978] argues that the constraint of nonnegative bequests is a major reason for the very existence of social security.[12] Of course, *inter vivos* gifts are difficult to measure. Parental support of education and child-rearing may be a bequest in part. Perhaps most important, there may be a reduction in those private transfers from children to parents which would have occurred in the absence of social security. Data on such activities are unreliable and difficult to interpret [Feldstein, April 1979] for a number of reasons. Hence, a serious flaw in our knowledge exists because of the inadequacy of the data to estimate such Barro-type offsets.

On a purely analytical basis, this Barro effect should occur in any situation in which the rate of interest exceeds the rate of growth of output. Suppose that an economy's output is growing at rate g, and the real rate of return is constant and equal to r. If r is greater than or equal to g, any initial issuance of debt (such as the introduction or expansion of a social security system without corresponding funding) would lead to a situation where the present value of the future taxes needed to finance the interest payments would equal the amount of the initial debt issued. Thus, viewed from the perspective of consumers in the economy, future social security benefits have not added to the net wealth of the private sector. Hence, we would not expect social security to have any wealth effect on private saving and capital formation. However, in the case where the rate of growth of output exceeds the rate of interest, is is possible to finance all implicit future interest payments (i.e., those due to issuance of explicit debt or unfunded social security) without incurring any future taxes. This is possible by having the debt grow forever at the rate of interest, which is presumed less than the rate of growth of output. In such a situation, the issuance of debt for the growth of social security would be perceived as net wealth, and therefore would raise aggregate demand and cause a shift from saving to consumption. However, the case in which the real rate of interest is less than the rate of growth of output of the economy implies inefficient capital overaccumulation.[13] Further, it is unclear that an economy can remain in a long-term steady state of equilibrium with the real rate of interest below the rate of growth of output. In any event, those who argue that social security has a substantial effect on private saving and deficit finance fiscal policy has a substantial effect on aggregate demand usually have the opposite case in mind.

The argument, whether social security and its unfunded obligations are perceived as additions to private wealth, is thus closely tied to the issue of whether the economy is over or under accumulating capital. As noted above, this reduces to whether the real rate of interest exceeds or falls short of the rate of growth of output. This raises another important issue. Even if it is the case that social security and

[12] J. P. Hagens, "A Re-Examination of the Link Between Social Security and Saving," Office of Research and Statistics, Social Security Administration, 1978.
[13] E. Phelps, "The Golden Rule of Accumulation: A Fable for Growthmen," American Economic Review, vol. 51, September 1961, pp. 638–643.

its large implicit obligations have led to a substantial reduction in private saving and capital formation, it is not necessarily the case that the only, let alone appropriate, method of moving back to an efficient level of capital formation in the economy is via changes in the structure of the social security system. Indeed, many other policies can be designed to affect the aggregate national saving rate. For example, many have suggested structural revisions in tax policy and/or maintenance of tight fiscal and easy monetary policy.[14]

Another important elaboration of the Feldstein effect has been made by Kotlikoff.[15] The original Feldstein estimates were based on a partial equilibrium analysis and did not allow factor returns to respond to the fall in the capital stock. If social security and its unfunded liabilities have indeed led private consumers to save less for their own retirement and have reduced the private saving rate, the initial impact of the reduced capital formation might be partially offset by an increase in the rate of return to capital, due to the declining capital/labor ratio. By presenting some plausible parameter value and performing a sensitivity analysis, Kotlikoff estimates that social security could have caused a major reduction in the capital stock, but that the general equilibrium feedback effects on the returns to capital and labor may reduce the *net* impact of social security on the private capital stock by about half, from Feldstein's estimated 38 percent to about a 20 percent decline.

There are several further issues that deserve mention in an analytical discussion of social security's potential reduction in private saving for retirement. First, it is possible that there is a greater willingness to bequeath collectively than individually. This conjecture has been made in other contexts by Sen and Marglin.[16] It may be that, given the nature of private capital markets, changing family relationships, and a variety of other factors, social security and private bequests are not potentially perfect offsets to one another. Further, due to real income growth, younger wealthier generations may be willing to transfer resources as a public good to older poorer generations on a collective basis that exceeds the amount they would be willing, when summed individually, to bequeath privately.

Second, there is still much debate about how to treat child-rearing and education expenditures in the intergenerational bequest framework. Are such expenditures really *inter vivos* gifts? Would they have been made anyway? Are they consumption or investment? Should we treat large growth in public spending on higher education, which roughly coincided with the huge growth of social security, as an offset to social security? Reasonable people may come to diametrically opposite conclusions on these issues, without sufficient empirical basis upon which to reconcile such differences. We shall not delve more deeply into the human capital offset here, but it is clear that "bequests" of human capital have a very different nature than bequests of ordinary capital, given differences in liquidity, taxability, and riskiness,

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[14] M. J. Boskin and J. Shoven, "Issues in the Taxation of Capital Income in the U.S.," American Economic Review, May 1980 (forthcoming).

[15] L. J. Kotlikoff, "Social Security and Equilibrium Capital Intensity," Quarterly Journal of Economics, vol. 93, May 1979, pp. 233–254.

[16] S. Marglin, "The Social Rate of Discount and the Optimal Rate of Investment," Quarterly Journal of Economics, vol. 77, February 1963, pp. 95–111, and A. Sen, "Isolation, Assurance, and the Social Rate of Discount," Quarterly Journal of Economics, vol. 81, February 1967, pp. 112–124.

as well as differential ability to bequeath these assets to still later generations.

Third, substantial international mobility of capital in the long-run—an assumption open to dispute—would weaken the possible reduction in the capital stock and, hence, reduce considerably the cause for concern over social security's effect on private saving.

Finally, it is important to emphasize that social security provides an "asset" with very different characteristics from private market assets, and even from regular government debt. Both social security and government debt are backed by a different type of collateral—that of the government. Social security thus provides a type of insurance against vagaries of post-retirement income fluctuations, life expectancy, etc., which is not privately available. Also, social security has very different tax, liquidity, and distribution of potential returns features from regular government debt or private assets. Perhaps most important, social security is not voluntarily bought and sold on markets. While there are a few mechanisms for opting out of social security, the overwhelming bulk of the population faces *predetermined* contribution rates and expected future benefits. Some families might wish to purchase more or less than this amount, but are prevented from doing so. Further, the presence of social security may change the covariance structure of returns to other assets and may well alter both the desired amount and composition of private saving.

The analytical debate can be roughly summarized as follows: Feldstein has identified a manner in which the large growth of unfunded social security liabilities may reduce private saving and capital formation; Barro has presented a telling argument that at least some of this social security effect will be offset by changes in private intrafamily intergenerational transfers; we have presented some additional reasons why social security might affect private saving. Any net social security effect may be reduced through the endogenous alteration of factor returns, as discussed by Kotlikoff. A variety of considerations render the stylized models of Feldstein and of Barro a starting point in the discussion. The ultimate resolution of these issues and the provision of an accurate estimate of the extent to which social security has indeed reduced private saving remain empirical issues.

B. Review of the Empirical Literature

We turn now to a brief discussion of the most important empirical literature on the effects of social security on private savings. The seminal paper is that of Feldstein [1974]. Here Feldstein estimates equations relating consumer expenditures to the usual economic variables: disposable income, disposable income lagged, lagged wealth, and retained earnings. Feldstein's novel contribution was to introduce the concept of "social security wealth" and provide a method of measurement. "Social security wealth" is an attempt to use the present value of expected future social security benefits as a measure of the magnitude of the program's potential effect on private saving. It is obvious that social security could be thought of in several ways by individual consumers who are making their consumption/saving choices. For example, consumers could look at the expected future retirement benefits, in present value terms, as an asset in their retirement income

portfolio, while looking upon the taxes paid in the future as reductions in their future disposable income. This is the concept Feldstein proposes most often and labels "gross social security wealth." A second concept would be to net out from the present value of expected future benefits the present value of expected future taxes to arrive at the net addition of the entire social security program, both taxes and benefits, to "perceived wealth." This corresponds to Feldstein's definition of "net social security wealth." As we shall see below, another possibility is to look at accumulated social security taxes as a measure of the social security program's effect.

In Feldstein's original paper, he analyzes U.S. aggregate time-series data for the period 1929–71, excluding the war years.[17] Feldstein also reports additional estimates: Using postwar data only; using alternative definitions of social security wealth; including and excluding the unemployment rate as a measure of cyclical variability; and using a variety of other statistical procedures. Feldstein's basic equation is presented below as equation (2.1):

(2.1)
$$C = \underset{(0.047)}{0.530}\, YD + \underset{(0.035)}{0.120}\, YD_{-1} + \underset{(0.074)}{0.356}\, RE + \underset{(0.004)}{0.014}\, W_{-1} + \underset{(0.006)}{0.021}\, SSWG + \underset{(31)}{228},$$

where C is real per capita consumption, YD is disposable income, RE is retained earnings, W is private wealth, SSWG is gross social security wealth, and $_{-1}$ refers to a one-year lag.

While we shall discuss the derivation of the data in more detail in the next section, which deals with our own results, we would like to point out several of the features of the basic Feldstein results and their implications, since they have formed the basis for much of the subsequent work.

Feldstein's equation is of the usual Ando-Modigliani[18] form, and is unusual only in its inclusion of the gross social security wealth variable, which has an estimated coefficient of 0.021 (with a standard error of 0.006). This implies that a $100 increase in social security wealth would reduce private saving *initially* by $2.10. The equation fits very well by the usual statistical measures, and the coefficient of the social security wealth variable is significantly different from zero by any reasonable measure of statistical significance. Before returning to the sensitivity of this estimate to a variety of other considerations, let us trace through some of the implications of such an estimate.

Since social security wealth is so enormous, amounting to several trillion dollars (more than twice the current Gross National Product), Feldstein's estimate suggests an enormous decrease in private saving; i.e., it implies an approximate decrease of 38 percent in private saving and the Nation's capital stock,[19] and a corresponding decrease of ap-

[17] The aggregate time-series data combines the decisions of the households receiving large windfall benefits at the start-up of the system with those of households entering a mature system. In principle, the transfers might be separated out or estimated as a seperate variable in cross-section analysis. See M. Kuz and M. Avrin, "The Funding Controversy and Modern Growth Theory" (Washington, D.C.: Technical Paper for the President's Commission on Pension Policy, 1979).

[18] A. Ando and F. Modigliani, "The Life Cycle Hypothesis of Saving: Aggregate Implications and Tests," American Economic Review, vol. 53, March 1963, pp. 55–84.

[19] Recall the provisos discussed above.

proximately 20 percent in GNP. This amounts, as Feldstein [20] notes, "to nearly 30 percent of total consumer spending, more than twice the total of individual income tax payments, and substantially more than twice the level of national defense expenditures.... Let me emphasize that this lower level of GNP reflects the pay-as-you-go nature of our social security system."

This is not exactly correct in calculating the long-run impact of social security. Since private wealth is included in these equations, the results imply that private net wealth would be much larger in the absence of social security (since private saving would have increased). However, short of estimating consumption and net wealth in the presumed absence of social security, the first-round effect gives only a rough guide to the long-run effect. Calculation of saving and consumption in the absence of social security also requires an estimate of the effect of any changes in the capital stock on rates of return and of rates of return on saving.[21]

Thus, if social security has had even a large fraction of the effect reported in Feldstein's original estimates, its direct effect has been to substantially curtail private capital formation. While we would obviously need to net out any Barro-type offsets and account for the full general equilibrium feedback effects discussed by Kotlikoff, the effects would still be enormous, given the size of the social security system. Before returning to such considerations, let us detail a variety of subsequent evidence on the effects of social security on private saving, including some critiques of Feldstein's original work.

At about the same time as Feldstein's original paper appeared, Alicia Munnell [1974] published a paper which has conclusions similar to those of Feldstein. As discussed above, increases in social security wealth might be thought of as having two effects: (1) An induced retirement effect which, by lengthening the retirement period, might be expected to increase private saving; and (2) an asset substitution effect, which might be expected to decrease private saving. Munnell included the retirement rate of men over age 65 as an additional variable in her equations estimating the private personal saving rate. This was done to make the social security wealth coefficient a measure of the pure asset substitution effect. Her coefficient is 0.30, somewhat greater than Feldstein's coefficient, suggesting that social security does have an induced retirement effect which offsets, on average, a nontrivial fraction of the asset substitution effect.[22]

The early critiques of Feldstein's econometric estimates focused on three basic issues: (1) Whether net or gross social security wealth was the appropriate measure (and how to measure each in the first place); (2) whether unemployment was properly included in a consumer expenditure equation; and (3) whether it was legitimate to use the entire sample period, including the Depression, which in-

[20] M. S. Feldstein (ed. Boskin), The Crisis in Social Security, Institute for Contemporary Studies, 1977.

[21] The sensitivity of saving to rates of return is somewhat controversial. See M. J. Boskin, "Taxation, Saving and the Rate of Interest," Journal of Political Economy, vol. 86, April 1978, pp. S3–S28. M. J. Boskin, "Comments," Brookings Paper on Economic Activity, 1978, pp. 694–700, and E. P. Howrey and S. H. Hymans, "The Measurement and Determination of Loanable Funds Saving," Brookings Paper on Economic Activity, 1978, pp. 655–685.

[22] This is corroborated by recent econometric studies of retirement. See the references mentiond in footnote 9.

cluded many years before the social security system was introduced, and hence during which social security wealth was zero.

Returning to Feldstein's original 1974 paper, the coefficient of the social security wealth variable fell to 0.010 (slightly less than its estimated standard error) when the unemployment rate was added to the equation. A number of people, especially Esposito,[23] emphasize this result; i.e., adding the unemployment rate to the equation decreases the social security wealth effect and renders it statistically insignificant. Feldstein [24] counters this argument by suggesting that the inclusion of the unemployment rate is a consumption function is not appropriate on analytical grounds and should not be taken as strong evidence against the social security wealth effect on private saving.

Returning to Feldstein's original paper and confining attention to the post-war period, the social security wealth variable has a coefficient which would substantially reduce it to less than its estimated standard error. This obviously reflects the substantial decrease in the variation in social security wealth in the postwar period, as well as the reduction in the variation of consumer expenditures. If this is all there is to the story, one would be left to choose between specification which leaves out the unemployment rate and shows a substantial social security wealth effect, or one which includes the unemployment rate even though its estimated coefficient is not statistically significant. One could also choose to confine attention to a period in which the sample variation in the measures of interest is sharply reduced, but with less possibility of a spurious correlation between social security wealth and consumer expenditures due to so many years of zero social security wealth at the start of the sample. These zeroes make the social security wealth variable substantially nonlinear, perhaps causing it to capture either a structural change in consumption behavior or an inadequate representation of permanent income in the other included variables during the Depression. We shall see in the next section that there is substantial evidence from the postwar data alone that social security has decreased private saving.

In addition to Barro's [1974] analytical skepticism, he also presents [Barro, 1978] his own econometric evidence on this issue. The major difference between the Barro and the Feldstein specifications is Barro's inclusion of the value of the stock of consumer durables and the government surplus in his consumer expenditure equations, which yields an estimated coefficient for social security wealth of 0.014 (with an estimated standard error of 0.010). This effect, only two-thirds as large as Feldstein's original effect, would still imply an enormous reduction in private saving due to social security. However, the effect is not statistically significant at the usual levels. This should not be taken to suggest that Barro has refuted Feldstein's findings, but rather that his specification generates evidence which is consistent with his own original hypothesis of no effect, as well as evidence which is consistent with Feldstein's econometric estimates. Feldstein [25] again argues that a government surplus variable does not belong in a properly specified consumption function. Although the coefficient of

[23] L. Esposito, "Effect of Social Security on Saving: Review of Studies Using Time Series Data," Social Security Bulletin, May 1978.
[24] M. S. Feldstein, "The Effect of Social Security on Saving," National Bureau of Economic Research Working Paper No. 334, April 1979.
[25] Ibid.

government surplus is statistically significant as presented by Barro, Feldstein argues that the significance is spurious because the government surplus is endogenous, reflecting cyclical variations in consumption. Barro's original argument for including the government surplus is that such a surplus implies a reduction in government debt which is equivalent to an increase in the disposable income of consumers due to the equivalence of taxes and debt. We shall return to a discussion of the inclusion of the government surplus variable, and more importantly, its proper measurement, in the next section.

Michael Darby [1979] uses somewhat different specifications of consumer expenditure equations. In particular, he includes measures of real money balances and other variables not included in the Ando-Modigliani type consumption functions. We agree with Feldstein[26] that inclusion of real money balances in the consumption function is unreasonable; the demand for money should be thought of as a separate equation in a full model of household behavior and should not be used as an independent regressor in a consumption function. Perhaps most important, Darby presents evidence which suggests that a substantial amount of saving is for other than life-cycle motives. This is probably the most important part of Darby's work in evaluating the Feldstein conjecture that social security substantially reduces private saving. Much more work needs to be done on this subject, but recall that the analytical apparatus suggested by Feldstein is an extension of the life-cycle theory of saving. Were it the case that a substantial amount of saving were for non-life-cycle reasons, there would be somewhat less force in the econometric estimates derived by Feldstein.[27]

Finally, Boskin and Lau [1978] estimate the effect of social security wealth in a more complete model of consumer behavior. This model estimates not only a consumption function but a labor supply function as well, and includes both relative prices and income as independent variables. Their maximum-likelihood estimate of the effect of social security wealth is that it substitutes dollar for dollar for private wealth (using U.S. aggregate time-series data, 1929–69).

Before turning to other types of evidence, it is important to note that Feldstein himself has reexamined the time-series evidence using the revised estimates of national income and its components developed by the Department of Commerce.[28] The coefficient of social security wealth using these revised data through 1974 yield a coefficient on social security wealth of 0.024 (estimated standard error of 0.009), quite close to his original estimate. In the revised data, inclusion of the unemployment rate has a small effect on the social security wealth variable, while the unemployment variable is itself statistically insignificant. However, the social security wealth coefficient of 0.019 has an estimated standard error of 0.013, and hence is not quite statistically significant. Feldstein also reports an estimating equation wherein the unemployment effect is treated in a slightly different manner, as suggested by Barro [1978]. This specification includes the unemploy-

[26] Ibid.

[27] M. J. Boskin, "Is Heavy Taxation of Capital Socially Desirable?" Hearings, U.S. Congress, Joint Economic Committee, 1977, and L. J. Kotlikoff and L. Summers, "The Role of Intergovernmental Transfers in Aggregate Capital Accumulation," unpublished mimeo, 1979.

[28] M. S. Feldstein, "The Effect of Social Security on Private Saving: The Time Series Evidence," National Bureau of Economic Research Working Paper No. 314, February 1979.

ment rate multiplied by disposable income, which implies that unemployment changes the marginal propensity to consume rather than implying that a percentage point change in the unemployment rate alters per capita consumption by the same dollar amount regardless of the level of income. With this specification, the social security wealth variable has an estimated coefficient of 0.023, with an estimated standard error of 0.012, and we return to Feldstein's basic conclusion: There exists a substantial social security wealth effect with a statistically insignificant unemployment-income interaction.

Aggregate time series evidence is only one way to estimate the effect of social security on private saving; several alternatives are available, including international comparisons and the examination of individual household evidence. While, for a variety of reasons, these alternatives have been less widely used and are likely to be subject to even more serious flaws than the aggregate time series data, we present a brief review of these studies. Feldstein and Pellechio use data from the 1963 *Survey of Consumer Finances* to estimate the apparent effect of social security wealth on the accumulation of household wealth for those households in which there was an employed man aged 55–64 (the immediate preretirement period).[29] This microeconometric evidence tends roughly to support Feldstein's time-series evidence, although the estimated effect of the substitution of social security wealth for private wealth accumulation is somewhat less than dollar for dollar.

An interesting study of the National Longitudinal Survey data by Kotlikoff comes to mixed conclusions concerning the effect of social security on saving. Social security reduces savings of 45–59 year olds, but it is unclear whether this is due to a perceived wealth effect or merely equivalent to other taxes.[30]

Finally, Feldstein examines a cross-section of 15 countries.[31] He estimates equations explaining the saving rate as a function whose arguments include: The rate of growth of income; the demographic structure of the population; an estimate of the ratio of social security benefits to average per capita income; and a rough measure of retirement. These estimates are consistent with a substantial social security wealth effect on private saving.

Barro and MacDonald [1979] also examine an international cross-section and make changes in the specifications embodied in Feldstein's original data. The authors conclude that "the cross-country evidence does not provide empirical support for the hypothesis that social security depresses private saving, and also does not permit an empirical refutation of that hypothesis."

There are obvious problems with international cross-section estimates. While we increase the potential for variability in the measures of interest, much else is not held constant across observations. It is extremely difficult to obtain comparable measures of the relevant components of saving; stages of cyclical variability in the relevant economies, other characteristics of the economy, demographics, and retire-

[29] M. S. Feldstein and A. Pellechio, "Social Security and Household Wealth Accumulation: New Microeconomic Evidence," unpublished, 1977.

[30] L. J. Kotlikoff, "Testing the Theory of Social Security and Life Cycle Accumulation," American Economic Review, vol. 69, June 1979, pp. 396–406.

[31] M. S. Feldstein, "Social Security and Private Savings: International Evidence in an Extended Life Cycle Model," in M. S. Feldstein and R. Inmans (eds.) The Economics of Public Services (London: Macmillan, 1977).

ment behavior of the population are extremely difficult to measure. It might also be said that cross-section estimates are also likely to have serious potential problems. To measure saving or spending, we really need to have balance sheet information on individual households at two points in time, including substantially more asset and liability information than is usually obtainable in such data.

Where does all this leave us? Our interpretation of the econometric evidence available to date is as follows: There is substantial time-series evidence that social security has had a direct effect in depressing private saving; however, this evidence is far from conclusive. There is still much debate on the proper specification of the consumption function, the proper specification of the social security wealth variable and its measurement, the proper sample period to be examined, and many other important empirical issues. The time-series evidence is not fully supported by other types of data. It is also clear that care must be taken in the interpretation of the evidence to allow for the general equilibrium feedback effects discussed above and for the potential of Barro-type (at least partial) offsets. Much empirical work remains to be done. We now turn to a discussion of our own estimates, based on U.S. aggregate time-series data.

4. New Time-Series Estimates of the Impact of Social Security on Private Saving

As can be seen from the analysis presented in section 2, there are many open empirical issues concerning the impact of social security and its funding procedures on private saving decisions. In order to help clarify some of these issues still further, we have reexamined U.S. aggregate time-series data and estimated consumption functions using alternative variable definitions and sample periods. In doing so, we have sought to examine the sensitivity of Feldstein's original conclusion—that social security has had a substantial impact on private saving—to a variety of assumptions. We examine alternative sample periods, several definitions of social security wealth, and the inclusion of a variety of variables left out of the previous analyses. A description of our new and revised body of data on the relevant variable is given in a technical appendix.

A. Econometric Results

We believe it is appropriate to shift attention away from consumer expenditures, which includes purchases of consumer durables, to a series on consumption which excludes durable goods purchases, but which includes the flow of services from the accumulated stock of durables in the measures of consumption and income. This has several advantages over examining consumer expenditures. The two most important are: Consistent treatment of the purchases of durable goods, which can be thought of as a form of saving; and reduction of variability due to the cyclical nature of durable goods purchases. Our basic equation, corresponding to the revised Feldstein basic equation, is presented as equation (3.1). In this equation we examine, for the period 1929–74 (excluding the war years), the effects on real per capita consumption of net income, retained earnings, wealth, and the measure of gross social security wealth. The major differences from Feldstein's

revised equation are: The focus on consumption, rather than consumer expenditures, as the dependent variable; and the inclusion of net, rather than gross, income measures. The equation performs quite well by the usual measures of goodness of fit; the standard error of the regression is less than one percent of the mean of the dependent variable. Virtually every coefficient is measured precisely and has the usual expected sign. Throughout, we will focus on the estimated coefficients (and their statistical significance) of the social security wealth measures. Our estimated coefficient on gross social security wealth of 0.034 is measured quite precisely; it is 3.5 times its estimated standard error. This estimate is somewhat larger than the original Feldstein measure, but again is consistent with the basic proposition that social security wealth has caused a substantial reduction in private saving and wealth accumulation.

(3.1)

$$C = \underset{(0.057)}{0.367}\,NYD + \underset{(0.040)}{0.172}\,NYD_{-1} - \underset{(0.075)}{0.023}\,RE + \underset{(0.006)}{0.043}\,W_{-1} + \underset{(0.010)}{0.034}\,SSWG + \underset{(84)}{332},$$

$$D\text{-}W = 1.6, \quad SSR = 16{,}815.0,$$

where C is real per capita consumption (not consumer expenditures), NYD is net disposable income, and other variables are refined as in equation (2.1); D–W is the Durbin-Watson statistic (which is close enough to 2 to reveal little serial correlation), and SSR is the sum of squared residuals.

We now turn to an examination of what happens when we include unemployment in the equation á la Barro—interacted with disposable income to reflect a change in the propensity to consume. Equation (3.2) is similar to equation (3.1), and fits the data extremely well.[32] The unemployment variable has an extremely small estimated coefficient and is statistically insignificant. Its inclusion reduces the estimated coefficient of the social security wealth variable slightly from 0.034 to 0.029, still slightly larger than the revised Feldstein estimates.

(3.2)

$$C = \underset{(0.058)}{0.373}\,NYD + \underset{(0.058)}{0.200}\,NYD_{-1} + \underset{(0.113)}{0.039}\,RE + \underset{(0.006)}{0.041}\,W_{-1} + \underset{(0.012)}{0.029}\,SSWG + \underset{(0.0012)}{0.0008}\,UYD + \underset{(113)}{278},$$

$$D\text{-}W = 1.4, \quad SSR = 16{,}547.7,$$

where UYD is the unemployment rate times disposable income.

We turn next to alternative specifications of the measure of social security wealth. Including net, rather than gross, social security wealth, equation (3.3) fits the data extremely well; its estimated coefficients have the expected signs, and are measured precisely. The social security wealth effect of 0.036 is similar in estimated magnitude to that of gross social security wealth. However, its economic significance is substantially different. Since net social security wealth is slightly less than one-half of gross social security wealth, the implied reduction in the capital stock is somewhat smaller than in Feldstein's

[32] "Equation fits the data well" in general terms, means that a large percentage variation in the dependent variable is accounted for by the independent variables. Moreover, there is a relationship between the dependent variable and each of the independent variables.

original estimates. However, our estimated coefficient of 0.036 compares to his original estimate on gross social security wealth of 0.021 and his revised estimate of 0.024. Our estimate is therefore about half again as large for a variable which is about one-half as large in absolute magnitude. Therefore, the implied reduction in saving and in the capital stock is roughly three-quarters of that implied (recall the corrections necessary) by Feldstein's original results.

(3.3)
$$C = \underset{(0.061)}{0.410}\,NYD + \underset{(0.044)}{0.190}\,NYD_{-1} - \underset{(0.087)}{0.016}\,RE$$
$$+ \underset{(0.007)}{0.043}\,W_{-1} + \underset{(0.015)}{0.036}\,SSWN + \underset{(87)}{237},$$
$$D\text{-}W = 1.3, \quad SSR = 19{,}933.2,$$

where SSWN is net social security wealth as defined above.

The same equation, with social security wealth defined as Barro's reformulation of the measure, yields a larger coefficient on social security wealth, but smaller estimate of the impact of social security wealth on private saving. Equation (3.4) reports this specification with the unemployment-income interaction for the postwar period only. This equation thus simultaneously confronts several of the empirical objections to Feldstein's original formulation. We note that, even in this formulation, the equation fits the data extremely well; the estimated coefficients are all measured precisely, and even for the postwar period alone we get a very large effect of social security wealth on private saving using the Barro measure (discussed in the appendix).

(3.4)
$$C = \underset{(0.058)}{0.371}\,NYD + \underset{(0.058)}{0.266}\,NYD_{-1} + \underset{(0.13)}{0.0005}\,RE$$
$$+ \underset{(0.008)}{0.047}\,W_{-1} + \underset{(0.027)}{0.065}\,SSWB + \underset{(0.0013)}{0.0021}\,UYD + \underset{(35)}{94},$$
$$D\text{-}W = 1.8 \text{ (1947–74 only)}, \quad SSR = 6{,}987.97,$$

where SSWB is the Barro redefinition of social security wealth.

Equation (3.5) embodies our original measure of social security wealth and the unemployment measure for the postwar period alone; it yields estimates similar to equation (3.1). However, the substantial reduction in sample size, and the variability of social security wealth increase the estimated standard error such that the estimated coefficient is no longer statistically significant from zero. The estimated coefficient is quite consistent with those from equations (3.1) and (3.2); however, the large increase in the sum of squared residuals relative to equation (3.4) results in an F–statistic significant well beyond conventional levels, and we reject (3.5) in favor of (3.4) for the postwar period.

(3.5)
$$C = \underset{(0.081)}{0.321}\,NYD + \underset{(0.104)}{0.190}\,NYD_{-1} - \underset{(0.143)}{0.078}\,RE$$
$$+ \underset{(0.012)}{0.048}\,W_{-1} + \underset{(0.032)}{0.031}\,SSWG + \underset{(0.0014)}{0.0027}\,UYD + \underset{(304)}{327},$$
$$D\text{-}W = 1.3 \text{ (1947–74 only)}, \quad SSR = 8{,}598.53.$$

We turn next to a discussion of variables considered by others and additional variables which may have affected postwar saving behavior in the United States. Equation (3.6) includes, in addition to our basic specification, the difference in the real value of the government debt

as an additional regressor. Recall that Barro argues that the Government surplus should be included in the consumption function, as new issuance of debt or retirement of debt changes the private sector's disposable income. The usual measure of the change in the Federal Government's balance sheet is the current deficit or surplus. In a world with no inflation, this would not be an unreasonable measure. However, in a world with substantial variations in inflation rates, the current deficit or surplus can be a very misleading measure of the change in the liabilities of the government. In recent years, the inflation rate has been high enough so that the real value of the outstanding debt has been falling substantially despite the very large Federal Government deficits (which in turn have helped fuel the inflation). Hence, it is more appropriate to look at the difference in the real value of the government's debt than at the current surplus or deficit to capture the impact of this change in government liabilities on consumer behavior. Doing so in equation (3.6) leaves us with precise point estimates similar to those of our original equation. The difference in the real value of the government debt is not quite statistically significant. Note that the social security wealth variable is still measured precisely, and its point estimate is quite close to that of the original equation, approximately 0.030.

(3.6)

$$C = \underset{(0.057)}{0.383}\,NYD + \underset{(0.051)}{0.191}\,NYD_{-1} + \underset{(0.111)}{0.024}\,RE + \underset{(0.006)}{0.0381}\,W_{-1}$$
$$+ \underset{(0.012)}{0.030}\,SSWG + \underset{(0.035)}{0.055}\,DFDEBT + \underset{(0.0012)}{0.0005}\,UYD + \underset{(112)}{305.}$$

$$D\text{-}W = 1.5, \quad SSR = 15{,}327.0,$$

where DFDEBT is the difference in the real value of the Government's outstanding debt.

Among the more remarkable changes in the postwar period has been the huge growth of private pensions. We have included the book value of private pensions as a regressor in our basic estimating equation. These results are reported in equation (3.7). While most of the other coefficients remain unchanged, the social security wealth coefficient declines substantially and is no longer estimated very precisely. However, it is clear that the growth of social security has occurred simultaneously with the growth of private pensions, and that the two variables are colinear. That is, our equation estimates the sum of the effects of the growth of private pensions and of social security wealth, rather than their separate effects, precisely. Feldstein [33] has examined the impact of private pensions on national saving elsewhere, and we shall not go into any elaborate discussion of this impact here. Rather, we note that the effect of private pensions and social security are not easy to disentangle. Further, the book value of private pensions is not a good measure of accumulated pension wealth; additional research on this subject is badly needed.

(3.7)

$$C = \underset{(0.049)}{0.404}\,NYD + \underset{(0.035)}{0.220}\,NYD_{-1} - \underset{(0.062)}{0.021}\,RE$$
$$+ \underset{(0.009)}{0.011}\,W_{-1} + \underset{(0.010)}{0.009}\,SSWG + \underset{(0.110)}{0.435}\,PENS + \underset{(81)}{489.}$$

$$D\text{-}W = 1.4, \quad SSR = 11{,}349.0,$$

[33] M. S. Feldstein, "Do Private Pensions Increase National Saving?" Journal of Public Economics, vol. 10, December 1978, pp. 277–294.

where PENS is the book value of private pensions.

Other important changes in the postwar economy have included the tremendous changes in the age structure of the U.S. population. The combination of the post-World War II baby boom, increased life expectancy for the elderly since around 1960, the recent baby bust, and a variety of other factors have combined to dramatically alter the demographic structure of the US. population and labor force. Each of these factors could potentially affect private saving, and since they have occurred over roughly the same span of time as developments in the social security system, it is important to see whether the effect of social security holds up when we attempt to account for the impact of changing demographics.

Equation (3.8) is the original equation with two measures of the changing demographic structure of the population as additional independent variables: The percentage of prime-age males in the male adult population, and the life expectancy of males at age 50. As can be seen from the estimated coefficients and standard errors, the original variables have about the same magnitudes as before. Most importantly, our social security wealth variable has almost an identical coefficient, estimated precisely. The effects of the changing proportion of prime-age males and increasing life expectancies in the 1929–74 period are not statistically significant. We shall not go into further detail on these demographic changes here, as they are the major focus of another body of research.[34] Rather, we note that this and other attempts to include estimates of the changing demographic structure do not alter the estimated coefficients on social security wealth.

(3.8)

$$C = \underset{(0.067)}{0.385}\,NYD + \underset{(0.036)}{0.150}\,NYD_{-1} - \underset{(0.101)}{0.191}\,RE + \underset{(0.009)}{0.035}\,SSWG + \underset{(578.1)}{721.1}\,PPAM + \underset{(18.2)}{24.6}\,LEM50 - \underset{(299)}{529.}$$

$$D\text{-}W = 2.0, \qquad SSR = 12{,}677.0,$$

where PPAM is the proportion of males aged 35 to 59 in the population and LEM50 is the life expectancy of 50-year-old males.

B. Summary

We have examined the U.S. aggregate time-series data in a more satisfactory context, and have developed a more consistent accounting system to deal with consumer durables and net income. We have seen that the estimated effects of social security wealth, under alternative definitions, on private savings, as inferred from these consumption function estimates, is usually quite substantial. In some cases, our estimates exceed Feldstein's original and revised estimates of the effects of social security wealth. Our preferred estimate, for reasons stated in the appendix, is that contained in the equations with net social security wealth. Even this equation, however, implies a social security-induced initial reduction in private saving of about three-fourths the original Feldstein estimates. This still leaves us with a large reduction in private saving, capital stock, and Gross National Product, due to the very rapid growth of net social security wealth. Alternative specifica-

[34] M. J. Boskin and L. Lau. "The Interaction of Economic and Demographic Factors in a Model of Aggregate Supply," unpublished mimeo, 1980.

tion of the social security wealth variable, sample periods, and inclusion of other variables, generate similar results: Social security appears to have had a substantial direct effect in reducing private saving and capital formation. We take this to be substantial and strong support for Feldstein's original conjecture and estimates. Obviously, these results are not conclusive. Further work will need to be done on other types of evidence, some of which are only now gradually becoming available, and additional refinements must be made as the time series lengthens and methods of estimating these relationships and measuring the relevant variables improve. We note further that these relationships *per se* reveal nothing about the possibilities of Barro-type offsets. Social security could indeed have reduced private saving while, at the same time, Barro-type offsets could be occurring in nontraditional saving forms, such as increased expenditures on human capital. As noted above, this must remain in the realm of conjecture, given the current availability of data. We thus conclude the discussion of these new estimates by suggesting that they substantially corroborate Feldstein's original econometric estimates.

5. A Brief Review of Some Unresolved Issues

As can be inferred from the preceding discussion, there are still a variety of unresolved issues in the debate over the effects of social security on private saving. Rather than elaborate each of them once again, we shall try to place them in the perspective we have achieved thus far. The major unresolved analytical issues concern (1) the extent to which there are operative intergenerational transfers which offset social security; (2) the extent to which, in a growing economy, an equilibrium consistent with an induced wealth effect can be maintained; and (3) the extent to which forced saving in a different type of asset (social security) affects the level and composition of saving. There will obviously be substantial analytical work along these lines in the near future which should not only highlight the importance of these issues, but resolve them.

There is a substantial analytical case for believing that some Barro-type offsets do occur. However, current data do not enable precise estimation. Given the available data, the lower bound on intergenerational transfers appears to be quite low. Most of the population does not leave much by way of traditional bequests; thus, the very existence of substantial private intergenerational transfers linking all generations in the Barro-type world is open to question. Indeed, why would we have social security in the first place merely to offset private transactions that would already have occurred? Are the insurance component and/or separation of the payment of the benefits from one's individual heirs or parents so important?

Another issue concerns the form the bequests take. Economists are still unsure of the appropriate treatment of expenditures on education and other so-called human capital expenditures. There is a substantial investment component in such expenditures, but its extent is indeterminate. Further, the purpose of these expenditures, which have grown enormously in the postwar period, is unclear. Perhaps they are an attempt to offset the increased obligations placed on future genera-

tions by rapidly growing social security benefits or they may simply reflect largely demographic factors.

On an empirical level, much work remains to be done in improving the data, developing new estimation techniques, and improving our general understanding of the consumption/saving choice. First, *it is clear that time-series evidence must ultimately be buttressed by other types of evidence: from household surveys, and perhaps from international cross sections.* Since each of these bodies of data has advantages and disadvantages, it is useful to find complementary types of data on which to try to achieve answers to the same questions. Among the more important data issues are: (1) Appropriate specification and measurement of pension wealth and its role in the capital formation and private saving process; (2) elaboration of the role of human capital; (3) improved measures and estimates of the impacts of interest rates and rates of return in general on the consumption/saving choice; (4) better measures of the changing age structure and household structure and their interaction with other variables; and (5) better measures of the social security wealth variable.

With respect to social security wealth, we strongly prefer the net social security wealth specification. However, frequent changes in the law compound the difficulty in the measurement of gross or net social security wealth at any particular time. Should the readers of this paper, for example, believe that the current benefits and taxes legislated will be the ones that will prevail into the indefinite future? What will become of the large social security deficit? How will it be financed? It is clear that we need to improve dramatically our understanding of the role of intergenerational income transfers through the private sector. We need much better measures of the transfers that have occurred; we need to improve our analytical understanding of how and why they occur. A broader model of the net effect of social security on the private intergenerational wealth transmission process is necessary.

Finally, we note that virtually all of the analysis [35] has been conducted in the framework of a single equation estimation of a consumption function or a consumer expenditure function. Obviously, such an equation is part of a larger model of the behavior of the household and of the economy as a whole. Which variables it is genuinely legitimate to treat as exogenous and which as endogenous to a reasonably manageable larger model is a difficult question to answer *a priori.* We might interpret our estimates as a reduced form in some cases and not worry about estimating a larger structural model. We believe this is not entirely appropriate because a large number of problems, such as omitted variables, can lead to substantially biased estimates under such considerations. Further, recent developments in macroeconomics are casting increasing doubt on the true exogeneity of many variables generally used as instruments in an instrumental variables estimation of a structural consumption function (or other structural equations). Evaluating these statistical problems is beyond the scope of this study: continued improvements along these lines should facilitate comprehension of the impact of social security on private saving.

[35] With the exception of M. J. Boskin and L. Lau, "Taxation and Aggregate Factor Supply," Compendium of Tax Research, U.S. Treasury, 1978.

6. Conclusion and Summary

We have reviewed a large and rapidly growing literature concerning the potential impact of social security on private saving, capital formation, and the level of income and output in our society. While deep divisions still exist in the economics profession concerning the analytical approach most appropriate in analyzing this question and the interpretation of alternative econometric estimates, much progress has been made in highlighting the issues at stake. Further, there has been some progress made in delineating the empirical as well as the analytical issues. To this literature we have added some analytical points and a series of estimates which we hope are somewhat improved over previous time series estimates of the effect of social security on private saving.

Our new estimates lend considerable, though inconclusive, support to the original estimates of Feldstein that social security has substantially retarded private capital formation in the United States. While much further work remains to be done, it seems prudent policy to begin to deal with this potential long-term effect on our economy of the enormous growth of social security. As mentioned above, if saving is believed to be inadequate, the correction need not involve a change in the social security system. The government could run substantial surpluses, structural tax policy could be designed to induce greater private saving, or the government could increase its own investment out of any given level of government expenditures.

The policy options to deal with the rapidly emerging problem of financing the baby boom's retirement are still many. We could opt for structural reform of social security. Raising the retirement age gradually to 68 from 65 would eliminate the long-run deficit (Boskin, Avrin, and Cone [1980]); separating the welfare goal of social security from the earned entitlements or annuity portion also offers substantial opportunities for release of resources for other purposes (Boskin, Avrin, and Cone [1980]). Neither these policies nor those mentioned above will be easy to implement. The longer we delay recognition of these emerging issues and implementation of policies to deal with them, the narrower our range of options will become.

Our major conclusion is that there now exists enough evidence to provoke serious concern with the potential impact, not only of the currently legislated benefits and taxes, but of any changes in them. We must no longer think of social security as a separate program, but realize that its enormous size and interaction with private decision-making can have substantial adverse incentives on private saving in our economy. The historical record suggests that it may already have done so. Of course, changing perception of the quality of social security as an asset alternative to private assets may make extrapolation of past impacts to future changes difficult. For example, widespread concern over the long-run deficit, inflation-indexing of benefits, added uncertainty due to inflation on private asset performance, all could affect the relationship between social security wealth and private saving. However, the declining rate of personal saving in the United States suggests that it may be time to begin a conscious effort gradually to remove the disincentives to save that a variety of programs, including social security, have created.

Data Appendix

The basic relation which is estimated in this paper is the consumption function developed by Ando and Modigliani [1963] and used in several earlier time-series studies [36] of the effect of social security on saving in the United States. The basic form of this relation is:

$$C_t = \alpha_0 + \alpha_1 Y_t + \alpha_2 Y_{t-1} + \alpha_3 W_{t-1} + \alpha_4 RE_t + \alpha_5 SSW\ (+\text{other variables}),$$

where, in the conventional approach, C_t is consumer expenditures in year t, Y_t is disposable personal income in year t, W_{t-1} is the market value of wealth at the beginning of year t, RE_t are corporate retained earnings, and SSW_t is social security wealth. Average lifetime income, in this equation, is approximated by the income, wealth, and retained earnings variables, together with an unemployment measure in some versions. While this version of the consumption function is extensively used, we believe its use has been characterized by the application of theoretically inappropriate definitions of income, consumption, and retained earnings.

Consumer expenditures, as defined in the National Income and Product Accounts (NIPA),[37] include purchases of durable goods. These should be considered part of gross private saving, with the services of these durables, currently excluded from income entirely, added to other consumer expenditures to give consumption, Christensen and Jorgensen [1972], as part of their system of accounts for input, output, savings and wealth for the national economy,[38] have developed measures of consumpetion and gross private savings which incorporate this adjustment, as well as other modifications which are less important. In addition, they have developed a depreciation series for the private national economy, based on the declining balance method and empirical estimates of useful service lives. In addition to being internally consistent, this series provides what we believe is a more accurate description of obsolescence and economic depreciation than the NIPA estimates, which are based on the straight-line method. The income series used in many of the estimates in this paper is the sum of the Christensen-Jorgenson series on consumption expenditure and net private saving; however, the surplus of social insurance funds is subtracted from saving,[39] and the estimate of net retained earnings is subtracted from income in those equations where it is included as an independent variable. Dale Jorgenson has very kindly provided us with a preliminary set of these accounts updated through 1977.

Two different series on net retained earnings are used. The NIPA series, with inventory valuation and capital consumption adjustments, is used in those equations which have personal disposable income as the income variable. When our preferred definition of income is used, the corporate capital consumption adjustment series that is calculated by the double-declining balance, rather than the straight-line, method of depreciation, is used.[40] The wealth series that is used in all regressions is the net worth of households, estimated at market value, which is the same series used by Feldstein and Barro.[41] As with all variables expressed in money terms, it is converted to per capita 1972 dollars by dividing by total population and, depending on whether consumer expenditure or consumption is the dependent variable, by either the personal consumption expenditure deflator from the NIPA or the consumption deflator from Christensen and Jorgenson.

Three different measures of the scale of the social security program were considered: The gross and net social security wealth concepts of Feldstein and of Munnell, and the benefit-coverage variable suggested by Barro. The gross social security wealth variable calculates the present value of expected social security benefits, assuming a specific net interest rate and a constant benefit (adjusted for

[36] See, for example, Feldstein (1974) op. cit., R. Barro, "The Impact of Social Security on Private Saving" (Washington, D.C.: American Enterprise Institute, 1978) and R. Barro and G. M. MacDonald, "Social Security and Consumer Spending in an International Cross Section," Journal of Public Economics, vol. 11, 1979, pp. 275–289.

[37] U.S. Department of Commerce, National Income and Product Accounts, Revised Estimates, 1974.

[38] L. R. Christensen and D. W. Jorgenson, "U.S. Real Product and Real Factor Input, 1929–67," Review of Income and Wealth, Series 16, March 1970, pp. 19–50.

[39] The relative variability of a saving rate is not severely affected by whether or not the surplus of social insurance funds is included.

[40] As stated above, we believe the straight line method underestimates true economic obsolescence.

[41] This is the basic Modigliani measure which is used in most macroeconomic studies.

coverage) to real per capita disposable income ratio. The present value of expected future taxes is subtracted to obtain net social security wealth.[42] The appropriate concept in a life-cycle model is ambiguous and depends on perceptions of social security taxes. The gross social security wealth concept assumes that households view social security taxes as unrelated to future social security benefits, and merely as a reduction in current disposable income. If households view the system as if it were a pension plan, with benefits related to accumulated contributions, net social security wealth would be more appropriate (and is the concept we prefer). Finally, if households view social security as a precise, actuarially fair system, ignoring the large transfers to those who have not retired,[43] the present value of accumulated taxes (less benefits for those retired) is the appropriate measure. Barro's variable is the product of benefits per recipient and the ratio of workers covered to the total labor force.[44] Since it is a flow rather than a stock concept, it is much smaller than either of the wealth variables.

The total government surplus series from the NIPA was included in Barro's consumption function. Since price changes affect the real value of the debt and therefore the real value of future tax liabilities, a series on the change in the real per capita government debt is included in our estimates. The *Historical Statistics* (HS) series on State and local government debt is not consistent with the surplus series from the NIPA because these governments have compensating assets; thus, the State and local portion of the nominal debt is taken to be the 1929 value from HS less the accumulated surplus from the NIPA.

Two different measures of unemployment's impact on compensation were examined. The first is unemployment in percentage terms; the second multiplies this by real per capita disposable income. Neither series uses the Darby modification.[45] Since the results using the two concepts were quite similar, only those using the second variable were reported.

Other series were also considered: The book value of private pension reserves; several different variables that capture some aspect of the important demographic changes that have occurred since 1929; etc. The proportions of households of different composition are taken from HS.[46] The fraction of the population under 21 or over 65 serves as proxy for the proportion of dependents, and the fraction of males between 35 and 59 in the total male population over 21 serves as proxy for the fraction of the population in the peak saving years; these are also found in HS.[47] *Vital Statistics of the United States* was the sources of the series on the life expectancy of males at age 50.[48]

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[42] In calculating both the benefits and the taxes, there is an issue as to what subsequent changes in the law are anticipated by consumers. We shall not delve into this in any detail here, but this remains a serious open issue, as discussed below in the development of an appropriate measure of social security wealth.

[43] M. J. Boskin, M. Avrin, and K. Cone, "Modelling Alternative Solutions to the Long-Run Social Security Funding Problem," National Bureau of Economic Research Working Paper, 1980 (forthcoming).

[44] Barro (1978) op. cit. Our own econometrics estimates using Barro's variables are presented below.

[45] M. R. Darby, "The Effects of Social Security on Income and the Capital Stocks" (Washington, D.C.: American Enterprise Institute, 1979).

[46] A variety of alternative measures of a changing demographic and household structure were used; none of the different formulations affected the results with respect to social security wealth.

[47] U.S. Department of Commerce, Bureau of the Census, "Historical Statistics of the United States," pt. I, 1975.

[48] U.S. Department of Health, Education, and Welfare, "Vital and Health Statistics of the United States" (various years).

INTERNATIONAL PERSPECTIVES ON SOCIAL SECURITY

By George F. Rohrlich*

CONTENTS

Summary and Options

Social Security, and particularly old-age security, has become an integral part of the social and economic fabric of the United States and other industrialized nations. Demands upon social security, in terms of the scope and level of protection, have been rising throughout the industrialized world. Public policy is committed to continue the real value of this protection.

The financial problems of meeting these growing expectations and commitments are serious and may reach crisis proportions in the future for three main reasons: (1) as the population ages, larger numbers of older persons become dependent on pensions and supportive services in proportion to the rest of the population, and, particularly,

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to those who are working; (2) periods of heavy and long-lasting unemployment accentuate this growing burden in the form of output and revenue losses, while at the same time, they swell the ranks of pension recipients; (3) inflationary pressures add to costs, which rise in proportion to the rate and duration of inflation.

This paper examines the scope and nature of these problems of coverage and financing, especially in the presence of "stagflation," and reviews possible policy options for Congress as drawn from other nations' experiences. It should be noted, however, that most of those countries have more homogeneous populations and more centralized planning than the United States. Thus, their policies suggest general directions for the U.S. to explore rather than specific programs to imitate. This comparative survey of international experience covers the two constituent parts of the problem: (1) developments to ensure adequate coverage for the aged and other groups of pension claimants; (2) fair and effective measures to meet the rising costs of adequate coverage.

Both demographic and macroeconomic factors affect the nature of these problems and their solutions. Compared to most other industrialized nations, the United States is in a favorable position since the percentage of its aging population will peak later, allowing it more time for necessary adjustments and policy changes. Besides demographic change, such factors as the labor force participation of women and the aged of both sexes, will also determine the number of pensioners and costs of pensions. And, of course, the overall state of the economy will have a decisive impact on social security programs.

Unemployment and inflation have the most unsettling effects on social security systems. Unemployment instantly reduces contributions to social security programs, and at the same time increases its costs by encouraging earlier retirement. Long-term unemployment is often "structural", i.e. those unemployed lack marketable skills or indeed any skills to fill existing openings. The remedy can be found in opportunities and incentives for training and/or retraining, and for greater labor mobility.

The impact of inflation upon social security, and especially on pension financing, is critically important in programs that adjust benefit levels to changes in consumer prices or the cost of living. While these adjustments are essential to guarantee the real level of benefits, it is possible that social security beneficiaries could fare better than workers when the prices outpace wages. This is but one of the difficult problems posed by inflation; it calls for innovative solutions on the part of policymakers.

Whatever the demographic and macroeconomic problems, however, the social security compact is based on a "social solidarity" between workers and contributors, on the one hand, and retirees, on the other. This intergenerational dimension is inherent in the idea of social security. The problem is to find a workable and acceptable cost-benefit balance between generations.

1. *Universal Coverage and Comprehensive Entitlement*

Evidence points to a growing discrepancy between an expanding range of protection and a relatively shrinking, even though still growing, economically active sector bearing a rising burden of costs. It

would be unthinkable to halt progress toward achieving comprehensive and adequate old-age security, yet the cost implications for the future cannot be ignored.

In most industrialized countries, universal coverage and comprehensive entitlement to benefits have been achieved through (1) social insurance, (2) universal non-contributory old-age pensions, and (3) social assistance benefits for the needy aged.

One method of improving coverage has been to extend social insurance programs to persons, notably housewives, who have been traditionally excluded from coverage in their own right and covered only as dependents. Consideration should also be given to ensuring coverage for working women who may lose entitlement to social security benefits if they leave the labor force early because of children. Another method of providing better protection for middle-income workers especially is to mandate private pensions. These offset the low-income bias of basic social security programs and ensure that retirement benefits for mid- to upper-income workers will be more nearly the same as their prior working incomes. Switzerland adopted this as a goal by a Constitutional amendment requiring employers to maintain such plans and to pay at least half the costs. Sweden has achieved the same result through collective bargaining, with the employer paying the total cost.

Eligibility for benefits has been broadened in many countries by reducing qualifying periods, relaxing residency requirements, and lowering age requirements. The latter presents a number of financial and social problems. The chief reasons for reducing retirement age have been to open up jobs for younger workers and to make early retirement possible for those older workers who want it. However, in addition to the fact that many older workers are anxious to continue to work on some basis, the costs of this policy, both benefits paid and productivity foregone, call for its reconsideration.

A system of partial pensions along with part-time employment offers real and interesting possibilities. Both Germany and Sweden have introduced such plans. In France and the Netherlands, even full time employment is compatible with pension receipt.

2. *Intergenerational Dimension: Balancing Costs and Benefits Between Age Groups and Between Generations*

Because of the past decade of inflation, social security benefits are now viewed in terms of changing costs of living. Moreover, the expectation now is that an adequate system provides more than essentials and is more closely related to past working income. As a result, pensions under most systems are adjusted automatically to changing prices or wages.

Alternative approaches to the fullest practicable attainment of dynamic stability for pensions can be categorized as follows: (*a*) Fully dynamic pension adjustment; i.e., pensions reflect the full measure of changes in wage levels. (The role of taxation, i.e., gross versus net earnings, differential needs and costs of living as between active workers and pensioners constitute subsidiary but very important choices.) (*b*) Partially dynamic pension adjustment; i.e., pensions follow wage level changes only in part. (*c*) Indexation of pensions in line with

price levels without regard to wage-level changes. (The question of which price level to choose is subsidiary but important.)

Increases in social security costs, especially old-age and survivors' pensions, have been a worldwide phenomenon. Statistics for 14 European countries show that old age benefits, across the board, represented about two-fifths of total social security payments in 1971. Comparative data for social expenditures in percent of gross domestic product (GDP) for the years 1970 to 1975 for the European Economic Community (EEC) countries show a 1970 range of 13 percent (Ireland) to 21 percent (Germany) and a 1975 range of 19 percent (United Kingdom) to 28 percent (Germany). In all EEC countries, as in most others, the old-age and survivors programs accounted for the largest share among the several social security programs. When combined with disability payments, they constituted half or more of total benefits paid in several countries, including Germany, Italy, the Netherlands and the United Kingdom.

The expected long-range increase in pension costs raises questions about financing of social security systems. Where employer and employee contributions based on earnings are no longer seen as adequate, new revenue sources, and money-saving devices, such as deferred retirement and less generous benefit indexing are also being studied.

3. *Increasing Productive Opportunity for Older Workers*

Important aspects of the overall problem extend beyond the confines of social security systems. They focus on maximizing and diversifying opportunities for productive gainful employment as an effective option and, perhaps, even as a complementary right for older workers. A study of social security measures and related economic policies and programs designed to increase labor force participation of older workers would be extremely useful in exploring the overall problem of old-age security in terms of work and retirement.

The three most common measures to facilitate continued labor force participation are (1) to remove compulsory retirement provisions, (2) to remove or ease prohibitions or limits on employment as a condition of pension receipt, and (3) to increase pension amounts for those postponing retirement.

Legislation designed to delay retirement in ten industrial countries has not had very successful results. It is possible that, apart from the attraction of leisure and pensions, suitable employment is not available for older workers, who also suffer from an age bias in hiring.

Norway, Germany, France and Sweden offer significant advantages to those who continue working past regular retirement age. In Norway, there is a deferred pension supplement of 9 percent per annum up to age 70 versus 3 percent to age 72 for the U.S.

Norway also allows a combined part-pension and part-earnings income of 80 percent of earnings. Germany's deferred retirement option yields an 8.7 percent increment per year of deferral up to age 67. France provides a pension equal to 75 and 100 percent of the final 10 year average salary if the pension receipt is postponed to ages 70 and 75 respectively. Sweden allows deferral of all or one half of one's pension past age 65 at 6 percent increase of the deferred amount per year to age 70. In the case of partial deferment with part-

time work, a worker may get 90 percent of former earnings, which is a higher percentage than that of a full time pension.

Official projections of average rates of change in age-specific labor force participation in the U.S., as well as in the EEC countries show a lowered or at best a steady share of aged participants between now and 1990. In spite of these projections, if the current practice of early retirement here and abroad continues, it may give rise in the future to an actual shortage of workers. This situation could provide a test for whether or not older people prefer to work if the "right" jobs are available.

4. *Improving Productivity Through Investment in Human Capital*

While there has been increasing interest in retraining and rehabilitation in recent years, concern has centered mostly on young or disabled workers, with the needs of elderly workers largely ignored. Germany provides the best example of a systematic and successful approach to training for older workers. The underlying philosophy of the German program, as one facet of its commitment to a "social market economy" combines the advantages of a competitive market with a social policy intended to bring about adjustments in income distribution through social services. This is known as the "social investment concept," which encourages placement in jobs and training for older employees. Every worker has a statutory right to paid training, retraining or rehabilitation with up to three years full time instruction. An allowance paid through that period replaces 80 percent of former net income from work. Incidentally, this is 12 percentage points above unemployment insurance and 22 percent above benefits paid to unemployed persons who do not take training. The purpose of training is to enhance productivity and improve occupational mobility.

The German National Employment Institute, a Federal agency, has administrative authority over the very wide range of programs. It is financed from employer and employee contributions levied on the statutory pension insurance base, and offers occupational guidance, training and retraining to persons of all ages, covering all or part of the cost. The key to the Institute's long and successful operation lies in its job placement monopoly.

In countries which have amassed large social insurance funds, these often serve broader purposes. For example, in Sweden, the employment-related pension system's massive reserves constitute the largest single source of capital formation. In Finland, they provide a source of loan money for employers up to half of their contribution to the employment-related pension program.

In the United States, the aged worker suffers from more pronounced job severance practices than in other countries. For example, U.S. employers typically rely more on layoffs to adjust to major cuts in output. By contrast, employers in Japan and many European countries try to maintain their work forces by cutting average hours more sharply and are assisted in doing so by government programs to subsidize employment. Special employment promotion features in Germany include a mobility allowance for unemployed persons willing to move to permanent jobs, wage subsidies for employers hiring unemployed workers, and part-time employment which is so often preferred by women and older workers.

It may be useful for the U.S. to institute an annual Social Report/ Social Budget patterned after that of Germany. Such a document would enable the U.S. to gain a perspective on its social security fabric in relation to the much broader economic framework of which it is so important a part.

Introduction

Social security is a fourfold public policy commitment to provide protection (1) in all the common contingencies of life, (2) to all persons exposed to them, (3) at socially acceptable levels, and (4) as a matter of right. In the United States, the first comprehensive and enduring public commitment originated with the enactment of the Social Security Act in August 1935.[1]

During World War II, the vision of "social security for all" (Atlantic Charter, 1941) served as an inspiring symbol of the better postwar world associated with the ultimate victory of the Allied cause. The idea was embodied in the famous "Beveridge Report" (1942); the "Philadelphia Declaration" of the International Labor Conference "in exile" (1944); and, finally, in the Universal Declaration of Human Rights unanimously adopted by the United Nations (1948), proclaiming that "everyone, as a member of society, has the right to social security" (Article 22). The result was that social security became a part of many postwar constitutions and practically all national programs for postwar reconstruction.

It is important to note, in retrospect, that the two most authoritative and influential formulations of the social security agenda were based on employment as the normal source of support for able-bodied persons and their families.

Availability of, and access to, a job were considered essential elements in providing for social security benefits during limited periods of involuntary unemployment. In the United States, the Committee on Economic Security in its report to the President (January 1935) prefaced all its other recommendations pertaining to social insurance, public assistance, and supportive social security measures with the following statement:

> Since most people must live by work, the first objective in a program of economic security must be maximum employment. As the major contribution of the Federal Government in providing a safeguard against unemployment we suggest employment assurance—the stimulation of private employment and the provision of public employment for those able-bodied workers whom industry cannot employ at a given time.[2]

The idea of a guaranteed minimum income based on universal old-age pensions or social assistance now forms part of several foreign old-age security schemes, e.g., Canada's and Sweden's. A possible restructuring of the American social security system along similar lines has been discussed in recent studies by the Federal government.[3] Alongside the groundswell for broadened minimum income guarantees, the long neglected push for "employment assurance" in the U.S.

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[1] See "Social Security in America—The Factual Background of the Social Security Act" as Summarized from the Staff Reports of the Committee on Economic Security, USGPO, Washington, 1937; "Report to the President of the Committee on Economic Security," USGPO, Washington, 1935.

[2] Ibid., p. 3.

[3] See "Social Security and the Changing Roles of Men and Women." U.S. Department of Health, Education, and Welfare, February 1979.

has gathered strength, apart from, rather than as an integral component of "social security."[4] In some foreign countries, notably Germany, the integration of these two strategies for guaranteeing economic security has developed successfully.

Social Security Systems: Adequacy and Solvency

Extended periods of severe unemployment, prolonged inflation, and the aging of entire populations can threaten the stability of social security programs, especially those of the social insurance type, as well as a country's entire social security fabric. Examples from history include the ruinous impact of rampant inflation after the first and second world wars upon the public as well as the private pension systems in Germany, Austria, and Japan. In the 1930's, Britain's unemployment insurance scheme went bankrupt, as benefits were stretched to meet the protracted and growing income deficiencies due to lingering mass unemployment.[5]

A drastic example of a closed system's "aging," reinforced and dramatized by a shrinking industrial base, is the U.S. Railroad Retirement System, where the number of recipients of long-term benefits is nearly double the number of employees currently contributing to the system.[6]

National social security systems with universal coverage contain two built-in features which protect them against such problems: (1) A general program covers substantially all workers in the nation. Thus, the workers it protects and from whose contributions it draws, come from many diverse industries and occupations. The decline in one or several of these is likely to be offset by expansion or stability in others.

(2) A nation's general program is also an open system. Young workers are constantly being added to the work force, thus becoming contributors to the general system, whatever their occupation or industry. They succeed and replace older workers as the latter retire and become entitled to pensions. These two stabilizers act as buffers, both during short periods of economic adversity and over the long pull. However, they cannot neutralize the massive impact of marked and sustained population changes, notably shifts in age distribution. Nor can they cancel out any pronounced downward trends in a nation's economic performance.

Recent experience in the industrialized countries highlights the vulnerability of social security schemes to changes in demographic compostion and macroeconomic performance. At the same time, it reveals the firm commitment of nations to maintain the integrity of their social security systems; and at levels which indicate the worldwide acceptance of President Kennedy's "wave of rising expectations," or in sociologist Daniel Bell's more recent phrase, the "wave of rising entitlements."

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[4] The legislative landmarks include the Employment Act of 1946, the Manpower Training and Development Act of 1962 followed by the Economic Opportunity legislation of 1964, and the overhaul and amalgam of both of these in the Comprehensive Employment and Training Act of 1973.

[5] See Harry Malisoff, "Cost Estimation Methods in Unemployment Insurance, 1909–1957." New York State Department of Labor, New York, N.Y., June 1958, Appendix A.

[6] See "The Railroad Retirement System: Its Coming Crisis." Excerpts from The Report to the President and the Congress by the Commission on Railroad Retirement. USGPO, June 30, 1972.

An International Overview

One seasoned observer of the international scene speaks of "the social security crisis as an international dilemma." [7] Indeed, over the past several years, two concerns have dominated the international research and conference agenda: (1) the impact upon social security of an aging population; and (2) the problems created for social security by "stagflation"—reduced economic growth, lingering high unemployment, and inflation.

A recent assessment of international "Developments and Trends in Social Security, 1974–1977" [8] reflects the widespread concern over (1) mounting benefit expectations, entitlements and costs, on the one hand, and (2) the financial problems of maintaining the real value of benefits in periods of stagflation, on the other.

A comparative review of some policy issues and program developments may be useful, especially since problems analogous to our own loom even larger in certain foreign countries due to (1) the longer history and more advanced state of the "Rentenberg" phenomenon; [9] and (2) the high priority given to achieving near-full employment, which has resulted in a lowering of the retirement age to open jobs for younger unemployed persons and steeper increases in pension costs to provide monetary incentives for early retirement.

Of particular interest are actual or proposed changes in policies and legislation affecting retirement conditions and eligibility for benefits; benefit adjustment methods; attempts to contain and to finance cost increases; and uses of related programs, particularly employment promotion, to lighten dependence on substitute (transfer) income.

Population Aging: A Changing Dependency Ratio

Social security policies and programs are designed to meet the actual or presumed needs of large population groups, and sometimes the entire population. To meet the needs of these groups, it is essential to know changing size, composition and characteristics not only at a given time but for the foreseeable future. In the case of old-age retirement pensions and other benefits designed to provide for long-term risks, one must know the numbers of retired persons and dependents relative to the rest of the population, and especially to active workers.

The bulk of the middle-aged, as well as some of the younger (e.g., 15 and over) and some of the "aging" cohorts (e.g., those above 55 or 60) are commonly counted among the economically active component. (This may more nearly reflect reality in some nations than in others.) However defined, it is this sector which has to provide for its own needs, as well as the needs of the rest of the population. The dependency ratio. i.e., the ratio between the economically active group and the rest of the population is of great practical importance. How will this ratio be affected by changes in national migration, reproduction and mortality rates?

In developed industrialized countries the mortality rate for older

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[7] Paul Fisher, "The Social Security Crisis: An International Dilemma." International Social Security Review, Geneva, vol. XXXI, no. 4, 1978. We wish to acknowledge our indebtedness to Dr. Fisher for helpful leads.

[8] International Social Security Review, vol. XXX, no. 3, 1977, pp. 271–313.

[9] "Rentenberg" is a German expression (literally "pension mountain") referring to the impact on social security of an aging population.

persons has been fairly constant, and there has been some variation in experience with international migration. With a declining fertility rate down to the replacement level or below, therefore, the gross reproduction rate in these countries has been falling and the median age of their population has been moving upward. In the United States, e.g., the median age, which had moved downward as a consequence of the post-World War II baby boom from 30.2 years in 1950 to 29.5 years in 1960 and to 28.0 years in 1970, is estimated to have inched up annually since then to 29.4 years in 1977.[10] Also, there is a tendency for the proportion of those in the dependent groups to rise relative to the number of the economically active, and likewise, among the dependents, for the aged component to rise relative to the young.

These relationships, documented in numerous national and international studies, have been summed up in a comprehensive unpublished study by Max Horlick of the Social Security Administration.[11] His statistics indicate that the aging process is at work in the nine countries studied [12] and is about to peak for the current century in several of them. In the United States this will happen within a decade. However, the percentage of the aged persons in the total population at that time will be lower (11.3 percent) than the peak percentage in any of the countries studied. Roughly the same comparative position holds true when those aged 65 and older are shown as a percentage of the persons of working age (15–64). In the United States, that maximum percentage is below the attained or projected peak during this century in any of the other countries. The comparatively favorable position of the United States gives the U.S. more time to make necessary adjustments.

Several important unknowns affect the reliability of statistical estimates of the rest of the population, and estimates of the size of the labor force in particular. The most important of these variables are (1) fertility rates, (2) female labor force participation, and (3) labor force participation of aging cohorts below 65. While demographic projections for the distant future are fraught with uncertainty, a general trend toward population aging in the industrialized countries in this century appears to be supported both by theory and actual experience. Whether and to what extent this demographic trend implies a growing cost of social security programs in general, and of old-age pensions in particular, depends in large measure on economic factors, especially the evolving labor-force participation patterns of working-age females and of older-age cohorts of persons of either sex.

Social and Economic Aspects

Social security as a public policy derives its impetus and formulation from a society's evolving notions of social justice. The policymakers' orientation and concern must be broad enough to transcend the interests of any one group at any given time. It is in this perspective that demographic aspects form a framework for any realistic and forward looking policy and program development. However, demo-

[10] "Statistical Abstract of the United States, 1978." U.S. Department of Commerce, 1978, p. 28.

[11] We wish to express our indebtedness to Mr. Horlick for having made available to us his valuable study "The Impact of An Aging Population on Social Security: The Foreign Experience."

[12] Austria, Belgium, France, Germany, Japan, Netherlands, Sweden, U.K., U.S.

graphic factors are themselves shaped, at least in part, by economic events and their impact on society is determined very significantly by economic choices.

Intergenerational Issues

Nobel-prize economist Paul Samuelson has called the social security compact "a paradox," inasmuch as "the young are assured of their retirement subsistence if they will today support the aged, such support to be guaranteed by a draft on the yet-unborn."[13] In light of this "paradox," a number of critics have concluded that the social-insurance model, the technique most prominently and most widely used in effectuating social security, was misleading, if not deceptive. It represents workers and their employers as paying contributions throughout the working years in return for which superannuated workers acquire an "earned right" to "convenanted" benefits (deferred earnings) in specified contingencies. According to these critics, the proper model is that of a pure and simple income transfer system.[14] This judgment, however, appears to be based on reservations about the rationale for social insurance. To some extent, it springs from certain private insurance notions, especially the central role of individual equity and its strict funding requirements.

Samuelson's observation, nevertheless, accurately highlights the spirit of "social solidarity" between workers and contributors, on the one hand, and non-workers on the other, as the basic premise of social security. The intergenerational dimension is inherent in programs providing economic security in long-term contingencies, old-age, disability, and survivorship.

The long-term problem of maintaining adequate and solvent social security programs centers around finding a workable and acceptable cost-benefit balance between age groups. This balance involves contemporary generations, i.e., the young, the middle-aged, and the old, and generations yet to be born. Thus, the problem is in part demographic and in part economic and these two parts are inexorably intertwined.

MODIFYING FACTORS

The possibility of achieving productivity increases that do not presuppose more capital per worker can be realized through advances in the state of the arts, such as important technological discoveries that enable us to do more with less. Thus, even an improvement in a nation's level of living is possible for some time, although its capital consumption is disproportionate to the concurrent population change.

We make a point here of stressing the relative indeterminancy of the effect of population changes *per se* upon economic well-being in order to counter the current, rather one-sided emphasis upon the formation of physical capital as *the* mode of economic growth. This view is in sharp conflict with the long-term growth patterns of the American economy, barely half of which has been traced to physical capital

[13] "An Exact Consumption-Loan Model of Interest with or without the Social Contrivance of Money." Journal of Political Economy, vol. 66, No. 6, December 1958, pp. 467–482.

[14] Two representative expositions of this point of view are Joseph Pechman, Henry Aaron and Michael Taussig, "Social Security—Agenda for Reform," The Brookings Institution, Washington, 1968; and Alicia H. Munnell, "The Future of Social Security," also Brookings, 1977.

formation and population growth. The greater part of American economic growth has been the result of the human factor, the improvement in human knowledge and skills through better education and other forms of investment in "human capital." [15] Other qualifying factors include changes in the labor-force participation rates of certain sectors already referred to, notably women, but also older persons, and in- and out-migration.

Cyclical Aspects and Problems of Dynamic Stability

In short and intermediate runs, the two economic factors that may have the most unsettling effects upon social security systems are unemployment (including underemployment) and inflation, especially when severe and extended. Both unemployment and inflation used to be regarded as essentially cyclical phenomena, the first associated with the recessionary and trough phases of the business cycle, the latter with the "overheating" of an economy in the later stages of recovery and attainment of near full employment. In recent times, both these problems have assumed medium-range or even longer-term dimensions. However, they do not, either conceptually or in their actual effect, pose intergenerational problems.

Specifically, longer-term unemployment is usually "structural," i.e., due to a lack of certain marketable skills required to fill existing openings. The traditional remedy of boosting aggregate demand can do little to help those who are either unemployed for lack of skills, or who are underemployed in terms of their potential. In these circumstances, what is needed are training and retraining programs, as well as other positive manpower policies, such as greater labor mobility.

Similarly, "stagflation" transcends the cyclical frame of reference. This may be defined as inflation that appears long before the attainment of near full employment, and intensifies in rate while the economy is operating well below capacity.

These problem areas involve recourse to the principle of social solidarity just as does social security. But here the scope and impact of such solidarity are primarily horizontal (e.g., levelling the severity of the incidence and consequences of unemployment), as between industries, occupations and regions, and only secondarily between younger and older workers.

UNEMPLOYMENT

While the aging of a population gradually reduces the number of contributors to the social product, unemployment instantly reduces the current revenue to finance social security programs, including pensions. On the outgo side, likewise, the effect is sharp and immediate al-

[15] Representative writings on both sides of this issue include the following: S. L. Lesnoy and J. C. Hamber, "Social Security, Saving, and Capital Formation," Social Security Bulletin, vol. 38, No. 7, July 1975, pp. 3–15; Martin Feldstein, "Social Security, Induced Retirement, and Aggregate Capital Accumulation," Journal of Political Economy, vol. 82, No. 5, Sept.–Oct. 1974, pp. 905–926; idem, "Social Security and Private Savings: International Evidence in an Extended Life Cycle Model," The Economics of Public Service, ed. by M. Feldstein and R. Inman, Macmillan, London, 1977; Louis Esposito, "Effect of Social Security on Saving: Review of Studies Using U.S. Time-Series Data," Social Security Bulletin, vol. 41, No. 5, May 1979, pp. 33–40. See also T. F. Pogue and L. G. Sgontz, "Social Security and Investment in Human Capital," National Tax Journal, vol. 30, No. 2, June 1977, pp. 157–169.

though the duration of its impact upon specific social security programs varies.

The financial impact of unemployment on unemployment insurance is in most cases coterminous with its duration. But, despite extensions of the duration of eligibility, unemployment insurance is ultimately self-limiting due to the eventual exhaustion of entitlement. This self-limiting feature may be a principal cause of the spillover effects on other social security programs, notably old-age retirement pensions, but also disability and health insurance programs. Initially, of course, all these programs, insofar as they are contributory, suffer a loss in contribution income. But, in addition, they experience increases in their claims load from the effects of protracted unemployment and its ramifications.[16]

Severe unemployment results in pronounced rises in applications for social security disability and pension benefits. In addition, persons at or past normal retirement age whose pension had been suspended or reduced on account of income from current work revert to full beneficiary status, once they lose paid employment. On both counts, there is a net swelling of pension rolls.

INFLATION

Inflation affects program revenues and benefit costs of social security in different ways, i.e., increased outgo is not matched by increased intake. In short-term risk programs, the effect is minimized due to the fairly simultaneous increases in program revenues and benefit outlays. Long-term programs, such as old-age retirement insurance and disability pensions, are more vulnerable to inflation, all the more so if such programs pay benefits from accumulated reserves. The effects of inflation are minimized the more closely the "pay-as-you-go" principle is adhered to.

The maintenance, on the other hand, of a mere contingency reserve under a pay-as-you-go system can provide a temporary buffer during periods of inflation or "stagflation" since its size is an independent variable and, therefore, discretionary.[17]

The impact of inflation upon social security and especially pension financing, is critically important in programs that guarantee the real value of benefits and adjust benefit levels to changes in consumer prices or the cost of living. This adjustment is necessary to safeguard a program's social adequacy, and adjustment mechanisms have become a part of all advanced systems.

THE PURSUIT OF DYNAMIC STABILITY

As a vehicle for social betterment, social security can ill afford any erosion in the real value of the economic protection it provides. Under

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[16] In some foreign systems, subsidies are paid from general revenues to programs affected, e.g., health insurance, to make up the loss in contributions. This helps to protect the financial integrity of the program by shifting the cost to the general taxpayer. During periods of severe unemployment, bona-fide claims for medical and related care are made for non-acute conditions of ill-health that are not totally work-disabling and, therefore, go unattended while the labor market is brisk. For some of the broader economic and financial impacts, see M. H. Brenner, "Estimating the Social Costs of National Economic Policy: Implications for Mental and Physical Health, and Criminal Aggression." Joint Economic Committee, 94th Congress, 2d session, U.S.G.P.O., 1976.

[17] This has been the case, e.g., in the German Federal Republic. (See "Effect of Recession on Financing of German Pension Program" by L. S. Copeland, Social Security Bulletin, vol. 40, No. 2, February 1977, pp. 29–33.)

normal circumstances, the lower limit would be to keep the purchasing power of benefits constant, except possibly where the economically active population suffers a lowering of real income. The upper limit, on the other hand, would be to keep abreast of rising wage levels, which represent improved standards of living due to productivity gains. In social security systems of industrialized nations, therefore, adjustment of past earnings records in light of wage-level movements assures a current retiree's participation in the general economic advancement that has occurred over the period of his work life. Once a pension is being paid, its real value is kept *at least* constant in terms of its purchasing power as measured by a cost-of-living index, or the like.[18]

In the presence of inflation, however, the rationale for this scenario may not hold true, especially when the price index outpaces the wage index. As a result, the "lower limit" of preserving the real value of social security benefits could actually cause beneficiaries to fare better than wage earners. In this context, inflation of a certain intensity and duration can superimpose difficult problems of public policy upon the otherwise essentially technical tasks involved in endowing social security protection with "dynamic stability." This predicament, which faces many industrially advanced nations, confounds past adjustment rationales; it calls for, and has given rise to, a number of innovative techniques which are discussed in the followup sections of this paper.

Problem Areas and Solutions

In light of the social policy objectives, the demographic premises, and the economic constraints discussed above, we need to identify those aspects of social security that require particular attention now or in the foreseeable future, if we are to assure the adequacy and solvency of the nation's economic security fabric.

Coverage and Entitlement [19]

National social security systems in all industrialized countries have generated their own momentum toward universal coverage and comprehensive entitlement to benefits. The goal of securing the essentials to aged persons is being implemented in one or more of three ways: through (1) social (old-age and retirement) insurance, (2) "demogrants" (universal old-age pensions) for all residents, and (3) social assistance (benefits as a right for needy aged persons).

COVERAGE EXTENSIONS OF PUBLIC PROGRAMS

Universal coverage virtually has been achieved in one of two ways: (*a*) extensions of compulsory and contributory social insurance either to all residents (e.g., United Kingdom, Netherlands, and Switzerland) or to all employed and self-employed persons, with optional insurance for certain nonemployed and others exempt from compulsory coverage (e.g., all but two of the European Common Market countries;) (*b*)

[18] See "Legal Aspects of the Calculation of Social Security (Social Insurance) Benefits in Particular as Regards Changes in the Cost of Living and the Level of Wages," Proceedings, Sixth International Congress on Labor Law and Social Security, Stockholm, 1966, Almqvist & Wiksell, vol. I, pp. 30–67.

[19] Much of the information in this subsection is drawn from the ILO compilation, Les Systèmes de Pensions dans des Pays Industrialisés, by A. Zelenka, Geneva, 1974.

establishment of "demogrant" programs, i.e., universal non-contributory pension schemes (e.g., Sweden, Norway, Finland, Canada, and New Zealand).

Recent innovative attempts to improve the pension cover of these systems have taken essentially two forms: (*a*) the extension of social insurance programs to persons traditionally excluded, and (*b*) *legally mandated* private (occupational) pension schemes.

Social insurance programs have recently been extended to persons who work at unpaid jobs (France, 1975).[20] Housewives, probably the largest single group of unpaid workers, have been covered for some years, albeit on a voluntary basis, in several national systems (e.g., United Kingdom, Italy, Germany). The problem of pension coverage for non-working women has been met traditionally only by the provision of dependents' benefits. But such coverage may not provide entitlement to benefits when needed, because of age or length of marriage requirements, or divorce. Even working women may not be entitled to benefits if they withdraw from the labor force early because of children.[21]

MANDATED PRIVATE PENSION SCHEMES

In striving for more ample protection, second and third program layers have been added to basic schemes. The newest method is the mandating of private pensions which, like the complementary public programs, is designed largely for middle-income workers. Since private pensions offset the minimum guaranties and low-income bias of many first-line programs, they make replacement rates of former income more nearly the same through the upper middle ranges.

Probably the clearest formulation of distinct policy objectives, as between basic and supplementary programs, has emerged from a recent restructuring of the Swiss social security fabric.[22] Pensions payable under the Swiss old-age and survivors insurance program were raised to "provide in themselves a minimum standard of living." At the same time, private pensions were mandated by a Constitutional amendment requiring employers to establish and maintain such plans and to pay no less than half of their costs.

In Sweden, essentially the same result is being achieved, but entirely at the employer's expense via the route of collective bargaining.[23] Agreements reached in 1960 for white-collar workers and in 1971 for blue-collar workers produced uniform private complementary retirement pension plans. In Sweden, these plans constitute a third rather than a second layer of protection. They are superimposed upon a basic universal old-age pension, a "demogrant" available uniformly at age 65, topped by an employment-based (social insurance) pension related to a medium range of earnings. Together the three components pro-

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[20] Organization for Economic Cooperation and Development (OECD), Old Age Pension Schemes, Paris 1977, p. 88. See also "Housewives and Pensions," Social Security Bulletin, September 1976, p. 37ff.

[21] See "Treatment of Women Under Social Security," hearings before the Task Force on Social Security and Women of the House Subcommittee on Retirement, Income and Employment and the House Select Committee on Aging, 1979.

[22] See E. K. Kirkpatrick, "Switzerland Changes Social Insurance Philosophy," Social Security Bulletin, April 1972, pp. 24–26, and Max Horlick, "Switzerland: Compulsory Private Pensions," ibid., October 1973, p. 46ff. and "Mandating Private Pensions: Experience in Four European Countries," ibid., March 1979, p. 18ff.

[23] In Sweden, both management and labor are represented virtually in their entirety by their respective organizations. Once ratified by both parties, collective agreements assume the force of law.

duce comfortable replacement ratios of preretirement income from the lowest to fairly high income brackets.

Similarly, the extension of compulsory private pension coverage to an entire industry through collective agreements has brought about substantial, though not universal, mandated private pension covers in France and the Netherlands.[24]

BROADER ELIGIBILITY PROVISIONS AND SAFEGUARDS TO ENTITLEMENT

Eligibility for benefits has broadened (*a*) as qualifying periods have been reduced under old-age insurance programs; (*b*) as residence requirements have been relaxed under "demogrant" programs; and (*c*) as the eligibility age has been reduced or made "flexible." A short minimum qualifying period providing *some* entitlement is a factor in opening access to pensions. Minimum qualifying periods of five years' contributions or less (e.g., in Canada, Ireland, Norway, Sweden, Switzerland, United Kingdom) compare favorably with the more prevalent requirement of 15 or more years' contributions (e.g., in France, Germany, Italy, Japan, and all of Eastern Europe).

In universal pension schemes a residence requirement of no specific length (the Netherlands) or of merely one year (for Danish nationals) contrasts favorably with a 20-year (New Zealand) or a 10-year (Australia) or even a 5-year requirement (Sweden).

The two most common methods of facilitating pension receipt have been the progressive lowering of the eligibility age, and various combinations of full or partial pension entitlement with part-time or unrestricted paid employment. No less important are safeguards which prevent covered persons from losing insured status, i.e., their (eventual) right to benefits as well as further safeguards which keep the eventual entitlement from shrinking. Unemployment, illness, childbirth, and other conditions that interrupt an insured person's normal activities are the most frequent causes of jeopardy under social insurance programs, since payment of contributions stops at those times. Unemployment and illness are usually considered "deemed" contribution periods (United Kingdom), or the government actually pays contributions due (the Netherlands), or the insured person pays voluntary contributions (France).

The voluntary payment method is also widely used to secure entitlement in case of loss of insured status after a substantial period of covered employment (Austria). It is along these lines, also, that insurance benefit entitlement is buttressed or maintained for some categories of women, by special pension credits for each child born to a worker whose attachment to the labor force was interrupted or ended prematurely by reason of childbirth and child raising (France); also for divorced women (Belgium).

Another factor affecting the possible loss of a pension is the compatibility of pension receipt with concurrent earnings from work. In France and the Netherlands, continuous gainful employment is fully compatible with receipt of pensions. Germany has introduced partial retirement combined with continued work on a reduced scale. Provi-

[24] See William C. Greenough and F. C. King, "Pension Plans and Public Policy," Columbia University Press, New York, 1976, pp. 261–265 and 270–271, and Horlick, "Mandating Private Pensions, etc.," loc cit.

sions for partial retirement from work coupled with a partial pension have been instituted in Sweden. A partial pension is payable up to 5 years before age 65 to those who want to continue in part-time employment (pursuant to provisions made in 1976 under the Partial Pension Insurance Act of 1975). A system of partial retirement and pensions along with part-time employment and continued payment of social security contributions offers interesting prospects, both financially and with a view to easing adjustment to retirement for the older worker. One difficulty is that large numbers of part-time positions may not be available in the United States.

In some countries, lowering the standard retirement age has been motivated, at least in part, by a concern with employment opportunities for younger workers. Aging workers themselves commonly welcome earlier entitlement to a full pension. However, apart from cost considerations, the aging of the workforce in the industrialized nations casts doubt on the likelihood of a continued trend in this direction.

Benefit Adequacy and Dynamic Stability [24a]

During the past two or three decades, people in industrialized nations have come to expect more of an adequate social security system. When such systems were first introduced, adequacy meant a system's capacity to provide for the essentials of life, i.e., to meet the minimum needs of the average family. Thus, provision was made for higher replacement rates for low-wage earners. This low-income bias has been a pronounced feature of the United States system from the start, and even more so since successive restructuring of the benefit formula in 1939 and 1950.

With the upward trend of incomes, the desire of middle-income groups for benefits more evenly related to earnings—that would enable them to retire without a drastic cut in living standards—led to changes in social security programming, notably the introduction of additional public and private supplementary schemes.

Moreover, "creeping" inflation gave rise to the need for a tie-in of social security benefits, especially pensions, to changing price and/or wage levels in order to prevent erosion of their real value. Ideally, the answer was seen in automatic (index-linked) adjustment mechanisms. In recent years, more pronounced inflation, coupled with lagging economic growth and increased unemployment has tended to draw into question the desirability of index-linking methods, and even their capacity to achieve the proper adjustments.

INITIAL BENEFIT ADEQUACY

In social insurance programs, qualifying periods are important not only in determining eligibility for benefits but also benefit amounts. The key points relate to (*a*) the treatment of past earnings relative to current earnings, and (*b*) the number of years counted in the base period.

In (*a*), some revaluation is necessary, particularly if past earnings

[24a] Grateful acknowledgement is expressed to Dr. V. Rys, Secretary-General, and to Mr. Dalmer Hoskins, Chief of Research, The International Social Security Association, Geneva, for current information for this section and the following section on Financing.

are averaged in the process of benefit computation.[25] With regard to (*b*), the main concern is choosing an earnings base which reflects accustomed levels of living.

Sweden and Germany have long employed a similar method to update past earnings. Each year an individual's earnings are expressed in relation to the average earned by all insured; these coefficients are then averaged for all countable years and finally translated into current amounts used for pension determination. In the United States, determination of the average monthly indexed earnings (AIME), pursuant to the 1977 Amendments to the Social Security Act, follows similar procedures.[26] Such revaluation is essential if the wage base at retirement is to reflect both the growth in real wages and inflation over the period of a retiree's work-life. Since every year's earnings may not be representative, in the United States, the five lowest-earnings years are omitted from computing the average.

Regardless of differences in rationale and technique, benefit adequacy bears a relationship to some measure of current or recent earnings. It is noteworthy that in countries with two or more general programs (multiple layer systems), the basic program, whether it is social insurance or a universal pension, tends to produce subsistence benefits which are then raised to a comfortable standard by one or more complementary systems. Those social security systems which rest exclusively on one general social insurance program may or may not go beyond "basics." Whether or not they do depends on the wage base and on the way benefits are structured.

The United States social security (old-age and retirement) benefit formula, e.g., rests on a high reference wage ($22,900 for 1979, $25,900 in 1980 and due to rise to $29,700 in 1981), coupled with a replacement rate which is very high for very low incomes but declines steeply for higher income bands.

In many other countries, the benefit structure differs in two important ways: (*a*) the benefit consists of a smaller percentage (typically 30 to 60 percent) of the entire reference wage at all benefit levels, plus (b) annual increments either at a constant percentage (e.g., 1.5 percent per annum in Germany, 1.67 percent per annum in Switzerland) or at rising percentages for successive 10-year periods (e.g., from 0.6 to 1.5 percent in Austria). As a result, 60 percent of higher replacement ratios all the way up to the taxable earnings limit are not uncommon for workers with 30 to 40 years of covered employment and earnings.[27] In the Netherlands, "a large section of the population" is reported to lose little or no income on reaching the age of 65.[28]

However, this state of affairs is far from general. Not unlike the United States, Switzerland had long viewed its social insurance program merely as a floor of protection. Its economic security fabric was

[25] See E. K. Kirkpatrick, "The Revaluation of Earnings Records in the Social Security Systems of Six Countries," International Social Security Review, Geneva, vol. 31, No. 3, 1978.

[26] See "History of the Provisions of Old-Age Survivors Disability, and Health Insurance, 1935–1977," HEW Publication No. (SSA) 78–11515, p. 4.

[27] For some comparative figures, see International Social Security Association, Committee on Old-Age, Invalidity and Survivors' Insurance. "Factors Entering Into the Calculation of Pension Amounts and Their Influence on the Level of Social Protection of Insured Persons." Reporter M. Lantsev. ISSA/IVS/XI/3 Provisional Report, May 1979, Annex 1.

[28] See "Pensions and Inflation: Current Issues in the Netherlands," by L. Lamers, Director General of Social Welfare, Netherlands' Ministry of Social Affairs, in Pensions and Inflation, International Labor Office, Geneva, 1977, p. 90.

considered to rest on "three pillars" in retirement: old-age insurance, private pensions, and individual savings and private insurance. It was discovered, however, in the early 1970's, that for the bulk of aged people social insurance benefits were the only resource. As a result, two changes were made. Old-age insurance was redesigned to provide for a minimum standard of living which would not necessitate supplementary support from means-tested programs.[29] Secondly, private pensions were made compulsory to "permit beneficiaries... to maintain their previous standards of living."[30] The same objective underlies the public promotion of private plans in Sweden where the aim is to extend upward the degree of pension protection by means of the (third) private pension layer.

Not all public sentiment, however, has supported such multiple protection. In Canada, where official reports show a considerable decline in private pension funds by the mid-1970's, the Canadian Labour Congress has gone on record in favor of the total elimination of private pension plans. Instead, it has called for a gradual increase of benefits payable under the Canada/Quebec Pension Plans until their replacement would reach 75 percent of final earnings at age 60 by 1996.[31]

SAFEGUARDING THE REAL VALUE OF BENEFITS

In recent decades, efforts to safeguard the adequacy of retirement benefits have been made, first by ad hoc corrective legislation, but increasingly by automatic or semi-automatic ties between price and wage movements on the one hand, and social security pensions on the other. A triple threat now comes from (*a*) increased benefit volume and costs due to population aging; (*b*) severe and prolonged stagnation and unemployment, lowering contribution income and increasing benefit outgo and, last but not least, (*c*) inflation with its frequently uneven impact on earnings and the cost of living.

Not until social security began to play a significant role in the lives of beneficiaries and in the economies of nations did it attract the serious attention of law makers. Denmark was the first country to build systematic benefit adjustment into its Social Insurance Act of 1933. It provided for up- or downward changes whenever the price index had moved either way by at least three percent.[32] Thus a clear-cut economic dimension was added to the legal guarantee.[33]

In 1966, a survey of fourteen highly industrialized countries showed that four of them legally provided for mandated periodic review of benefit structure, while others had instituted adjustment methods according to predetermined rules and formulas. Movements of defined size in prices or wages were to trigger benefit adjustments, in most instances subject to some government action. Only Sweden had in-

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[29] See "Switzerland Changes Social Insurance Philosophy," Social Security Bulletin, April 1972, p. 24ff.

[30] See "Switzerland: Compulsory Private Pensions," Social Security Bulletin, October 1973, p. 46ff.

[31] See "The Future of Private Pension Plans: A Canadian Viewpoint" by Harry Weitz, paper prepared for the Conference on The Economics of Aging: Toward 2001. University of Michigan—Wayne State University Institute for Gerontology. Ann Arbor, August 1975, p. 8.

[32] See Pensions and Inflation, op. cit., p. 14.

[33] In 1952, International Labor Convention No. 102, Concerning Minimum Standards of Social Security, stipulated adjustments in benefits in the event of appreciable variations in the general level of earnings or in the cost of living.

stalled a fully atuomatic benefit adjustment mechanism as early as 1948.[34]

International Labor Organization (ILO) statistics for 12 industrialized countries indicate that, regardless of method, at least the purchasing power of pensions under national programs was maintained from 1963 to 1975.[35] This result, however, is not attributable entirely to automatic or other index-linking procedures. In the United States, Congressional action increased social security benefits by almost 100 percent in the 1970's significantly faster than inflation over the same period.[36] Curiously, during the recent inflationary period, the "ad hoc" method has been resorted to over and above index-linked adjustments in a number of foreign systems.[37] Conversely, automatic adjustment mechanisms have been criticized as a contributory cause of the inflationary process which they were instituted to offset.[38]

From the mid-1970's onward, in most industrialized nations, accelerating rates of inflation plus mounting unemployment changed the relationship between the wage and price increases. Moreover, slowing rates of economic growth affect different sectors of the economy unequally, thereby infusing the earnings index with an erratic quality. Differential price increases in goods and services made dissimilarities in the "market basket" of an active as against a retired worker's household loom larger than before. Most pressing of all were the concerns about the cost of automatic benefit adjustment and its equity: should pensioners be able to count on, and could active workers be asked to underwrite, a more stable market position than that enjoyed by active workers themselves? Should restraints in containing inflation be borne entirely by the latter?

A clear change in direction characterizes the most recent foreign developments in the area of pension adjustments. Instead of hastening the adaptation of benefits to make them more fully reflect every movement in any given reference base (notably price levels), several recent changes have aimed at preventing "overcompensation." Also, there is the need to steer a balanced course "between social needs and financial constraints." [39]

With regard to private pensions, the possibility of assuring automatic upward adjustment is fraught with problems. With few exceptions, techniques to do this are still in the realm of proposals rather than realities. The difficulty arises from the need for funding of private pensions with a view to guaranteeing their availability when due. Additional funding is required whenever pension rates are increased, whether due to inflation or to other causes. Such increased new financial liability—much like "past-service credits" in a newly established

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[34] See "Legal Aspects of the Calculation of Benefits, in Particular as Regards Changes in the Cost of Living and the Level of Wages," Reporter: G. F. Rohrlich, op. cit., Uppsala 1968.

[35] Pensions and Inflation, op. cit., p. 2. For specifics, see Zelenka, op. cit., pp. 202–211. By the 1970's mandatory index-linking had become a standard feature of the pension systems of the industrialized countries and many others.

[36] J. H. Schulz, The Economics of Aging, Wadsworth, Belmont, CA, 1976, p. 1. Similar developments have taken place elsewhere. (See paper by A. Delperee, cited in footnote below, p. 18; and especially, M. B. Tracy, "Maintaining Value of Social Security Benefits during Inflation: Foreign Experience," Social Security Bulletin, November 1976, pp. 33–42.)

[37] E.g. Austria, France, Italy, Sweden.

[38] See A. Delperee, "Social Security Cash Benefits in a Period of Concurrent Inflation and Recession," in Problems of Social Security Under Economic Recession and Inflation. International Social Security Association, Geneva, 1978, pp. 13–24.

[39] ILO, Pensions and Inflation, op. cit., p. vi.

private plan—can be funded at least over a period of years, subject to a firm's continued solvency. Alternatively, the creation of "book reserves," as in Germany, enables an employer to invest in his own business, thereby, presumably, making reserve accumulation less onerous, though no less of an additional liability. Under the German law, employers are required to investigate the need for and possibility of upward adjustments of private pensions in line with wage and/or cost-of-living increases. A proposal for compulsory private-pension indexing did not pass the legislature "because of anticipated high costs to the company in an inflationary period." [40]

Considerations of cost and financing, which have an important bearing on policy choices and methods of implementation are discussed in the following section.

Financing

Studies of social security financing, especially old-age pensions, indicate a sustained and significant rise in costs, now and for the future, which social security contributions may not be able to meet. The search for new revenue sources reaches into the area of general taxation. This section discusses these problems and their implications for the economy, particularly in light of continued stagflation.

MOUNTING COSTS OF SOCIAL SECURITY AND PENSIONS

Rises in social security costs generally and of old-age and survivors' provisions in particular, have been a worldwide phenomenon over the last several decades.

The Council of Europe has published comparative ratios of social security benefit expenditures as percentages of gross domestic product (GDP) for fiscal years 1960 to 1971. (See table 1.)

TABLE 1.—SOCIAL SECURITY EXPENDITURES, 1960–71, (AS A PERCENT OF GDP)

Country	Fiscal year 1960	Fiscal year 1971
Austria	14.5	18.1
Belgium	13.7	16.9
Denmark	10.5	18.1
Finland	8.5	13.8
France	12.5	13.9
Germany	14.6	16.3
Greece	9.4	10.9
Ireland	8.8	12.0
Italy	11.0	16.9
Norway	9.0	15.7
Netherlands	10.4	20.2
Switzerland	7.1	10.1
Sweden	10.7	20.1
United Kingdom	10.2	13.2

Source: Selected and excerpted from Council of Europe, Financing of Social Security, Strasbourg, 1979, table G, pp. 16–19

For old-age, death, and survivors' benefits alone, comparative percentages of GDP for the years 1962 and 1971, respectively, in some of the foregoing countries ranged as follows: Belgium—5.9 to 6.9 percent; France—5.0 to 6.8 percent; Germany—7.2 to 8.0 percent; Italy—4.4 to 6.6 percent; Netherlands—6.1 to 8.4 percent; Sweden (1960)—

[40] See "New Private Pension Law in the Federal Republic of Germany," Social Security Bulletin, July 1975, p. 44.

2.8 to 3.4 percent; U.K. (1960)—3.4 to 4.7 percent; U.S.A. (1960)—2.7 to 4.2 percent. Old-age benefits, across the board, represented about two-fifths of total social security payments in 1971.[41]

During the 1970's social expenditures generally increased at a faster pace than during the 1960's. Comparative data (social expenditures as percent of GDP) for the years 1970 to 1975 are available for the European Economic Community (EEC) countries. They show a 1970 range of 13 percent (Ireland) to 21 percent (Germany) and a 1975 range of 19 percent (UK) to 28 percent (Germany).[42] In all EEC countries, as in many others, the old-age and survivors' programs accounted for the largest share among the several social security programs. When combined with benefits paid for work-disabling illness, they constituted half or more of total benefits paid in several of these countries (e.g., Germany, Italy, Netherlands, and UK).[43]

Looking to the future, the relative importance of the extension of eligibility is bound to decline, as near-universal pension coverage has been attained almost everywhere. Similarly, the importance of the aging factor will loom larger in the future only in countries which have not yet reached their maximum number of old-age pensioners. Increases in the "transfer ratio,"—the average pension per pensioner in relation to Gross Domestic Product (GDP)—on the other hand, should play a more significant role as benefit improvements will no longer be offset by the typically below-average entitlements of newly added categories of persons. Often among the last to achieve pension protection, these categories will have been covered in recent program expansions nearly everywhere.

In any event, the well-nigh certain long-range increase in pension costs raises the question as to how the mounting costs are to be met.

CHANGING MODES OF SOCIAL SECURITY FINANCING AND STAGFLATION

In reviewing actual and proposed changes in social security financing over the past several years, some general observations can be made:

(*a*) Any notions of full funding for public pension schemes have been abandoned; in those instances where substantial funding exists, available reserves appear to be used more for interprogram liquidity and overall financial flexibility than as a guaranty for long-term solvency.

(*b*) Traditional contributory financing sources, notably payroll taxes, are perceived to have yielded the largest possible revenues through base and rate changes; thus, proposals are made that they be supplemented from other revenue sources, preferably supportive of labor-intensive enterprises.

(*c*) Decisions on social security financing are increasingly infused with general economic policy concerns and assessed within the framework of national systems of taxation.

(*d*) Dampers are being devised to retard or lessen costly benefit adjustments; the view is gaining ground that such adjustments are the responsibility of the government rather than that of any particular program, especially a supplementary one.

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[41] OECD, Old Age Pension Schemes, op. cit., pp. 40, 43 and 44.

[42] See Eurostat Social Accounts, 1970–1975, Statistical Office of the European Communities, Brussels, 1977, p. 54. The nine members of the EEC are Belgium, Denmark, France, Germany, Ireland, Italy, Luxembourg, the Netherlands and the United Kingdom.

[43] Ibid., p. 57.

(*e*) Money saving alternatives, notably cost containment through positive labor market policies, are increasingly explored as a possible option to retirement at the earliest eligible age in cases where deferred retirement is feasible and favorable to the worker.

Examples of the first four concepts are given below. The fifth is discussed in the concluding section.

The dwindling and changing role of reserves

A recent review of "Social Security Funding Practices in Selected Countries" observes that, contrary to the popular belief that substantial funding was widespread in foreign social security schemes, "few countries follow this practice. The programs with sizable reserves are, for the most part, relatively new and will not pay full benefits for some time. When full benefits are eventually paid, the funds are expected to dwindle".[44] These systems, for the most part earnings-related, are experiencing an initial phase analogous to the early years of social security in this country.

The impracticality of full actuarial funding for a national old-age and survivors' insurance program was highlighted in a recent study prepared in the Office of the Actuary of the U.S. Social Security Administration.[45] Such funding practice would lead to growing reserve accumulations during a 75-year period, stabilizing at about 28 times annual expenditures and peaking, in terms of percent at the time, at between 160 and 180 percent of GNP.[46]

Under conditions of severe inflation, one of the principal benefits of substantial reserves—interest earnings—would be in jeopardy. Despite rising nominal rates, *real* rates of interest have turned negative in an increasing number of countries.[47] In those few countries which have, at least temporarily, amassed large social insurance fund accumulations, these are made to serve various broader purposes. In Sweden, e.g., the employment-related pension system's massive reserves constitute the largest single source of capital formation. In Finland, they serve, in part, as an assured source of loan money for employers (up to one-half of their contribution to the employment-related pension program).[48]

Under supplementary private pension schemes, notably mandated ones, more extensive funding is important. But even here, current practices have veered away from conventional patterns. In Sweden, an elaborate private pension reinsurance system enables an employer to satisfy solvency standards through credit insurance while, at the same time, maintaining "book reserves," i.e. earmarking internal funds invested in his own business.[49] In addition, the mutual credit insurance companies extend renewable loans to firms insured with them. In the

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[44] Leif Haanes-Olsen, in Social Security Bulletin, May 1976, p. 24. The pension schemes in point are those of Canada, Finland, Norway, Sweden and Switzerland.

[45] J. A. Applebaum, "Some Effects of Fully Funding OASDI" Actuarial Note No. 97, September 1979.

[46] In present (September 1979) GNP values, this would amount to an order of magnitude ranging from $3.7 to $4.2 trillion. See also K. H. Wolff, in International Social Security Review, vol. XXX, No. 2, 1977, pp. 220–221.

[47] See R. Turvey, "Rates of Interest and of Inflation, and Their Effect on Funded Pension Schemes," in ILO, Pensions and Inflation, op. cit., p. 131 ff.

[48] See L. Haanes-Olsen, loc. cit., pp. 25 and 27.

[49] See Pension Systems in Sweden, op. cit., p. 32. The same "book reserve" method is in use in compliance with the government-regulated but non-mandated private pension scheme in Germany.

Swiss and Dutch mandated private-pension systems, a pool or equalization fund is used across firms, industries and risks. Essentially the same technique is used in France under a different name.[50]

The common reliance on the pay-as-you go method, in public as well as private programs, underpinned by contingency funds of varying size, is characterized by inter-program pooling and shifting of funds. This is the current practice in both France and Germany.[51]

The search for additional income

Since employer and employee contributions based on earnings have long been the predominant source of pension financing, recent high unemployment rates have adversely affected revenues while contributing to rising costs of benefits. This has given rise to increases in contribution bases and rates. On the other hand, it has caused renewed discussion and some action to provide additional or less volatile alternate revenue sources, preferably free from employment disincentives.

Though ceilings on taxable earnings are common, the ratio of taxable to total earnings has frequently been higher abroad than in the United States (prior to the 1977 amendments), and they have been subject to automatic or semi-automatic escalation earlier than in this country. Some countries currently have no contribution ceiling at all (in some programs), while limiting benefits to a certain maximum, e.g., Belgium, Denmark, Finland, France, Italy, Switzerland.[52] A variant of this method is to levy contributions at a lesser rate on that portion of (higher) earnings which do not enter into the benefit computation, e.g., France.[53]

Among the countries levying employer contributions at a higher rate than worker contributions are Belgium, France, the Netherlands, and Italy.[54] Combined employer-employee contribution rates frequently exceed the U.S. percentage. Self-employed persons usually pay the combined employer-employee tax rather than from one-half to three-fourths thereof, as in the U.S. Despite these high perecntage levies, the rates were raised when stagflation produced a deficit.[55] In Denmark, a recent investigatory commission proposed a broadening of the tax base by defining it more broadly through the abolition of some present exclusions.[56] These and related changes are motivated by fiscal policy considerations, rather than solely by social security financing concerns.

New revenue sources and strategies

In evaluating the potential for greater yields from existing revenue sources, and particularly from new or additional revenue sources, attention has turned from program financing *per se* to the broader

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[50] See M. Horlick, Mandating Private Pensions, etc., loc. cit., p. 25 ff.

[51] See Haanes-Olson, loc. cit., and Lois Copeland, "Effect of Recession on Financing of German Pension Program," Social Security Bulletin, February 1977, pp. 29–33.

[52] See M. Horlick and Robert Lucas, "Role of Contribution Ceiling in Social Security Programs: Comparison of Five Countries," Social Security Bulletin, February 1971, p. 19 ff., and Martin Tracy, "Payroll Taxes Under Social Security Programs: Cross National Survey," ibid., December 1975, p. 3 ff. (Also in the International Social Security Review, vol. XXIX, No. 1, 1976, p. 66 ff.)

[53] See Lois Copeland, "Impact of Recession on Financing of French Program," Social Security Bulletin, July 1976, p. 44 ff.

[54] See Tracy, loc. cit., p. 11, and F. W. Heus, "A 'Social Budget Compiler' for Short and Medium Term Forecasts of Expenditures and Receipts of Social Security in the Netherlands," ISSA/CAS/VII/Item III, 1979, Paper No. 6, p. 3.

[55] See Copeland, loc. cit., p. 47.

[56] See J. H. Petersen, "Financing Social Security by Means of Taxation," ISSA/RDS/Conf. 4/C, 1979, p. 32.

economic policy context. Thus, abolishing any limit on the taxable wage base is justified on the ground that it gives greater weight to the overall counter-cyclical effect of payroll taxes.[57] Conversely, after adjustment for inflation, the evident corresponding increases in social security contributions and benefits may veil the more massive and more lasting inflationary impact upon benefits, thus keeping "structural imbalances in social security" from becoming apparent.

Abolition of taxable wage ceilings, too, is argued on the ground of equity between labor-intensive and low-wage firms and industries on the one hand, capital-intensive and high-wage firms and industries, on the other. In light of this, the suggestion has been made that contribution rates for firms employing upward of a certain number of workers be reduced.

Suggested new or additional revenue sources other than wages include contributions or taxes based on turnover, "value added," and depreciation.

A comprehensive reform proposal combining several of these approaches has been advanced recently within the Council of Europe by the Belgian Minister for Social Welfare.[58] Its avowed purpose is to achieve an employment-neutral financing system that would distribute the social security burden among all factors of production more equitably. As at present, the current level of contribution receipts is to be guaranteed, and work income continues to serve as the contribution base. The rationale of its innovative features is "to reinforce solidarity as between economically strong and weak sectors, at the same time preventing any penalization—proportionally [sic]—of labor-intensive firms compared with capital-intensive firms." [59] Specifically, employer contributions would be paid, preferably on total payrolls or alternatively, subject to a uniform high ceiling adjusted annually to the cost of living index. The amount of wages taxed above the earnings ceilings for benefit purposes would not enter into the computation of benefits.

The differential tax treatment of pensions and of social security benefits generally has become part of this more comprehensive approach.[60]

The problem was addressed by a committee on Social Security and Taxation of the International Social Security Association.[61] In general, there was acknowledgement of past, and prediction of future, increases of general-revenue subsidies in financing of social security.

At the same time, "the specific objectives of social security as opposed to the fiscal system" were emphasized; the view was expressed that priority be given to eliminating contradictions between the two systems rather than "seeking ways of integrating and combining them." [62] Nevertheless, it was taken for granted that "schemes based purely on contributions related to wages would soon become a thing of the past." [63]

With regard to taxation of old-age pensioners, it was argued that

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[57] See Francis Pavard, "Social Security Financing Through the Contribution Method," ISSA/RDS/Conf. (1979)/4/B, p. 6.

[58] Council of Europe, Conference of European Ministers Responsible for Social Security, Strasbourg 6–7 March 1979, First Report, Financing of Social Security. Strasbourg, 1979, pp. 31–32.

[59] Ibid., p. 32.

[60] See, e.g., Denmark—Committee on Co-ordination of Taxes and Social Benefits, Second Report, Copenhagen, 1977, as quoted by J. H. Petersen in "Financing Social Security by Means of Taxation," ISSA/RDS/Conf.—1979/4/C, p. 32.

[61] See Social Security and Taxation, Studies and Research No. 13, ISSA, Geneva, 1979.

[62] See, e.g., ibid., pp. 122, 123 and 115 respectively.

[63] See Social Security and Taxation, op. cit., p. 116.

non-earned income plays a greater role in retirement; thus, taxation of post-retirement, just as of pre-retirement income, might have an equalizing effect. Waiver of tax concessions to old-age pensioners, as in Israel, could finance 3–4 percent increases in pensions. Since low-income pensioners would not be affected, removal of tax exemptions would affect only pension recipients without a presumptive need for tax relief.[64] On the other hand, it was pointed out that the inclusion of benefits in the tax base raises the marginal tax rate on savings and on any currently earned income, thus constituting or adding to disincentive effects on work and saving.[65] From a different point of view, the question was raised concerning the possible trade-offs not only in revenue yields, but also in social equity, if special tax exemptions allowed aged persons under national income taxation were eliminated in favor of higher pension benefits.[66]

Coping with the burden of benefit adjustment

A balance must be struck between adjusting benefits to account for changing prices and overcompensating "reforms" that themselves can engender financial instability in benefit schemes. Apart from certain instances in which adjustment has been deferred or contained, various makeshifts have helped to provide at least temporary relief for pension schemes experiencing financial difficulties due to stagflation. Into the former category fall many of the revisions in adjustment mechanisms reviewed earlier in this study, and the shifting between programs of contingency reserves noted above. A more comprehensive cost containment was resorted to in the Netherlands which limited future growth rates of all social programs to one percent of the national income.[67]

The mix of the remedial and preventive measures adopted or proposed in Germany in response to the financial crisis caused by the 1974 recession is representative of a short-run course of action. The recession, coming on top of a coverage expansion and benefit liberalization, brought with it above-average unemployment and earlier and more numerous retirements. These actions and plans included: (1) a substantial shift and liquidation of reserves from one branch to another; (2) a remission of interprogram dues i.e., pension system contributions to sickness insurance for pensioners' medical care; (3) an almost equally substantial advance on the annual subsidy; (4) a proposed postponement of the next regular pension adjustment and/or, alternatively, a pensioners' sickness insurance rate increase; (5) a linkage of benefit adjustments to changes in net rather than gross wages and, finally, (6) a general tax increase to subsidize the pension system.[68]

In Germany's case, the financial crisis of the pension system was only partly a result of stagflation, and a relatively moderate one at that,[69]

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[64] Ibid., p. 119. A similar rationale underlies the recent proposal by Robert M. Ball, former Commissioner of Social Security, to tax half of the old-age pension—presumably in some loose analogy to the worker's share in total contributions. (See Social Security Today and Tomorrow, Columbia University Press. New York. 1978. pp. 95–96.)

[65] See Jack Habib. "The Relationship Between Social Security and Taxation: An Overview," in Social Security and Taxation. op. ct., p. 123 ff.

[66] Ibid., p. 129. For a proposal referring to certain aspects of the U.S. system, see Robert H. Myers. "Income Tax Mechanism Solves Inequity in Social Security Disability Benefits," Journal of Commerce. Dec. 7, 1979.

[67] See Paul Fisher. "The Social Security Crisis. etc.," loc. cit., p. 386.

[68] See Lois Copeland, "Effect of Recession on Financing of German Pension Program," loc. cit., p. 33.

[69] Nearly a million foreign workers had left the country which meant a sizable loss in pension contributions. At the same time, there were some savings in unemployment benefit disbursements.

and the extent of Federal subsidization was moderate. Elsewhere, total reliance on government aid for the entire cost of pensions is either a fact, as in the United Kingdom, or a mounting demand. The argument in support of this position is based on the extra-systemic origin of those economic developments which give rise to the recurrent need for upward adjustment.[70] Essentially the same argument is being made with regard to "inflation-proofing" private pensions.[71]

Meanwhile, in at least one country, Denmark, in which the program financing burden has rested heavily on the general revenues of the government, the idea is emerging that the growth of social programs represents such a degree of income equalization as to warrant, in principle, "a return to more of quid-pro-quo notion of taxes and benefits." [72]

Thus, financing practice and tax theory appear to have failed to discover any new sources or more productive means of tapping established sources to finance the mounting burden of old-age pension costs.[73]

Continued Labor Force Participation, Training, and Employment

An additional avenue for achieving old-age security is to encourage continued participation in the labor force. Legislation designed to influence workers to delay retirement beyond the normal retirement age has shown little measurable result to date.[74] The possible causes of this situation deserve attention. It may well be that, quite aside from the comparative attraction of wages and pensions, the preference for early retirement is influenced or even forced by (*a*) the nature and conditions of the work, (*b*) the narrow choice between this job or none, (*c*) the lack of reorientation to the labor market, (*d*) the lack of retraining or flexible employment opportunities, and (*e*) an age bias in hiring.

If suitable employment could be counted upon and were within reach of the worker eligible for a pension, would he or she still choose retirement? A poll in August 1978 showed that "a majority of Americans . . . would rather keep working than take an early or full retirement." [75] In elaborating on his findings in a report to the House Select Committee on Aging, pollster Louis Harris stated: "They not only think such work contributes to their own mental and physical and material well-being but they also feel that they can contribute to the mainstream of American society." [76] If one compares this statement with the actual experience of older workers in the job market, it is clear that the greater part of this potential goes unused. This also can be

[70] See, e.g., Lorenzo Gil Pelaez and J. Soler Bordetas, "Theoretical and Practical Aspects of the Adjustment of Pensions to Changes in Prices and Wages," ISSA, CAS/VII/Point II, 1979, Communication No. 6.

[71] See James E. Pesando, "Private Pensions in an Inflationary Climate." Economic Council of Canada, Discussion Paper No. 114, April 1978.

[72] See J. H. Petersen, "Financing Social Security by Means of Taxation," loc. cit., p. 35.

[73] See Robert J. Myers, "Social Security Taxes: Regressivity and Subsidies" in Tax Review, vol. XXIV, No. 12, December 1973, pp. 45–48.

[74] Martin Tracy, "Retirement Age Practices in Ten Industrial Societies, 1960–1976," International Social Security Association, Geneva, 1979, p. 97.

[75] See "Poll Shows Most Workers in U.S. Prefer Jobs to Early Retirement" (UPI, Washington, March 3, 1979). New York Times, March 4, 1979. Of the 1,330 employees surveyed, 51 percent said they wanted to continue working when they reached retirement age, either full-time or part-time, instead of retiring; among those already retired, 46 percent indicated they wanted to work "during or instead of retirement."

[76] Ibid.

inferred from an analysis of the discouraged-worker syndrome in the peak-to-trough phase of the recent recession (1973–75).[77]

Official projections of average rates of change in age-specific labor-force participation in the United States, based on alternate assumptions as to future economic growth, show a lowered or at best a steady share of aged participants between now and 1990. Official projections of labor force changes for the European Economic Community countries (1975 to 1995), also are consistently lower for the age group 65 and over. Except for the period 1980–85 this is also true for both male and female workers, age 60 to 64.[78]

If the current practice of early retirement here and abroad continues, it may give rise at some future time to an actual shortage of workers, a development that would drastically change the situation and test older people's desire to work at the "right" jobs.[79]

In the meantime, an intensive study of measures designed to increase labor-force participation of older workers would be the single most worthwhile area for exploring the problem of old-age security.[80]

MEASURES TO INCREASE LABOR-FORCE PARTICIPATION

The three most common measures to facilitate continued labor-force participation have been (*a*) the removal of compulsory retirement provisions, (*b*) the removal or easing of prohibitions or limitations on gainful employment as a condition of pension receipt, and (*c*) increases in pension amounts for those eligible for but postponing retirement. Incentives (*a*) and (*b*) result in a reduction of net pension costs only to the extent that the receipt of pensions concurrent with gainful employment is limited, and/or contributions are payable on earnings after regular retirement age.

Norway, one of the few countires in which the standard retirement age is 67, rather than 65, provides significant advantages to those who continue working, under both the universal basic and the employment-related supplementary pension schemes. The reward may comprise a bigger pension due to added years of coverage and a deferred pension supplement of 9 percent per year up to age 70. On the other hand, the worker has to pay contributions even if he has attained full basic pension entitlement, and his current earnings do not improve his "best 20-year" earnings average for supplementary pension entitlement; the additional contributions, therefore, do not lead to a further boost in either pension. However, the worker may choose to draw a partial pension at or after age 67, in which case the increment will be applied only to the deferred portion. In this case, he or she is limited to a combined part-pension and part-earnings income of 80 percent of his

[77] Recession's Continuing Victim: The Older Worker. A working paper prepared for use by the Special Committee on Aging, U.S. Senate, 94th Congress; 2nd Session, July 1976, p. 7.

[78] See Commission of European Communities, The Economic Implications of Demographic Changes in the European Community: 1975–1995, E.E.C., Brussels, June 1978, p. 125 (in French edition).

[79] For predictions of such a possibility see "Early Retirements May Create Shortage of Workers," Philadelphia Inquirer, October 22, 1978, p. 7A, and especially Harold L. Sheppard and S. E. Rip, "The Graying of Working America," the Free Press, New York, 1977.

[80] Numerous references to established foreign programs to promote employment of older workers are contained in Beatrice G. Reubens, The Hard-to-Employ: European Programs, Columbia University Press, New York, 1970.

earnings from age 61 to age 65 or from age 63 to 65, whichever is higher.[81]

Germany's deferred retirement option yields an 8.7 percent increment per year of deferral up to age 67, at which time the increased pension may be drawn without regard to concurrent earnings.[82] France provides a pension equal to 75 percent and 100 percent of the final 10-year average salary, if the onset of pension receipts is postponed to ages 70 and 75 respectively.[83] Sweden's arrangements allow deferral of all or one-half of one's pension past age 65 at a six percent increase of the deferred amount per year up to age 70 in both the basic and supplemental pensions. In the case of partial deferment with part-time work, a worker may obtain up to 90 percent of former full-time earnings, which is a higher percentage than that of a full-time pension. This arrangement combines extended work with a gradual transition to retirement.[84]

TRAINING AND REHABILITATION

The fact that there appears to be little information in this area may indicate the lack of attention to the needs of retraining the elderly. This is all the more noticeable in light of increasing interest in the subject in the last two decades in this country, and longer in a few others. By and large, training has focused on young entrants to the labor force, or on "mid-career" workers whose skills have become obsolescent because of technological changes. These problems have been addressed, for the most part, under the heading of "active" manpower policies, sometimes in connection with unemployment insurance reform, more frequently as part of disability benefit schemes, but seldom in connection with old-age pensions.[85]

Sweden has recognized that "the most serious problem at the moment is that older workers and people with handicaps find themselves being squeezed out of the labor market."[86] While it has passed legislation to increase the job security of older workers, its rehabilitation programs are geared chiefly to the needs of the "handicapped," i.e., partially disabled persons. In Germany, rehabilitative services for pensioners include cost-free stays at health resorts, and other amenities such as clubs, continuing contacts with former place of employment, and mutually useful ties with youth groups.[87] The British National Insurance system offers training courses to employed or unemployed insured persons. The latter are credited with contributions to protect their pension rights without having to pay them.[88]

The Pension Insurance System of Germany provides medical and occupational rehabilitation for those who meet the eligibility require-

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[81] See "Lower Pensionable Age in Norway," Social Security Bulletin, January 1974, pp. 34–35. (Prior to 1973 the minimum pension age in Norway was 70 years.)

[82] See "German Provisions for Deferred Retirement," Social Security Bulletin, pp. 24–25.

[83] See Greenough and King, "Pension Plans and Public Policy," op. cit., pp. 258–259.

[84] See "Pension Systems in Sweden," op. cit., pp. 10–13; M. B. Tracy, "Flexible Retirement Features Abroad," Social Security Bulletin, May 1978, p. 33; and "Swedish Unemployment Program," ibid., March 1974, p. 41 ff.

[85] See, e.g., the report by the Permanent Committee on Unemployment Insurance and Employment Maintenance, ISSA, International Social Security Review, vol. XXX, No. 4, 1977, p. 465.

[86] Leif Holgersson and Stig Lundström, "The Evolution of Swedish Welfare, the Swedish Institute," ISBN, 1975, p. 21.

[87] See Trofimyuk, loc. cit., p. 60.

[88] See U.K. Department of Health and Social Security, "Training for Further Employment?", Leaflet NI 125/August 1979; also Gary B. Hansen, "Britain's Industrial Training Act," National Manpower Task Force, Washington, D.C., August 1967, especially pp. 60–61.

ments for a pension, i.e., at least 120 months of covered work.[89] Altogether, The German system is probably the most systematic approach to retraining and rehabilitating older workers. This program is one facet of its commitment to a "social market economy." It has been conceived as "a search for a new synthesis, combining the advantages of a competitive market with a social policy intended to bring about adjustments in income distribution through a diversity of social services." [90] In conjunction with this socio-economic philosophy, the "social investment concept" has been developed as a guiding principle.[91]

The cornerstone of this policy is the Employment Promotion Act of 1969, under which placement in jobs and training receives priority over benefits to the unemployed, and, by implication, to employable persons of pension age. It contains a special section titled "Programs for the Creation of Employment Opportunities for aging Employees." [92] Every worker in Germany, including non-German nationals of the Common Market countries has a statutory right to paid training, further training, retraining or rehabilitation.[93] Full-time instruction may be granted up to two or three years. An allowance, paid throughout that period, typically replaces 80 percent of former net income from work. (This is 12 percentage points above the unemployment insurance and 22 percent above the unemployment assistance benefit which is paid to those unemployed persons who cannot or will not take some kind of training.)

The most relevant components of Germany's active labor market policy and program are aimed at "safeguarding and improving the occupational mobility of gainfully occupied persons," at preventing or countering any "harmful consequences (of) technical developments or structural changes," and at "the occupational integration of older workers." [94]

These policy objectives are linked through the National Employment Institute, an autonomous Federal agency with top administrative authority under the supervision of the Federal Minister of Labor and Social Affairs. It is a tri-partite body with representatives of employers and employees constituting one-third each, and representatives of Federal, State and local government authorities the remaining third. The Institute is financed from employer and employee contributions levied on the statutory pension insurance base. Federal loans are available when the Institute's funds and reserves run dry and, in exceptional cases, special Federal subsidies are also available. Thus, the financing of the Institute in itself is intended to be countercyclical, in the nature of an automatic stabilizer.

The key to the Institute's successful operation lies in its job-placement monopoly. Infractions of this monopoly are punishable by steep

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[89] See Bundesministerium für Arbeit und Sozialodnung. "Eine stabile Rentenversicherung und eine gesunde Krankenversicherang," Bonn, 1977, Chapter 7.

[90] T. E. Chester, "Western Germany—A Social Market Economy," Department of Social Administration, the University of Manchester, processed, undated, p. 5.

[91] See Embassy of the Federal Republic of Germany, Labor News and Social Policy, Washington, D.C., February 1978.

[92] See International Labor Office, Employment Promotion Act. Dated June 25, 1969, Legislative Series 1960—Ger. F.R. 1, especially Sections 97 to 99; also D. Eichner, "The Response of Social Security Schemes to High Rates of Unemployment: Experience in the Federal Republic of Germany," in Problems of Social Security under Economic Recession and Inflation, ISSA Studies and Research, No. 10, Geneva, 1978, Chapter IV, especially p. 27ff.

[93] Labor News and Social Policy, loc. cit., p. 2. Since 1977 prisoners in penitentiaries, too, are entitled.

[94] See Eichner, loc cit., p. 27.

fines, and exceptions are made for one year at a time only after consulting the employers' and employees' associations concerned.[95] While combining under one roof all preventive, corrective (adjustment-oriented) and compensation functions, the Institute has widely decentralized its administration to regional, local and branch offices. The Institute offers occupational guidance, training and retraining with a view to career advancement to persons of all ages, covering all or part of the cost. On-the-job training is offered by employers with the amount of the grant paid to the employer determined by the difference between the low work output and the desired maximum efficiency.

Further emphasis was given to training and retraining in 1973–74 in a special action program known as "Vocational Training and the Employment Situation." It added nearly a third to the number of trainees who had become or were in danger of becoming unemployed. In 1975, 12 percent of the new applicants desired retraining, which accounted for over one-fifth of the total cost of over half a billion marks that year (plus two billion marks in wage replacement benefits).[96] In retrospect, these programs were judged to be very effective during the 1974–75 recession.

EMPLOYMENT ASSURANCE

In the United States, there has been a recent increase in the permissible age limit for compulsory retirement in the private sector, and its waiver altogether in much of the public sector. But there is no assurance of employment for an older worker who loses a job due to retrenchment or who has chosen to be pensioned off and then seeks to return to work. Yet, it is precisely the option and guarantee of suitable paid employment, including part-time opportunities, which would make possible a decrease in the number of pensioners and pension costs in the future.

One widely used approach has been "mandatory employment" legislation, but primarily to enforce gainful employment for handicapped or disabled persons.[97] It consists of a legal obligation for firms of specified size to employ numbers of such workers under a quota system. Though predating World War II in some countries, such as the United Kingdom, it was newly adopted in several of the Common Market countries following World War II, in the attempt to guarantee gainful employment to all handicapped workers, especially ex-servicemen. Success has varied inversely with sagging employment conditions and the number of nondisabled unemployed. This was true even in Germany where a financial penalty attaches to each quota job remaining unfilled. If this system were applied to aged workers, its enforceability in times of large labor surpluses similarly would be doubtful.

Another approach, aimed specifically at compliance with the "right-to-work" promise of the U.N. Universal Declaration has taken the form of public employment programs, sometimes after preparatory rehabilitation and performance. One example is the Dutch Social Employment Program, which focuses on the so-called "less productive

[95] See Employment Promotion Act, Sections 23 and 228–233.
[96] See Eichner, loc. cit., pp. 34, 35.
[97] See "Mandatory Employment for the Handicapped," Social Security Bulletin, February 1979, p. 23ff.

worker," which is not a suitable designation for the older worker or an image he or she seeks to project.[98]

The older worker, notably the one who has reached "retirement age," has different needs from disabled or "less productive" workers. He may need lighter or different work, but his need for work is not essentially different from that of younger members of the labor force. Yet, the aged worker in the United States suffers from more pronounced job severance practices and preferences of employers than those in other countries. As characterized in a recent U.S. Department of Labor comparison:

> U.S. employers typically reduce average hours when output turns down, but they usually rely much more on layoffs of employees to adjust to major cuts in output. In contrast, employers in Japan and many European countries try to maintain their work forces by cutting average hours more sharply. These countries are frequently assisted in this effort by government programs to subsidize employment.[99]

Once more, the philosophy and practice of Germany's "social market economy" provides promising ideas. Special employment promotion features include: (*a*) a mobility allowance for persons long unemployed and willing to move to a non-temporary job; (*b*) wage subsidies for employers hiring unemployed workers for non-temporary jobs; and (*c*) permanent part-time employment which "answers to the preferences of many women . . . because of family obligations . . . and older workers. . ." [100]

At present, we are far from any realistic knowledge of the "saturation levels" of activity of the upper-age cohorts of the population, especially those of pension age and above. Past experience gives us little to go on, because opportunities and alternatives have been too limited. It may be useful for the U.S. to embark on an annual Social Report/Social Budget patterned after the German model.[101] Such a document would enable us to gain a perspective on our social security fabric with reference to the much broader economic framework of which it is so important a part.

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[98] See R. H. Haveman, "The Dutch Social Employment Program," Institute for Research on Poverty Reprint Series, No. 319, 1979. See also R. H. Haveman and G. B. Christiansen, "Public Employment and Wage Subsidies in Western Europe and the U.S.: What We're Doing and What We Know," Institute for Research on Poverty, Discussion Paper No. 522–78, especially the overview chart in Appendix A, giving the highlights of eighteen different programs in the U.S. and six European countries.

[99] Keith Daly and Arthur Neff, "Productivity and Unit Labor Costs in Eleven Industrial Countries, 1977," Monthly Labor Review, November 1978, p. 13.

[100] See Eichner, loc. cit., p. 35, and German Federal Republic, Ministry for Labor and Social Affairs, "Teilarbeit, A Guide to Workers and Employers." Bonn, November 1978, p. 7.

[101] For a short summary of its features, see "West Germany Compiling a Social Balance Sheet" in European Industrial Relations Review, London, Mp/66. July 1979, pp. 7–8.

INTEGRATED PENSION PLANS: AN ANALYSIS OF EARNINGS REPLACEMENT

By Ray Schmitt* **

CONTENTS

APPENDIXES

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**A more detailed Congressional Research Service (CRS) paper which includes additional appendixes and earnings replacement tables and graphs for workers with 10, 20, and 30 years service is available from the Joint Economic Committee.

Introduction

Social security covers virtually the Nation's entire private work force. About half of these persons also are covered by private pension plans provided by their employers, which offer benefits that supplement the old-age, survivors, and disability insurance (OASDI) program of social security.

Private pension plans that relate their benefit formulas or contribution levels to social security benefits are said to be "integrated." Integrated pension plans must conform with Internal Revenue Service guidelines, which are aimed at insuring that the plan does not discriminate in favor of highly compensated employees, stockholders, or officers. However, since social security benefits are weighted in favor of lower-income workers the guidelines allow private pension plans to "counter-weight" or "tilt" their benefit or contribution formula up to a certain amount in favor of higher income workers. The nonintegrated pension plan is one that provides the same benefits (same formula, dollar sum, or percentage of earnings) for all employees independent of social security.

All private pension plans—whether or not they are integrated—are in a sense government-supported since they receive favorable tax treatment. For fiscal year 1980, the revenue loss associated with qualified plans is estimated to be about $13 billion.[1] Indeed, without such favorable tax treatment, pension plans would undoubtedly not exist in their present magnitude. The assets of private pension plans totaled about $331.5 billion on June 30, 1979, thus constituting a major source of investment capital.

Studies of the prevalence of pension plan integration provide divergent estimates of the number and type of pension plans that are integrated with social security as well as the number of participants affected. All of the studies point out, however, that integration affects a large number of plans and participants. About 60 percent of more than 400,000 active corporate-type pension, profit-sharing, and stock bonus plans are integrated, covering about 30 percent or more of all plan participants.[2]

Pension plans can be integrated on either an "excess" basis or an "offset" basis. An excess plan provides benefits only in regard to compensation above a certain level, called the plan's "integration" level. A *flat benefit excess* plan may provide a pension benefit to a worker with at least 15 years' service of 37½ percent of average compensation in

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[1] Compensation paid to an employee is generally deductible by the employer only if the employee will receive the income at approximately the same time. The only exception to this "matching" rule for compensation is for pension and profit-sharing plans that qualify under section 401 of the Internal Revenue Code. Contributions to such plans are tax deductible by the employer when made, while taxation to the employee is delayed until benefits are received. When a plan is qualified, the earnings on these invested funds are not taxed until distributed. This is the principal advantage to achieving qualified status. By allowing taxes on investment income to be deferred until included in benefits to the employee (who often is in a lower tax bracket by then), the government provides a significant tax benefit to qualified pension plans.

[2] See pension integration studies by A. S. Hansen, Inc., "Analysis of Private Pension Plans," April 25, 1978; National Associates, Inc., "Analysis of the Effect of Proposed Integration Rules on Small Pension and Profit Sharing Plans"; "Integration of Private Pension Plans With Social Security" by Raymond Schmitt, Joint Committee Print, Studies in Public Welfare, Paper No. 18, Issues in Financing Retirement Income, Joint Economic Committee, December 27, 1974; 1975 Study of Corporate Pension Plans by Bankers Trust Company, New York; and "Integration—Scope of the Problem" by Gabriel Rudney, Pensions and Investments, March 3, 1980.

excess of the plan's integration level, without providing a benefit in relation to compensation below it. For workers retiring in 1979, the maximum integration level is $8,724.[3] The 37½ percent figure is considered by the IRS to reflect the employer's share of all benefits provided under social security (including benefits available to employee's spouse, widow, or child; lump-sum death benefits; and disability benefits) expressed as a percentage of earnings covered by social security.

Another type of excess plan—a *unit benefit excess*—may provide a benefit of 1 percent of average compensation above the integration level for each year of service without providing a benefit in relation to compensation below it. On the other hand, an *offset* plan may reduce or offset the amount of the otherwise payable pension benefit by as much as 83⅓ percent of the social security benefit the individual receives. The 83⅓ percent figure is intended to reflect the employer's share of all benefits provided under social security expressed as a percentage of the primary social security benefit.[4]

The Integration Controversy

Pension plans can be integrated with social security in different ways and to different degrees. Pension plans which are "fully" or "maximally" integrated with social security are the subject of controversy. Under these plans it is permissible for employers to provide pensions which, when combined with social security, amount to almost the same percentage of preretirement pay to all of a company's workers. The result is that lower income individuals may receive little or no pension benefits.

The assumption that all retired workers of a firm should receive the same percent of preretirement pay may be questioned. On the one hand, low-income workers may need a higher percentage of their earnings replaced to maintain their standard of living. Low-income persons are also likely to have fewer sources of income, such as personal savings and investments, to supplement their social security benefits. On the other hand, measuring adequacy of benefits by a standard of "need" may be inappropriate for a pension plan and may rather be the concern of a public welfare program. Furthermore, if a plan is not fully integrated, long-service employees may receive more income in their retirement years from a combination of their pension and social security benefits than they received while they were working.

Congress recognized that certain questions of equity existed under the integration guidelines. However, Congress also recognized that

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[3] Both the social security payroll tax and benefits are based on wages up to the taxable wage base. Earnings above the taxable wage base are not taken into consideration for social security purposes. Under excess plans, earnings which are covered by social security may be ignored in the computation of pension benefits. Stated another way, for any given year, the maximum single integration level a flat benefit excess plan may use is the maximum average monthly wage (covered compensation) for workers retiring in that year. Since the taxable wage base is the same for everyone no matter what their actual salary is, the average taxable wage base, called "covered compensation," will also be the same for all workers who worked during the same years. Thus, the $8,724 amount is essentially the average of the maximum taxable wage bases for individuals age 65 retiring in 1979. Since all the individuals in the analysis were assumed to retire in 1979, the maximum integration level would be the same. However, if individuals participating in the pension plan were assumed to retire in different years, the maxmum integration level would be different.

[4] For a further discussion of the derivation of the maximum integration percentages, see appendix IV of the paper "Integration of Private Pension Plans With Social Security" cited in footnote 2.

changes in the integration guidelines could cause a substantial increase in the cost of financing private plans and could result in the termination of many fully or partly integrated plans. These matters were considered during its deliberation on the Employee Retirement Income Security Act of 1974 (ERISA). However, the House Ways and Means Committee and the ERISA Conference Committee both subsequently voted a "freeze" on further integration as a temporary measure prior to full consideration of the integration question.[5] Employers stressed their fears that the freeze could result in increased plan costs, because the plans could not increase their level of integration by taking into account changes in the social security wage base, or in social security benefit levels after 1971. Because of last minute concerns by employers and pension practitioners, the freeze was deleted by a concurrent resolution of the Congress.

Scope of Analysis

This paper analyzes what can happen under certain "fully" or "maximally" integrated plans for 25 hypothetical workers. These plans either provide the maximum benefits permissible under IRS integration guidelines to higher earners without providing benefits to lower wage earners (so-called "pure excess" plans), or reduce the pension benefit otherwise payable by the maximum social security offset (83⅓ percent). A less integrated but commonly used formula (i.e., a 50 percent offset plan) was included for comparison purposes.

While the model from which the data in this paper have been developed has the capability to examine earnings replacement rates under a broad variety of integrated or nonintegrated benefit formulas, only four integrated benefit formulas were used. This was done not only to determine what indeed may happen under present integration policy, but also to keep the number of variations within a modest range. It should be noted that less integrated benefit formulas which *are more usual* would produce higher earnings replacement rates—particularly for the lower wage earners. Similary, other combinations of integrated benefit formulas (such as the commonly used step rate plan[5a]) would yield higher earnings replacement rates in all cases. Furthermore, some "pure excess" plans may cover just one or more high salaried individuals so that each person may receive a pension even though the plan is fully integrated. In still other cases, a minimum benefit may be provided to all participants or the employee's benefit may be calculated under two formulas—one that is integrated and one that is non-integrated—with the retiree receiving whichever benefit is greater.

The purpose of this analysis therefore is not to attempt to simulate what happens in actual practice but to demonstrate what may happen under present integration guidelines, given the wage histories and assumptions used in this paper. While this approach is somewhat limited, it nevertheless provides a framework for analyzing present integration policy. If policymakers find the results of this analysis of

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[5] See Conference Report to accompany H.R. 2, Senate Report No. 93–1090/House Report No. 93–1280, pp. 280–281; and House Committee on Ways and Means Report on H.R. 12855. House Report No. 93–807, p. 29.

[5a] Under a step-rate excess plan all earnings are taken into account in applying the plan formula; however, the formula will contain two percentages—a lower percentage for earnings up to the plan's integration level and a higher percentage for earnings in excess of this amount. Essentially, one part of the benefit formula is integrated whereas the other part is not.

fully integrated formulas acceptable, then less integrated formulas under the current guidelines should prove, at the least, equally acceptable. Also, information on salary levels and job tenure for representative plans and representative workers under those plans is generally not available.

The analysis has been primarily limited to hypothetical workers retiring in 1979 under the "old" social security benefit formula to determine the potential effects of integration on people currently retiring (see appendix B). A more limited analysis was made of workers retiring in 1987 taking into account the "new" social security benefit formula enacted with the 1977 social security amendments (see appendix C).

Methodology—the Retirement Security Model

In order to test the effects of current pension plan integration rules on earnings [6] replacement rates, a retirement security microsimulation model was developed. The model has the capacity to calculate gross (before tax) and net (after tax) earnings replacement rates under a variety of pension plans which may or may not be integrated with social security, as well as under different economic assumptions for wage growth and rate of inflation. The following four benefit formulas have been used in computing earnings replacement rates before and after tax for 25 single and married wage and salary earners with final year's earnings ranging from $4,000 to $100,000 retiring on January 1, 1979, at age 65 with 10, 20, and 30 years of service. The nonworking spouse was assumed to be the same age as the working spouse.[6a]

A. Pension Formulas

(1) 1.5 percent of compensation times years of service less 50 percent social security (offset).

(2) 1.5 percent of compensation times years of service less 83⅓ percent social security (offset).

(3) 1 percent of compensation in excess of integration level ($8,724) times years of service (unit benefit excess).

(4) 37½ percent of compensation in excess of integration level ($8,724) (flat benefit excess).

Although the first formula listed above is just a "less integrated" version of the second formula, it was included since it is the offset rate most commonly used. Furthermore, in practice most plans reduce the maximum offset by prorating it for periods of service of less than 25 or 30 years. A 50 percent offset frequently is used because employees

[6] The more precise term "earnings" replacement rate is used interchangeably with "income" replacement rate throughout this paper.

[6a] The Bureau of Labor Statistics estimates that 40 percent of women have had some work experience by retirement age. Many women will therefore be entitled to a social security benefit on their own account.

pay half the cost of social security and therefore would consider it unfair if the company offset an individual's pension benefit by more than half his social security benefit. In actual practice, moreover, fully integrated plans cannot offset the plan benefit by the full 83⅓ percent if integrated ancillary benefits such as disability or pre- or post-retirement death benefits are provided, or if normal retirement age is earlier than age 65. Similar adjustments also would have to be made to the permitted integration differentials in the other types of integrated plans (unit benefit excess and flat benefit excess). The assumptions used in developing the wage histories and in computing after tax earnings replacement are discussed in appendix A.

Summary Analysis

The amount of final year's earnings replaced by each of the four pension formulas together with social security is shown in the following two summary graphs for single and married workers retiring with 30 years service. The bottom line (line E) in both graphs is the amount of final earnings that are replaced by social security. Summary graph 1 illustrates the weighted benefit provided by social security. Summary graph 2 shows the effect of the 50 percent spousal benefit provided to married individuals. In both cases (single and married), as earnings increase, the earnings replacement from social security decreases. The other curves are built on top of social security and show the combined earnings replacement rates attained under the four integrated formulas analyzed. Note that the 50 percent offset plan does provide benefits to all workers with 30 years service whereas the three fully integrated plans do not. Of course the 50 percent offset is not a fully integrated plan. The "hump" which can be seen in the earnings replacement curves under the two excess plan formulas (lines C and D) is discussed further in the section on comparison of excess formulas and in detail in appendix B.

In viewing the following summary graphs, it is important to keep in mind that most individuals in the private sector would have final earnings considerably less than $100,000. Since integrated plans base pension benefits on some average of final years' earnings (at least final 5 years'), a distribution of wages and salaries of individuals approaching retirement gives an insight into the potential impact of pension plan integration. The median wage of women aged 60 and 61 working full-time in private industry in 1978 was $8,003 compared to $15,228 for men. Ninety-eight percent of the women had earnings under $20,000 compared with 74.4 percent of the men; in fact, 83.7 percent of the women had earnings under $12,500. Assuming that workers approaching retirement are participating in integrated plans at the same sex and income distribution as shown in the following table, women more than men would be adversely affected by fully integrated plans because their earnings on the average are about half as much as men's.

TABLE 1.—DISTRIBUTION OF PERSONS 60 AND 61 YEARS OF AGE WORKING FULL TIME WITH WAGES AND SALARIES IN 1978 FROM A PRIVATE COMPANY AND NO PENSION INCOME, BY SEX

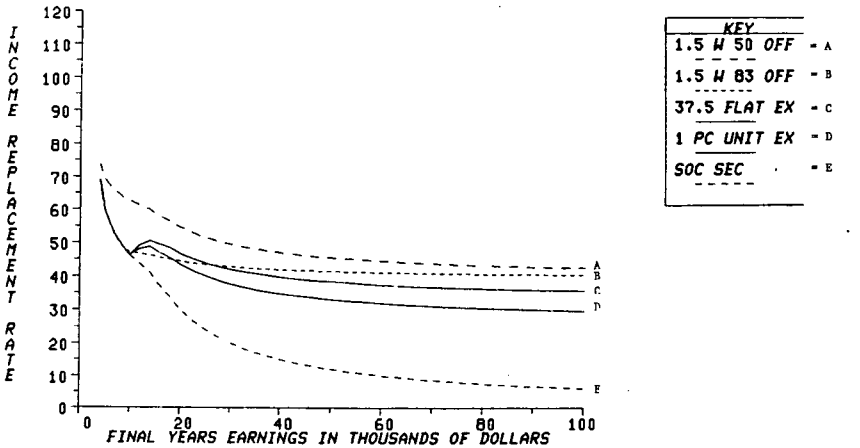
[In thousands]

	Total	Male	Female
Total	1,259	817	443
Less than $2,500	69	30	39
$2,500 to $4,999	81	38	44
$5,000 to $7,499	169	57	112
$7,500 to $9,999	165	67	99
$10,000 to $12,499	180	103	77
$12,500 to $14,999	136	99	37
$15,000 to $19,999	241	213	28
$20,000 to $24,999	110	107	4
$25,000 to $29,999	39	36	3
$30,000 to $39,999	39	39	0
$40,000 to $49,999	16	16	0
$50,000 and over	14	14	0
Median wage	$11,903	$15,228	$8,003
Standard error	449	408	343
Mean wage	13,463	16,190	8,436
Standard error	417	561	335

Source: Unpublished data, Current Population Survey, Department of Commerce, Bureau of the Census.

Following is summary graph 1 which shows a comparison of *gross* replacement rates under the four formulas analyzed for single workers aged 65 retiring after 30 years in 1979.

COMPARISON OF GROSS REPLACEMENT RATES UNDER INTEGRATED PLANS
SINGLE WORKERS AGED 65 RETIRING AFTER 30 YEARS IN 1979

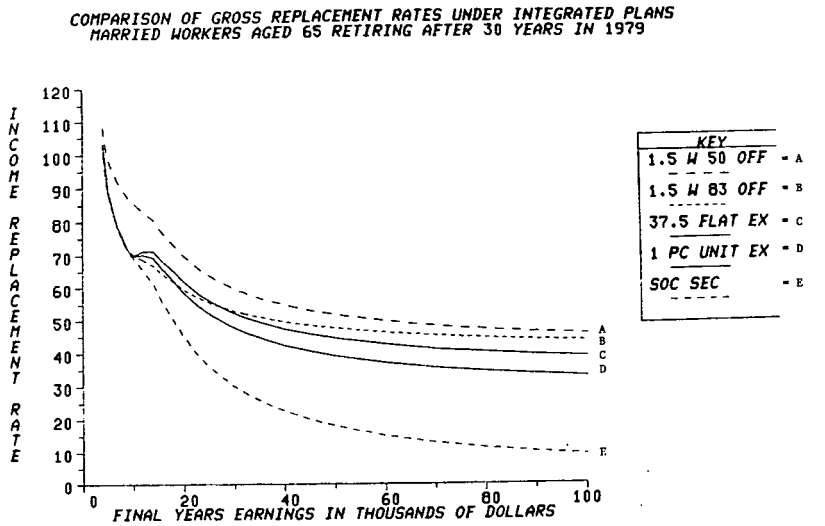


SUMMARY GRAPH 1

A. Effects of Social Security Spousal Benefit

The inclusion of the social security spousal benefit increases the social security earnings replacement rate for married couples by 50 percent as shown in summary graph 2. The value of the spousal benefit is much greater to lower-income individuals, causing a dramatic in-

crease in the combined earnings replacement rates attained under all four plan formulas analyzed. Benefits provided under a pension plan are computed independent of marital status.



SUMMARY GRAPH 2

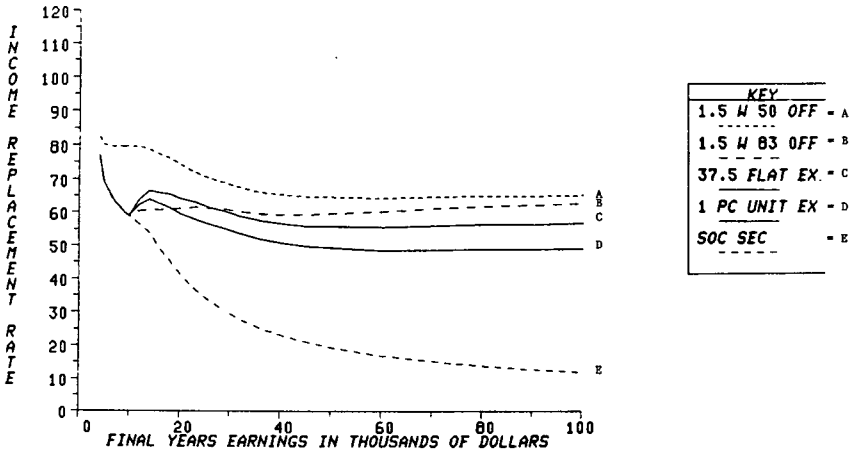
The inclusion of the social security spousal benefit also causes steeper slopes in the earnings replacement curves—particularly under offset plans. This is because the social security benefit, which is already weighted toward the lower-paid, is increased by 50 percent while the offset against the pension is limited to the worker's primary insurance amount (PIA).

B. Net Earnings Replacement Analysis

Earnings replacement rate analysis compares the retirement income of individuals with their most recent earnings. Traditionally, this analysis has been made for *gross* earnings replacement rates by examining retirement income before taxes are taken out and comparing it to the preretirement earnings also before taxes. Since taxes reduce income, a more accurate measure of earnings replacement may be achieved by subtracting taxes from pre- and post-retirement earnings; this is referred to as the *net* earnings replacement in this analysis.

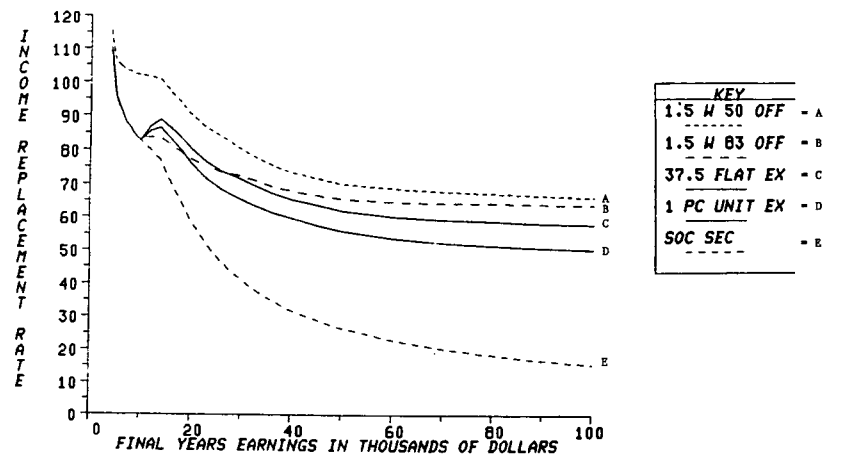
When earnings replacement rates are examined on a net basis, the replacement rates are significantly higher than gross earnings replacement rates as shown in summary graphs 3 and 4. (Assumptions used in computing net earnings replacement are discussed in appendix A.) The net earnings replacement rate actually fluctuates slightly up and down for the 83⅓ percent offset plan. (See table 2 in appendix B). It also should be noted that married individuals with 30 years service and earnings up to $14,000 have more than 100 percent of their net earnings replaced by social security and a 50 percent offset plan.

COMPARISON OF NET REPLACEMENT RATES UNDER INTEGRATED PLANS
SINGLE WORKERS AGED 65 RETIRING AFTER 30 YEARS IN 1979



SUMMARY GRAPH 3

COMPARISON OF NET REPLACEMENT RATES UNDER INTEGRATED PLANS
MARRIED WORKERS AGED 65 RETIRING AFTER 30 YEARS IN 1979



SUMMARY GRAPH 4

C. Comparison of Offset Formulas

Summary Graph 1 shows that the 50 percent offset formula provides rather uniform earnings replacement for the $50,000–$100,000 earners while providing a significant boost in earnings replacement for those individuals with final year's earnings under $20,000. On the other hand, the 83⅓ percent offset formula does not provide significant earnings replacement to the lower income earners and causes a general flatten-

ing of the earnings replacement curve for all earners. Yet, the higher earners do not experience an appreciable reduction in earnings replacement. For example, individuals with final earnings of $50,000 would experience a reduction in earnings replacement of only 4 percent when changing from a 50 percent offset to an 83⅓ percent offset, whereas individuals with $16,000 final earnings experience a reduction in earnings replacement of 12 percent—three times as much.

D. Comparison of Excess Formulas

While there is a greater slope in the earnings replacement curves under excess plans, particularly for workers with final earnings between about $18,000 and $40,000, there is also a great disparity in earnings replacement between the two plans—the 37½ percent flat benefit excess plan and the 1-percent unit benefit excess plan. Summary graphs 1 and 2 show that fully integrated excess plans compared with fully integrated offset plans redistribute retirement income away from the higher income to the lower and middle income ($10,000–$16,000) earners. This can be seen in the "hump" which develops in the earnings replacement curves. The increase in the earnings replacement rate is due to the fact that once pension benefits are triggered (when final 5 years' average compensation exceeds the integration level), the relative increase in the replacement rate as a result of the pension alone is greater than the relative decrease in the social security replacement rate. The "hump" continues until the maximum social security benefit of $503 is reached for the $18,000 and above single wage earners. If a lower integration level were used by the plan, the "hump" would start earlier and have a different shape. (For a more detailed analysis of the "hump" see appendix B.)

If the distribution of workers under the excess plan used in this analysis were similar to the general distribution in table 1, the rise in the "hump" would affect a substantial number of workers covered by excess plans. Viewed another way, if the integration formula replaced earnings in the "dip" or "valley" between about $6,000 and $15,000, so that gross earnings replacement rates continually decreased as final year's earnings increased, a substantial number of individuals could have increased gross earnings replacement rates. For instance, about 38 percent of the individuals between 60 and 61 years of age had earnings in 1978 between $7,500 and $14,999.

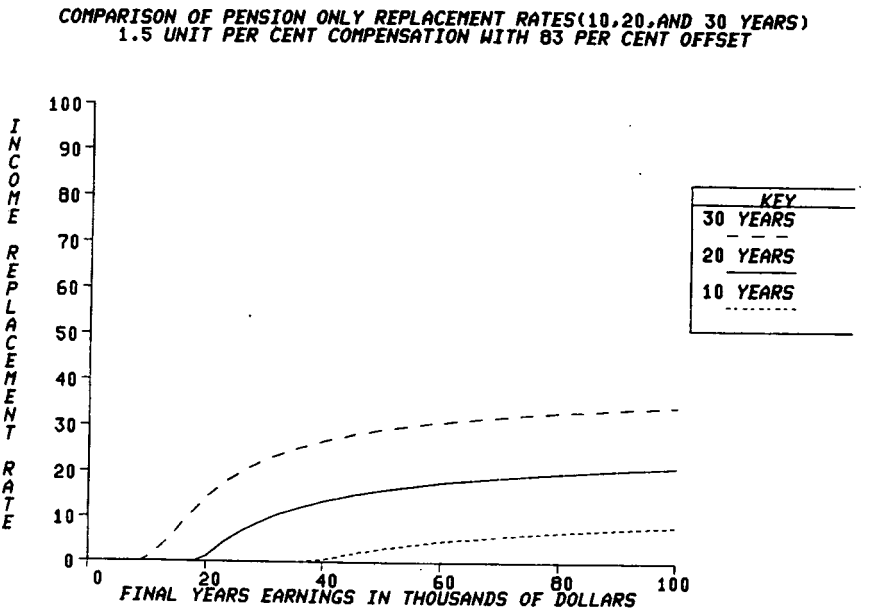
Excess plans provide different income distributions than offset plans. In an *excess* plan, when workers' earnings exceed $8,724 (the maximum permissible integration level under IRS regulations for *all* workers retiring in 1979), increases in their pension benefits go fully to the worker along with social security. Under the *offset* plan, however, increases in the pension benefit are reduced by up to 83⅓ percent of the social security PIA. When the social security benefit stops increasing, the earnings replacement curve seen for the offset plans flattens out.

E. Effects of Offset on Short-Service Workers

It has been reported that small pension plans are more likely to be of the "pure excess" type, in which employees with incomes above the plan's integration level receive benefits while those with incomes below

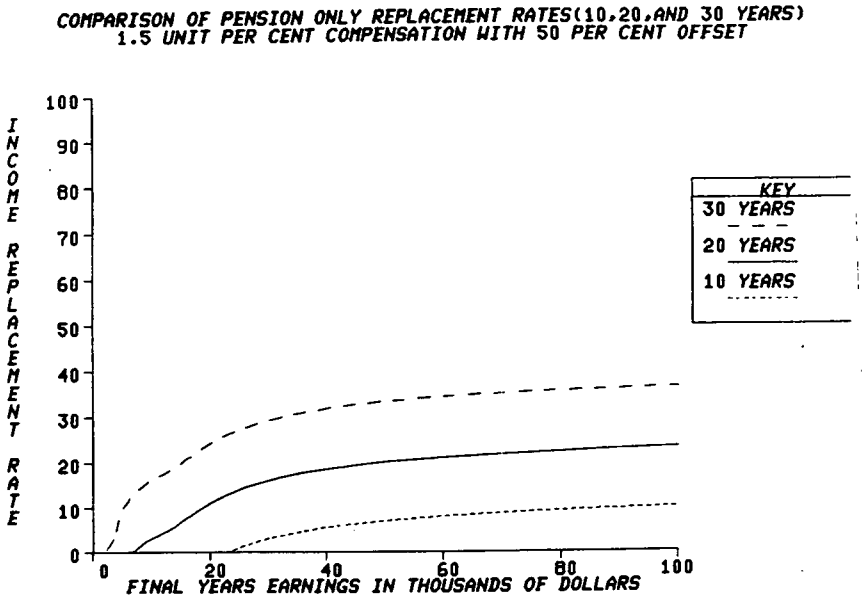
it receive nothing. It should be noted that "offset" plans can have the same effect of eliminating any private pension paid to certain workers—particularly lower paid and short-service employees.

IRS integration guidelines do not require a pro rata reduction in the full amount of the social security offset for shorter periods of service, unless the employee terminates employment prior to age 65 in which case a reduction may be required. This failure to pro rate does not affect earners with incomes below $10,000 because no matter how long they work, the 83⅓ percent offset effectively denies them any pension. However, it does affect higher earners with short periods of coverage under the pension plan and hence, lower benefit accruals. For instance, a worker retiring at age 65 with 10 years of service under a fully integrated offset plan would have to have final year's earnings of about $40,000 in order to receive a pension and then it would amount to only $18 per month. After 20 years' service only workers with about $20,000 or more of final year's earnings would receive a pension as shown in summary graph 5.



SUMMARY GRAPH 5

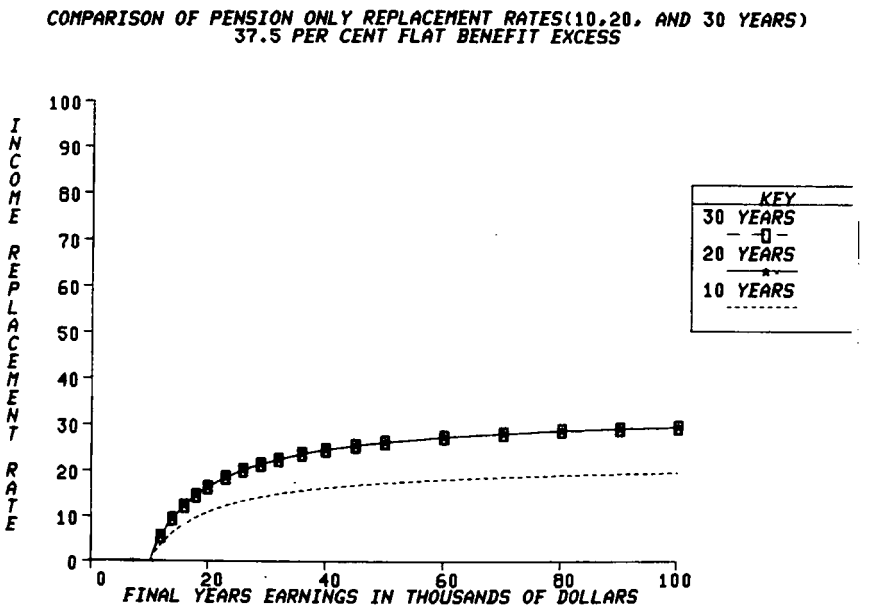
Integration under offset plans is therefore not just an issue that concerns low-wage earners; short-term workers are affected as well. As long as social security is a significant portion of a worker's retirement income, a smaller offset will significantly increase pension benefits. If a 50 percent offset were applied, as is the usual case, instead of the 83⅓ percent offset, the low- and moderate-wage earners would fare better. Summary graph 6 shows that low-income workers receive substantially more with the 50 percent offset as contrasted with the 83⅓ percent offset shown in summary graph 5.



SUMMARY GRAPH 6

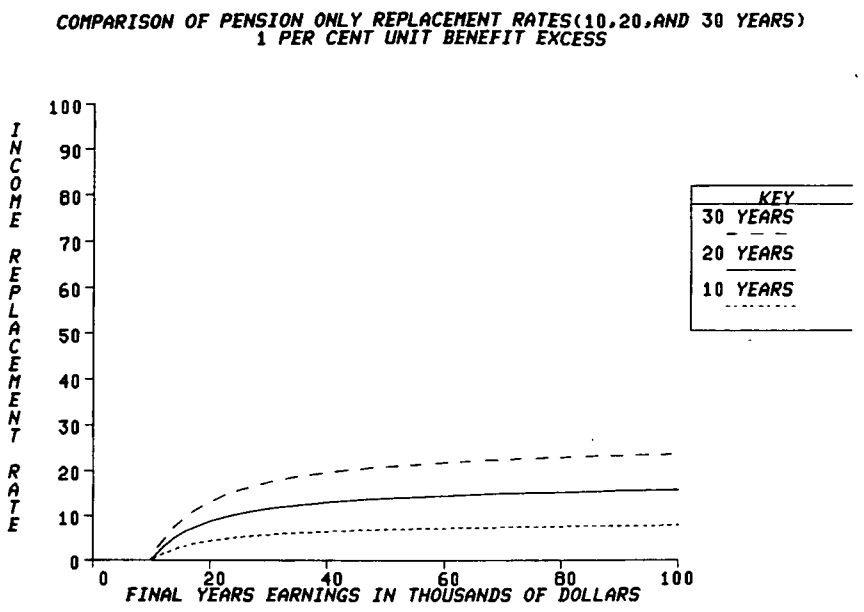
F. Comparison of Flat Benefit Excess and Unit Benefit Excess Formulas

Flat benefit excess plans may produce different earnings replacement than unit benefit excess plans. IRS integration guidelines permit a flat benefit of 37½ percent of final 5 years' average compensation in excess of the integration level for employees retiring at 65 with as little as 15 years' service. While the graphs and tables show benefits for 10, 20, and 30 years of service, employees with 15 years' service under a flat benefit excess plan can receive the same pension as individuals with 20 or 30 years' service if they had identical salary patterns for their final 5 years. (Note that the earnings replacement curve in summary graph 7 is the same for the 20-year worker as it is for the 30-year worker.)



SUMMARY GRAPH 7

A pro rata reduction in the 37½ percent flat benefit excess formula is required for employees with less than 15 years' service at age 65. Yet if the employer had adopted a unit benefit excess plan it would only be able to provide a benefit, after 15 years' service, of 15 percent of compensation above the integration level. In essence then, to comply with applicable integration rules, a flat benefit excess plan may provide a benefit of 2.5 percent of compensation in excess of the plan's integration level for each year of service up to 37.5 percent. Unit benefit excess plans, however, can not provide a benefit of more than 1 percent of compensation above the integration level. Thus, a worker would have to work over 37 years under a unit benefit plan to get the same pension as a 15-year worker under a flat benefit excess plan. Stated another way, a 15-year worker could receive 2½ times as much under a flat benefit excess plan as under a unit benefit excess plan (37½ divided by 15). A comparison of the earnings replacement rate for different periods of service from the pension alone under a unit benefit excess plan is shown in summary graph 8.



SUMMARY GRAPH 8

G. Effects of 1977 Social Security Amendments on Earnings Replacement Rates

Major changes in social security legislation enacted in 1977 raised the taxable wage base and the payroll tax rate. The amendments also revamped the OASDI benefit formula to lessen overcompensation for inflation caused by the method of computing initial benefit amounts upon retirement. These "decoupling provisions" were aimed at maintaining the ratio of social security benefits to prior earnings at roughly constant levels through time regardless of inflation. Under the previous law, many future beneficiaries would have received annual benefits higher than their final year's wages.

The new benefit formula enacted with the 1977 amendments was designed to reduce the replacement rate of the average wage earner to an ultimate level of 42 percent representing about a 6 percent reduction in the average replacement rate received by 1979 retirees. While future retirees may have lower replacement rates than this current cohort of retirees, it is important to emphasize that this change simply restored the typical ratio of benefits to earnings which existed in the mid-1970's. Thus, 1979 is an abnormally high year to use as a benchmark for comparing replacement rates under the old and new social security benefit formulas. The lower replacement rates affect offset plans whereas the increase in the taxable wage base affects excess plans.

1. OFFSET PLANS

While the 1987 retirees will have lower social security earnings replacement rates, they will have slightly higher earnings replacement from pension plans since their pension benefits are offset by a lower

social security dollar amount. The net effect is only a slight decrease in combined social security-pension plan gross replacement rate. For instance, under the 83⅓ percent offset formula, a 1979 retiree with 30 years' service and final earnings of $16,000 would have a combined gross replacement rate of 45.6 percent compared to a 44.3 percent replacement rate for a comparable worker in 1987—a reduction of only 1.3 percent.

2. EXCESS PLANS

Under both excess plans, the "hump" in the earnings replacement curves for 1987 retirees starts earlier, and is slightly broader and higher. More retirees would therefore be covered by the hump and would also receive slightly higher replacement rates. This occurs because the excess plans' maximum permissible integration level (a career average) does not rise nearly as fast as either wages (average of last five years) or the taxable wage base. Thus, the 1987 integration level is lower relative to the integration level for 1979 employees.

The effects of the 1977 amendments on both offset and excess plans are discussed in further detail in appendix C.

Major Findings

The major findings of this paper raise important policy questions in two areas: levels of earnings replacement and current integration guidelines and practices.

(1) The three fully integrated pension plan formulas provide significantly different earnings replacement curves due to inconsistencies in the integration guidelines.

(2) When the formulas are examined on a net earnings replacement basis or with the inclusion of the social security spousal benefit, there are significant increases in the earnings replacement curves. Furthermore, net earnings replacement rates for single individuals begin to increase at higher income levels.

(3) None of the fully integrated plans analyzed provide pensions to hypothetical workers with as much as 30 years' service and final year's earnings under $10,000. (The 50 percent offset plan does provide benefits to all workers with 30 years' service, but it is not a fully integrated plan.)

(4) Participants in fully integrated pension plans may not receive a benefit even though they meet the plan's vesting requirements (usually 10 years' service is required). Women workers would be particularly affected since their wages and salaries on the average are much lower than men's and since their job tenure is relatively shorter.

(5) The 83⅓ percent offset formula produces relatively low earnings replacement ratios for low- and middle-income workers as well as for short-service workers.

(6) The excess plan formulas cause a "hump" to develop in the earnings replacement curves. Under the flat benefit excess formula, workers with $12,000 to $20,000 of final year's earnings have greater gross earnings replacement rates than workers with $10,000 final earnings. When net earnings are considered, the formula results in still higher replacement rates for workers with up to $29,000 final earnings than for workers with $9,000–$10,000 final earnings. This "hump" exists in unit benefit excess plans as well.

(7) There is no required pro rata reduction in the maximum social security offset applied against the pension benefit for workers retiring with shorter periods of service. Thus, a worker retiring at age 65 with 10 years' service can have the same 83⅓ percent social security offset applied against his or her smaller pension as another worker with 30 years' service but with a pension three times as large.

(8) For employees with less than 15 years' service, a flat benefit excess plan permits benefit accruals of 2.5 percent per year of service compared to 1 percent under a unit benefit excess plan—2½ times as much.

(9) The 1977 Social Security Amendments do not have a significant effect on the combined social security-pension plan earnings replacement rates for 1987 retirees under the integrated plans examined.

Policy Implications and Conclusions

Consideration of pension plan integration within the context of present integration guidelines focuses attention on the role that private pension plans should play in relation to social security. This question centers on: (1) the levels of earnings replacement which should be sought from the combination of pensions and social security; and (2) whether integration guidelines can achieve these levels.

Differing views exist on the amount of preretirement earnings that should be replaced through a retirement system. If we assume that only earnings necessary for basic preretirement goods and services should be replaced, it would follow that earnings replacement ratios would decrease as preretirement income increased. Since, under social security, earnings replacement declines as preretirement earnings increase, it could be argued that integration guidelines should be similarly structured. However, if the policy objective is to provide replacement rates which support a preretirement standard of living, replacement rates would be approximately the same for all wage earners.

In constructing the present integration guidelines, employers were credited with half the cost of providing social security benefits since employers and employees pay equal payroll taxes. Yet many economists believe that workers and consumers as a group bear the ultimate cost of social security (and even the cost of private pensions, for that matter). Moreover, the employer is allowed to deduct his FICA (Federal Insurance Contributions Act) contributions as a business expense whereas the employee is not.

Consideration could be given instead to constructing integration rules from a benefit-oriented point of view. In other words, an earnings replacement curve could be constructed with the tax-qualified plan permitted to replace the difference between the social security curve and any specified replacement curve. For instance, the integration guidelines could be based upon some congressionally approved earnings replacement objectives, that (*a*) would assume a Federal responsibility to provide a certain standard of earnings replacement at various income levels through a public system, and (*b*) would offer tax incentives for the private pension system to supplement the public system up to certain maximum levels. The policy objective may be for low-wage earners to receive earnings replacement approaching 80–90 percent of preretirement earnings with the rate gradually de-

creasing as earnings increase. Higher income individuals who wish to make up the difference between their preretirement income and the congressionally defined standard of combined public and private earnings replacement could do so through voluntary saving.

The possible advantages of developing integration guidelines on a net earnings approach should be explored. This would take into account the difference in tax liability before and after retirement.

The private pension system has been criticized because it does not cover a sufficiently large number of individuals. This criticism is sharpened by the realization that "coverage" is no assurance that all workers in integrated plans will receive pension benefits even though they are vested. It has already been shown that fully integrated benefit formulas can result in no pensions for lower wage earners and shorter service workers.

As part of the administration's 1978 tax program, the Treasury Department proposed changes in the integration rules to prohibit "pure excess" plans under which low wage earners may receive no pension benefits because of integration. Considerable opposition to these proposals came from pension plan consultants, actuaries, and sponsors of integrated plans—particularly small employers who faced increased pension and administrative costs as a result. In the end no changes were made. However, the administration's proposal and the difficulty that some pension actuaries and consultants find with "pure excess" plans have stimulated private sector initiatives to develop alternative ways of integrating.

Hourly wage employees, especially those covered by a collective bargaining agreement, usually participate in nonintegrated plans where the wage spread for the workers may be small. On the other hand, pension plans for salaried employees are frequently integrated and the salary spread for individuals covered by these plans can be significant. In such cases, without some form of integration, it might be too costly for an employer to provide an adequate pension for all employees. For instance, if an employer wanted to provide a pension of 50 percent of final pay to a relatively few high salaried employees under a nonintegrated plan, he would have to provide a pension of 50 percent of pay to a relatively large number of lower salaried employees who may already have half their final earnings replaced by social security.

No employer is required to provide a pension. Pensions are both voluntary and an important part of this country's system of capital formation. Thus, any action to "tighten" integration guidelines which would impose additional cost burdens on private employers has to be balanced against the possibility that some employers might terminate their pension plans. For instance, if the integration guidelines were modified so that a "hump" would not develop in the earnings replacement curves for excess plans, the most likely result would be additional complexities to already complicated IRS guidelines. While there is little information in this area, it appears that the "hump" in excess plan curves may cover a large percentage of the working population. Elimination of the "hump" would take either (1) a very high integration level that would result in no benefits to low- and middle-income workers, or (2) a very complex integration formula.

While the 1977 Social Security Amendments did not have a signifi-

cant effect on combined social security-pension plan earnings replacement rates for 1987 retirees within the limited scope of our analysis, the increases in both the social security tax rate and the tax base could have an effect on pension plan formation and benefit improvements. Any increased employer costs attributable to these and any other changes in social security may provide incentives to some employers with nonintegrated plans to integrate their pensions with social security benefits as one way of holding total retirement costs in line.

In addition, serious consideration is now being given to the controversial subject of mandatory social security coverage of all Federal, State, and local government employees. The March 1980 report of the Universal Social Security Coverage Study Group found such an expansion to be feasible. If this were to occur, staff retirement plans would be likely to coordinate their benefits using the integration concepts. For this and other reasons, the integration issue promises to become broader and even more important in the future.

Appendix A. Retirement Security Model and Methodology

In order to test the effects of pension plan integration on earnings replacement rates a retirement security microsimulation model was developed. The model has the capacity to calculate earnings replacement rates under a broad variety of pension plans which may or may not be integrated with social security. Specifically, the model can test the effects that the present Internal Revenue Service guidelines, or any possible future changes in the guidelines, may have on earnings replacement rates for wage earners under various assumptions regarding earnings, work histories, type of plan, and rate of inflation. The calculations may be done for both single and married wage earners before and after taxes in the first year of retirement and at a later time (such as 5 years after retirement). This permits the effects of income taxes and inflation to be factored in on "real" replacement rates since social security benefits *are not* taxed and also are *automatically* indexed to the CPI while employer-financed pension benefits *are taxed* and are usually *not automatically* indexed to increases in the cost-of-living.

Much of the debate prior to enactment of the Social Security Amendments of 1977 centered on the pattern in replacement rates over time under the alternative "decoupling" proposals and the associated implications for longrun program costs. Replacement rates under the "old law" benefit structure were projected to increase rapidly over time, whereas the benefit structure enacted by the 1977 amendments was described as leading to stable replacement rates over time.

The model can calculate social security benefits under the various computation formulas used in the program. Specifically, it can calculate the retirement income received by (1) those workers who became age 62 prior to 1979 (i.e., whose benefits are calculated under the old benefit formula), (2) those workers who become age 62 after 1983 (i.e., whose benefits are calculated under the new benefit formula that was established by the 1977 amendments to the Social Security Act), and (3) those workers who become age 62 after 1978 and before 1984 (i.e., whose benefits are calculated under the old benefit formula or under the new benefit formula, whichever is higher). The model also can calculate disability and survivor benefit amounts under the old benefit formula as well as under the new formula.

Earnings replacement rates can be computed on a "gross" or a "net" basis. Gross replacement rates look at how much the retiree gets, *before* taxes, as a fraction of his preretirement income, also *before* taxes:

$$\frac{\text{Social Security} + \text{Pension}}{\text{Gross} = \text{Final Year's Earnings}}$$

Net replacement rates look at how much the retiree gets, *after* taxes, as a fraction of his preretirement income, also *after* taxes:

$$\frac{\text{Social Security} + \text{Pension} - \text{Taxes}}{\text{Net} = \text{Final Year's Earnings} - \text{Taxes}}$$

Federal, State, and local personal income taxes were taken into consideration as well as the employee's share of the FICA payroll tax.

Assumptions Used to Compute Wage Histories

Wage histories were constructed for 25 hypothetical workers with final year's earnings ranging from $4,000 to $100,000. For purposes of this paper the earnings in the year prior to retirement are considered to be the highest of any year with the wage growth rate to the year of retirement determined by the average rate increase in earnings covered by social security—the so-called "FQ array" (first quarter average wages).

Determination of Comparable Workers for the 1987 Analysis

The 1987 analysis was conducted on workers whose wage structures were equivalent to the 1979 workers—that is, workers whose relative positions in the economy remain the same. This was done by indexing the 1978 earnings to the average growth in wages (taken, along with the inflation rate assumptions, from the 1981 fiscal year budget) from 1979 to 1986. As a result, if case 1 were the lowest wage earner in 1979 (earning $4,000), case 1 would be the lowest wage earner in 1987 (earning $7,816).

It should be noted that, because the assumed inflation rates over this 8-year period were lower than the assumed wage growth rates (188 percent compared to 195 percent), case 1 would have earnings in 1987 of $4,157 in 1979 dollars, higher than the $4,000 earnings of case 1 in 1979. This means that the 1987 workers, while being comparably situated in relation to their fellow workers, will have slightly more purchasing power than the comparable 1979 workers.

Thus, for individuals retiring in 1987, the first 8 years of the wage histories for workers retiring in 1979 were dropped and earnings from 1979 to 1986 were projected based upon the administration's fiscal year 1981 budget forecast as follows:

Increase in average covered wages (percent)

Year:		Year:	
1979	8.3	1983	9.6
1980	9.1	1984	9.1
1981	8.9	1985	7.9
1982	10.1	1986	6.9

Federal Income Tax Assumptions

Private pension benefits are subject to Federal, State, and local government personal income taxes whereas social security benefits are not. Therefore, the computation of the net earnings replacement rate (NERR) takes these taxes into account. In addition, an individual's wages and salaries are subject to Federal, State, and local government personal income taxes as well as employee payroll deductions for FICA up to the maximum taxable wage base (6.05 percent of covered compensation up to $17,700 for someone working during 1978). These taxes were also taken into consideration in determining after tax income in the final year of employment. Thus, the net earnings replacement rate (NERR) equals:

$$NERR = \frac{NRE}{NFYE}$$

where net final year's earnings (NFYE) equals gross earnings (GE) minus personal income taxes and FICA payroll deductions, and net retirement earnings (NRE) equals social security and private pension benefits minus applicable personal income taxes.

Following are the tax assumptions used in calculating Federal income tax liability:

(1) Federal income tax is based on the Revenue Act of 1978 and uses the tax rate schedule for 1979.

(2) Married taxpayers file jointly and are always the same age as their spouse.

(3) No exemptions are allowed for blindness.
(4) Income in final year is entirely made up of wages and salaries.
(5) Retirement income is comprised solely of social security and any private pension benefits.
(6) Tax credit is computed for schedules "R" and "RP."

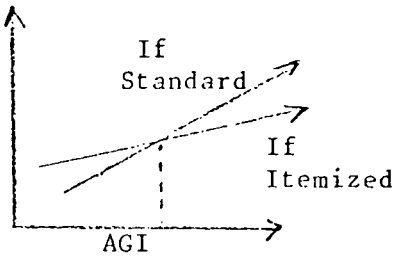
When adjusted gross income (AGI) exceeds $11,499 for single taxpayers and $17,499 for married taxpayers, taxable income (TXINC) is computed using a generalized formula for itemizing rather than using the standard deduction.

The generalized formula for itemizing is:

TXINC=AGI−(Exempt amount + (20 percent × AGI)−zero bracket amount)

The 20 percent rate was derived by calculating the average itemized deductions per return with itemized deductions for taxpayers age 65 or over as contained in the Internal Revenue Service Publication 79(5–78), Statistics of Income 1975, Individual Income Tax Returns, and dividing that figure by the midpoint of the income range. This percentage ranged from 17 percent to 23 percent, so 20 percent was used as an approximation. Obviously, these are not ideal methods. Yet they probably convey a more realistic impact of the tax system than assuming that everyone takes the standard deduction.

The $11,500 breakpoint for single individuals and the $17,000 breakpoint for married individuals was determined by equating the formula used for finding the amount of taxable income taking the standard deduction with that taking the itemized deduction. This equating of formulas determines the point of AGI at which the standard deduction will have the same effect on taxable income as will itemized deductions. Below this point of AGI, the standard deduction will be more advantageous to the taxpayer; above it, the itemized deduction will be better as shown below:



Single taxpayer: AGI−(1,000+(.2×AGI)−2,300)=AGI−1,000
.2×AGI=2,300
AGI=2,300÷.2=$11,500

Married taxpayer: AGI−(2,000+(.2×AGI)−3,400)=AGI−2,000
.2×AGI=3,400
AGI=3,400÷.2=$17,000

State and Local Government Income Tax Assumptions

There is great disparity in the tax structure of State and local governments. For purposes of computing net earnings replacement rates a general assumption was made that State-local personal income tax liability was 21.5 percent of the Federal personal income tax liability for single taxpayers, and 22.6 percent for married taxpayers. These rates were derived from an analysis of the relationship of State individual income taxes on specified wages and salaries during calendar year 1975 contrasted to Federal income taxes prepared in 1976 by Lillian Rymarowicz of the Economics Division of the Congressional Research Service (CRS). This analysis showed that average State taxes as a percentage of Federal income tax was 21.5 percent for single taxpayers and 22.6 percent for married taxpayers. This analysis, however, did not include individual income taxes levied by local governments or tax credits for such payments against State income tax liability. Therefore, the ratio would be understated. However, States are beginning to index their individual income tax rates for inflation. This has

the effect of lowering tax rates for higher income individuals. This contrasts with recent Federal provisions cutting taxes. The net effect would be to lower the ratio between Federal and State-local personal income taxes.[7]

Appendix B. Detailed Analysis of Earnings Replacement Rates Under Integrated Pension Plans

The CRS pension model is designed to show the amount of earnings that are replaced through social security and a pension plan. This paper is limited to defined benefit plans that are fully or maximally integrated with social security within the parameters of applicable IRS revenue rulings. This appendix is limited to individuals retiring on January 1, 1979, under the "old" social security benefit formula. Individuals retiring January 1, 1987, under the "new" social security benefit formula are presented in appendix C. Each table provides the monthly social security and pension benefit as well as the combined gross (before tax) and net (after tax) earnings replacement rates for each of the 25 hypothetical individuals analyzed.

Social security

Table 1.1 shows the amount of final year's earnings replaced by social security *alone* in 1979 assuming the wage histories for the 25 cases. Since the same wage histories are used for all of the 1979 pension analyses, the social security earnings replacement rates are the same under all plans for individuals retiring in 1979 with the exception that the social security benefit for married individuals is 50 percent higher than for single individuals.

As can be seen in table 1.2 the inclusion of the 50 percent spousal benefit dramatically increases earnings replacement rates for married retirees with low and average preretirement earnings. The earnings replacement from social security ranges from 69 percent for a single individual with $4,000 final earnings in 1979 (103.5 percent for married individuals) down to 6 percent for a single individual with $100,000 final year's earnings (9.1 percent for married individuals).

For the single individual with $16,000 final earnings in 1978, social security replaces 37 percent of earnings. For the married $16,000 earner, the earnings replacement from social security alone is 55.5 percent even if he does not receive any pension. The effect of the spousal social security benefit on high earners is relatively insignificant. For instance, the difference in replacement rates from social security alone for the $50,000 earner was 6 percent, and only 3.1 percent for the $100,000 earner.

The replacement rate of social security alone increases for all cases when net earnings are considered. Since the social security benefit is not taxed whereas the individual's final year's earnings were subject to both Federal-State-local government personal income taxes and FICA payroll deductions, the *net* earnings replacement rate from social security alone increases from 69 to 77 percent for the $4,000 earner (an 11.6 percent increase), from 37 to 49.2 percent for the $16,000 earner (a 33 percent increase), and from 6 to 11.9 percent for the $100,000 earner (a 98 percent increase).

Since the same wage histories are used in the construction of the following tables, the earnings replacement rates from social security will always be the same. Of course, because of the social insurance aspects of the social security program, the replacement rates from social security alone for married individuals will be 50 percent higher than their single counterparts, all other factors being equal. Therefore, earnings replacement rates for married workers under integrated pension plans will not be discussed hereafter.

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[7] In an article entitled "Battle of the Heavyweights: Social Security vs. Private Pension Plans" appearing in the January 1979 issue of Pension World, Alicia Munnell utilized a 13.1 percent rate for determining the relationship between State and local income tax and Federal income tax for determining retirement income equivalents needed for married couples retiring in January 1976. In 1974 State and local income tax receipts were 13.1 percent of Federal income tax receipts. Ms. Munnell stated that "this percentage probably rose in 1975 because Federal taxes were decreased while state taxes increased." A comparison of direct tax burdens between Federal and State-local personal income taxes borne by average families during 1977 is contained in the May 1979 Advisory Commission on Intergovernmental Relations publication M–115 entitled "Significant Features of Fiscal Federalism 1978–79 Edition." This analysis shows a ratio of 18.8 percent between Federal and State-local taxes for an average family. An average family was defined as one having $16,000 of income in 1977 assuming all income was from wages and salaries and earned by one spouse. (By way of comparison the estimated State-local tax liability for a family earning twice as much as the average family ($32,000) was 19.6 percent of the Federal tax liability.) In any event, the effect on income replacement rates by using different assumptions for State and local taxes is insignificant.

TABLE 1.1.—SOCIAL SECURITY ONLY—NO PENSION—SINGLE WORKERS AGED 65 RETIRING AFTER 30 YEARS IN 1979 (MONTHLY)

Case No.	Comp base	After tax comp base	SSA	Pension	Ben taxes	Repl rate (SSA only)	Repl rate (SSA+PP)	Repl rate (SSA+PP—tax)
1	333	299	230	0	0	0.690	0.690	0.770
2	417	361	249	0	0	.597	.597	.689
3	500	421	278	0	0	.556	.556	.661
4	583	481	304	0	0	.521	.521	.633
5	667	540	333	0	0	.500	.500	.618
6	750	598	358	0	0	.478	.478	.599
7	833	655	386	0	0	.463	.463	.589
8	1,000	773	437	0	0	.437	.437	.565
9	1,167	889	479	0	0	.411	.411	.539
10	1,333	1,002	493	0	0	.370	.370	.482
11	1,500	1,110	503	0	0	.336	.336	.454
12	1,667	1,215	503	0	0	.302	.302	.414
13	1,917	1,367	503	0	0	.263	.263	.368
14	2,167	1,516	503	0	0	.232	.232	.332
15	2,417	1,656	503	0	0	.208	.208	.304
16	2,667	1,805	503	0	0	.189	.189	.279
17	3,000	1,996	503	0	0	.168	.168	.252
18	3,333	2,175	503	0	0	.151	.151	.231
19	3,750	2,393	503	0	0	.134	.134	.210
20	4,167	2,590	503	0	0	.121	.121	.194
21	5,000	2,978	503	0	0	.101	.101	.169
22	5,833	3,308	503	0	0	.086	.086	.152
23	6,667	3,631	503	0	0	.076	.076	.139
24	7,500	3,954	503	0	0	.067	.067	.127
25	8,333	4,242	503	0	0	.060	.060	.119

DEFINITION OF COLUMN HEADINGS USED IN EARNINGS REPLACEMENT TABLES

Case No.—Corresponds with wage histories for 25 hypothetical workers.
Comp base—Gross monthly compensation in final month of employment.
After tax comp base.—Gross monthly compensation in final month of employment minus estimated Federal-State-local government personal income taxes and FICA payroll deductions.
SSA.—Monthly social security benefit (including spousal benefit if married).
Pension.—Monthly pension benefit.
Ben taxes.—Federal-State-local government personal income taxes on pension benefit (monthly).
Repl rate (SSA only).—Amount of gross monthly compensation in final month of employment replaced by social security alone.
Repl rate (SSA+PP).—Amount of gross monthly compensation in final month of employment replaced by social security and pension plan.
Repl rate (SSA+PP−Tax).—Amount of net monthly compensation (gross compensation minus estimated Federal-State-local government personal income tax and FICA payroll deductions) replaced by social security and pension plan minus estimated Federal-State-local government personal income tax.

TABLE 1.2.—SOCIAL SECURITY ONLY—NO PENSION—MARRIED WORKERS AGED 65 RETIRING AFTER 30 YEARS IN 1979 (MONTHLY)

Case No.	Comp base	After tax comp base	SSA	Pension	Ben taxes	Repl rate (SSA only)	Repl rate (SSA+PP)	Repl rate (SSA+PP—tax)
1	333	313	345	0	0	1.035	1.035	1.102
2	417	390	373	0	0	.895	.895	.957
3	500	454	417	0	0	.834	.834	.919
4	583	518	456	0	0	.782	.782	.882
5	667	579	500	0	0	.750	.750	.863
6	750	641	538	0	0	.717	.717	.839
7	833	701	578	0	0	.694	.694	.825
8	1,000	821	655	0	0	.655	.655	.799
9	1,167	936	719	0	0	.616	.616	.768
10	1,333	1,052	739	0	0	.555	.555	.703
11	1,500	1,171	755	0	0	.503	.503	.645
12	1,667	1,288	755	0	0	.453	.453	.586
13	1,917	1,459	755	0	0	.394	.394	.518
14	2,167	1,625	755	0	0	.349	.349	.465
15	2,417	1,782	755	0	0	.312	.312	.424
16	2,667	1,950	755	0	0	.283	.283	.387
17	3,000	2,164	755	0	0	.252	.252	.349
18	3,333	2,368	755	0	0	.227	.227	.319
19	3,750	2,609	755	0	0	.210	.201	.289
20	4,167	2,850	755	0	0	.181	.181	.265
21	5,000	3,284	755	0	0	.151	.151	.230
22	5,833	3,702	755	0	0	.129	.129	.204
23	6,667	4,094	755	0	0	.113	.113	.184
24	7,500	4,486	755	0	0	.101	.101	.168
25	8,333	4,860	755	0	0	.091	.091	.155

Offset Plans

Under the 83⅓ percent offset plan, each individual receives a pension amounting to 1.5 percent of his/her final 5 years' average compensation for each year of service, reduced by 83⅓ percent of his/her social security Primary Insurance Amount (PIA). This offset reduces the pension to zero for individuals with final year's earnings up to $9,000, and results in a monthly pension of $7 for the $10,000 earner with progressively higher monthly benefits in each successive case. Thus, under the offset plan low wage earners receive no pension, even though they were technically "covered" by the plan for 30 years. (See table 2.) If a lower benefit accrual rate were used, such as 1 percent or 1.25 percent a year, individuals with higher earnings would be similarly affected. Nonetheless, the combined gross earnings replacement rates decline continuously as final year's earnings increase. Even though the wage earners under $10,000 do not receive a pension, their earnings replacement from social security alone is higher than the other wage earners receiving both social security and a pension. When *net earnings* are considered, the replacement rate was only 8 percent higher for the $4,000 earner, but 22.2 percent higher for the $100,000 earner. While the $100,000 earner receives a monthly pension of $2,865, he also pays personal income taxes on this pension of $713 ($8,556 per year). On the other hand, while the amount of pension received by the low and moderate wage earners is much less, retirees do not have to pay any personal income taxes until the monthly pension approaches $400 in the case of the $26,000 earner (case 14). Unlike gross earnings replacement rates, *net* earnings replacement rates fluctuate.

The pension amount received by married and single workers working 30 years is the same. However, the married worker pays less in taxes on his pension compared to the single worker. This has the effect of increasing his net income. The single worker begins paying taxes on the pension when his final year's earnings reach $26,000. However, the married worker does not begin paying taxes until his final year's earnings reach $32,000. Thus, married workers receive a tax break in addition to the 50 percent increase in social security benefits.

IRS integration guidelines do not require a pro rata reduction in the offset for shorter periods of service provided the individual retires at age 65. No adjustment is needed in case of retirement or severance of employment prior to age 65 if no further income is assumed and benefits do not commence before age 65. However, if additional income is assumed (which might in turn increase the individual's estimated social security benefit), the basic limit must be ratioed down by years of service with the employer divided by total years to 65. For example, if an individual began employment at age 35 and terminated employment at age 55, the 83⅓ percent offset would have to be multiplied by 20/30, leaving a maximum offset of 56 percent to be applied at age 65.

While individuals may work 10, 20, or 30 years under the same offset plan, they all may have the same 83⅓ percent offset subtracted from their pension benefit if they all retired at age 65. This failure to pro rate does not affect the lowest income earners because no matter how long they work, the 83⅓ percent offset effectively denies them any pension. However, it does affect higher earners with short periods of coverage under the pension plan. For instance, a worker retiring at age 65 with 20 years of service would have to have final year's earnings of about $20,000 in order to receive a pension and then it would amount to about $18 per month; workers with only 10 years of service have to earn $40,000 to begin receiving a pension.

TABLE 2.—EARNINGS REPLACEMENT FROM SOCIAL SECURITY AND PENSION OF 1.5 PERCENT OF FINAL 5 YEARS' COMPENSATION WITH 83⅓ PERCENT SOCIAL SECURITY OFFSET—SINGLE WORKERS WITH 30 YEARS' SERVICE (MONTHLY)

Case No.	Comp base	After tax comp base	SSA	Pension	Ben taxes	Repl rate (SSA only)	Repl rate (SSA+PP)	Repl rate (SSA+PP—tax)
1	333	299	230	0	0	0.690	0.690	0.770
2	417	361	249	0	0	.597	.597	.689
3	500	421	278	0	0	.556	.556	.661
4	583	481	304	0	0	.521	.521	.633
5	667	540	333	0	0	.500	.500	.618
6	750	598	358	0	0	.478	.478	.599
7	833	655	386	7	0	.463	.471	.599
8	1,000	773	437	30	0	.437	.467	.604
9	1,167	889	479	60	0	.411	.463	.607
10	1,333	1,002	493	115	0	.370	.456	.606

TABLE 2.—EARNINGS REPLACEMENT FROM SOCIAL SECURITY AND PENSION OF 1.5 PERCENT OF FINAL 5 YEARS' COMPENSATION WITH 83⅓ PERCENT SOCIAL SECURITY OFFSET—SINGLE WORKERS WITH 30 YEARS' SERVICE (MONTHLY)—Continued

Case No.	Comp base	After tax comp base	SSA	Pension	Ben taxes	Repl rate (SSA only)	Repl rate (SSA+PP)	Repl rate (SSA+PP−tax)
11	1,500	1,110	503	172	0	.336	.450	.608
12	1,667	1,215	503	237	0	.302	.444	.610
13	1,917	1,367	503	336	0	.263	.438	.614
14	2,167	1,516	503	434	13	.232	.433	.610
15	2,417	1,656	503	533	32	.208	.429	.606
16	2,667	1,805	503	631	53	.189	.426	.599
17	3,000	1,996	503	763	83	.168	.422	.593
18	3,333	2,175	503	894	113	.151	.419	.590
19	3,750	2,393	503	1,058	150	.134	.416	.590
20	4,167	2,590	503	1,223	187	.121	.414	.594
21	5,000	2,978	503	1,551	270	.101	.411	.599
22	5,833	3,308	503	1,879	366	.086	.408	.610
23	6,667	3,631	503	2,208	474	.076	.407	.616
24	7,500	3,954	503	2,536	589	.067	.405	.620
25	8,333	4,242	503	2,865	713	.060	.404	.626

If a 50 percent offset were applied as is the usual case instead of the 83⅓ percent offset, the low and moderate wage earners would fare better. So long as social security is a significant portion of a worker's retirement income, a lower offset will significantly increase his pension benefits. For instance, a 30-year worker earning $9,000 (case 6) would receive $116 a month under a 50 percent offset plan, but no pension under an 83⅓ percent offset plan. A 30-year worker earning $26,000 (case 14) would receive a pension of $602 per month under a 50 percent offset and a pension of $434 a month (28 percent less) under an 83⅓ percent offset plan.

A $10,000 earner (case 7) with 30 years service as shown in table 3 would receive a monthly pension of $136 under a 50 percent offset plan increasing his gross earnings replacement rate to 62.5 percent (79.6 percent net). However, under a maximally integrated plan offsetting 83⅓ percent of the social security PIA as shown in table 2, the $10,000 earner would receive a monthly pension of only $7 and a gross earnings replacement rate of 47.1 percent (59.9 percent net)—a difference of 15.4 percent (19.7 percent net). However, the relative differences at higher income levels is not as great. A $50,000 earner (case 20) would receive a monthly pension of $1,390 under a 50 percent offset plan producing a gross earnings replacement rate of 45.5 percent (64.3 percent net) compared to a monthly benefit of $1,223 under an 83⅓ percent offset plan producing a gross earnings replacement rate of 41.4 percent (59.4 percent net)—a difference of only 4.1 percent (4.9 percent net).

TABLE 3.—EARNINGS REPLACEMENT FROM SOCIAL SECURITY AND PENSION OF 1.5 PERCENT OF FINAL 5 YEARS COMPENSATION WITH 50 PERCENT SOCIAL SECURITY OFFSET—SINGLE WORKERS WITH 30 YEARS' SERVICE (MONTHLY)

Case No.	Comp base	After tax comp base	SSA	Pension	Ben taxes	Repl rate (SSA only)	Repl rate (SSA+PP)	Repl rate (SSA+PP−tax)
1	333	299	230	16	0	0.690	0.739	0.824
2	417	361	249	40	0	.597	.693	.800
3	500	421	278	58	0	.556	.672	.799
4	583	481	304	78	0	.521	.655	.795
5	667	540	333	96	0	.500	.644	.796
6	750	598	358	116	0	.478	.633	.794
7	833	655	386	136	0	.463	.625	.796
8	1,000	773	437	176	0	.437	.613	.793
9	1,167	889	472	220	0	.411	.599	.787
10	1,333	1,002	493	279	0	.370	.579	.770
11	1,500	1,110	503	339	0	.336	.562	.759
12	1,667	1,215	503	405	8	.302	.545	.741
13	1,917	1,367	503	504	26	.263	.525	.717
14	2,167	1,516	503	602	47	.232	.510	.698
15	2,417	1,656	503	701	68	.208	.498	.686
16	2,667	1,805	503	799	91	.189	.488	.671
17	3,000	1,996	503	931	123	.168	.478	.657
18	3,333	2,175	503	1,062	151	.151	.470	.650
19	3,750	2,303	503	1,226	188	.134	.461	.644
20	4,167	2,590	503	1,390	228	.121	.455	.643

TABLE 3.—EARNINGS REPLACEMENT FROM SOCIAL SECURITY AND PENSION OF 1.5 PERCENT OF FINAL 5 YEARS' COMPENSATION WITH 50 PERCENT SOCIAL SECURITY OFFSET—SINGLE WORKERS WITH 30 YEARS' SERVICE (MONTHLY)—Continued

Case No.	Comp base	After tax comp base	SSA	Pension	Ben taxes	Repl rate (SSA only)	Repl rate (SSA+PP)	Repl rate (SSA+PP—tax)
21	5,000	2,978	503	1,719	318	.101	.444	.639
22	5,833	3,308	503	2,047	421	.086	.437	.644
23	6,667	3,631	503	2,376	530	.076	.432	.647
24	7,500	3,954	503	2,704	652	.067	.428	.646
25	8,333	4,242	503	3,032	780	.060	.424	.650

Unit Benefit Excess

The unit benefit excess plan used in table 4 provides a benefit of 1 percent of average final 5 years' compensation in excess of the plan's integration level ($8,724) for each year of service (30). Pension benefits do not begin until individuals have $10,000 final year's earnings (case 7). Individuals with lower earnings receive all their earnings replacement from social security. Under this type of plan, the $9,000 earner (case 6) would receive less than 50 percent gross earnings replacement from social security, although this would increase to almost 60 percent when calculated on a net earnings replacement basis—less than most studies indicate is necessary to maintain a preretirement standard of living.

Compared with maximally integrated offset plans, maximally integrated unit benefit excess plans redistribute income away from the higher paid to the middle-income ($10,000–$16,000) earners. This is because excess plans integrate according to the maximum average monthly wage (covered compensation), which is *not related to actual salary* and thus not related to actual social security benefits. In an excess plan, when workers' earnings exceed $8,724 (maximum covered compensation according to Rev. Rul. 71–446 for *all* workers retiring in 1979), increases in social security go fully to the worker, along with the pension. Under the offset plan, however, 83⅓ percent of those increases would effectively be taken away by reductions in the pensions. At the point where the maximum social security benefit is paid ($503 PIA for $18,000 and above wage earners), the money that the offset plan does not give the middle-income earners is redistributed to the higher income earners.

This redistribution is seen in summary graphs 1 and 2 as a "hump" in the replacement rate curves. The "hump" in the unit benefit excess plan begins at 46.4 percent for the $10,000 single earner (case 7) with 30 years' service and rises to 48.7 percent for the $14,000 single earner (case 9) before the gross earnings replacement rates begin their steady decline. Thus, a $14,000 single earner would receive a gross pension of 2.3 percent more than the $10,000 single earner (4.8 percent when computed on a net earnings replacement basis). The "hump" flattens for a worker with 20 years' service and does not exist for a worker with 10 years' service.

The lower the excess plan's integration level, the earlier the hump will start occurring. This is because the pension benefits would be triggered sooner and, when added to the social security benefit which is still increasing in absolute dollars, would result in an increasing combined replacement rate until the social security benefit levels off. The hump will also be broader. On the other hand, were the integration level raised to where social security tops off (i. e., case 11 where final year's earnings are $18,000 in 1979), there would be no hump at all. Workers earning over this level would not receive social security increases out of which to create a hump.

Under the methodology by which pension integration guidelines were developed, the value of employer financed social security benefits was determined to be equivalent to 37½ percent of the maximum average covered wages (covered compensation) upon which contributions were based. However, the permissible integration level (i.e., "covered compensation") is determined from a career average of the maximum taxable wage bases—$8,724 for a worker retiring in 1979. The 37½ percent benefit, though, can be based on that portion of *average final 5 years'* earnings in excess of the integration level—$13,980 for someone earning the maximum taxable wage base and retiring in 1979. Again, were the

integration level raised to $13,980 (final year's earnings near $18,000) there would be no hump at all.[8]

Thus, a hump will arise in an excess plan whenever the integration level is lower than the average of final 5 years' earnings up to the point where social security benefits top off. Especially in inflationary times, career average earnings will be a significantly lower figure. By providing a lower integration level: (1) certain lower income workers get pension benefits instead of being integrated out, and (2) a hump forms in the overall earnings replacement curve.

TABLE 4.—EARNINGS REPLACEMENT FROM SOCIAL SECURITY AND PENSION OF 1 PERCENT OF COMPENSATION IN EXCESS OF INTEGRATION LEVEL TIMES YEARS OF SERVICE—SINGLE WORKERS WITH 30 YEARS' SERVICE (MONTHLY)

Case No.	Comp base	After tax comp base	SSA	Pension	Ben taxes	Repl rate (SSA only)	Repl rate (SSA+PP)	Repl rate (SSA+PP—tax)
1	333	299	230	0	0	0.690	0.690	0.770
2	417	361	249	0	0	.597	.597	.689
3	500	421	278	0	0	.556	.556	.661
4	583	481	304	0	0	.521	.521	.633
5	667	540	333	0	0	.500	.500	.618
6	750	598	358	0	0	.478	.478	.599
7	833	655	386	1	0	.463	.464	.590
8	1,000	773	437	45	0	.437	.482	.623
9	1,167	889	479	88	0	.411	.487	.638
10	1,333	1,002	493	132	0	.370	.469	.624
11	1,500	1,110	503	176	0	.336	.453	.612
12	1,667	1,215	503	220	0	.302	.434	.595
13	1,917	1,367	503	285	0	.263	.412	.577
14	2,167	1,516	503	351	0	.232	.394	.564
15	2,417	1,656	503	417	10	.208	.381	.550
16	2,667	1,805	503	483	22	.189	.370	.534
17	3,000	1,996	503	570	40	.168	.358	.518
18	3,333	2,175	503	658	59	.151	.348	.507
19	3,750	2,393	503	767	84	.134	.339	.496
20	4,167	2,590	503	877	109	.121	.331	.491
21	5,000	2,978	503	1,096	158	.101	.320	.484
22	5,833	3,308	503	1,315	209	.086	.312	.486
23	6,667	3,631	503	1,533	264	.076	.306	.488
24	7,500	3,954	503	1,752	328	.067	.301	.487
25	8,333	4,242	503	1,971	396	.060	.297	.490

Flat Benefit Excess

The flat benefit excess plan used in table 5 provides a flat benefit of 37½ percent of average final 5 years' compensation in excess of the plan's integration level ($8,724) for employees with 30 years' service at age 65. IRS integration guidelines permit this same 37½ percent figure to be used without pro rata reduction for employees with as little as 15 years' service at age 65. Yet, if the employer had adopted a unit benefit excess plan it would only be able to provide a benefit after 15 years' service of 15 percent of excess compensation. Thus, the earnings replacement curve for the flat benefit excess plan would be exactly the same for a 20-year service worker and a 30-year service worker. (See summary graph 7.)

As shown below, low wage earners do not receive pension benefits until their final earnings reach $10,000 (case 7). As was the case with the unit benefit excess plan illustrated in table 4, once pension benefits begin they amount to a monthly pension of $1 for the $10,000 earner with 30 years' service and increase up to $2,464 for the $100,000 earner (case 25). Taxes on the pension do not begin until benefits reach about $439 in the case of the $26,000 earner (case 14). Moreover, gross earnings replacement rates increase from 46.4 to 49.3 percent for the $12,000 earner (case 8) and again to 50.5 percent for the $14,000 earner (case 9), before they begin their steady decline down to 35.6 percent (case 25). The net earnings replacement rate also increases from 59 to 63.8 percent for the

[8] If a plan uses a higher integration level, the 37½ percent excess benefit would have to be reduced by a fraction, the numerator being the maximum permissible integration level ($8,724) and the denominator being the actual integration level ($13,980), or 62 percent. Sixty-two percent times 37½ percent equals 23.4 percent. However, the 37½ percent excess benefit level can not be increased if the plan uses a lower integration level than otherwise permitted.

$12,000 earner and again to 66.3 percent for the $14,000 earner. This increase in both gross and net earnings replacement rates is due to the fact that once pension benefits are triggered, the relative increase in the pension replacement rate is greater than the relative decrease in the social security replacement rate until the maximum PIA of $503 is provided to the $18,000 (case 11) and above wage earners. This is the "hump" in the curve which was discussed in the section on unit benefit excess plans.

To comply with the applicable integration rules, a flat benefit excess plan may provide a benefit of 2.5 percent per year of excess compensation for retirement at age 65, up to 37.5 percent. Unit benefit plans, however, maximally integrate at 1 percent. Thus, a worker would have to work over 37 years under a unit benefit plan to get the same pension as a 15-year worker retiring at age 65 under a flat benefit plan. Stated another way, a 15-year worker retiring at age 65 could receive 2½ times as much under a flat benefit plan as under a unit benefit plan (37½ divided by 15). Note that if the 15-year worker was not retiring at age 65 there would be a pro rata reduction in the 37½ percent.

TABLE 5.—EARNINGS REPLACEMENT FROM SOCIAL SECURITY AND PENSION OF 37½ PERCENT OF COMPENSATION IN EXCESS OF INTEGRATION LEVEL—SINGLE WORKERS WITH 30 YEARS' SERVICE (MONTHLY)

Case No.	Comp base	After tax comp base	SSA	Pension	Ben taxes	Repl rate (SSA only)	Repl rate (SSA+PP)	Repl rate (SSA+PP—tax)
1	333	299	230	0	0	0.690	0.690	0.770
2	417	361	249	0	0	.597	.597	.689
3	500	421	278	0	0	.556	.556	.661
4	583	481	304	0	0	.521	.521	.633
5	667	540	333	0	0	.500	.500	.618
6	750	598	358	0	0	.478	.478	.599
7	833	655	386	1	0	.463	.464	.590
8	1,000	773	437	56	0	.437	.493	.638
9	1,167	889	479	111	0	.411	.505	.663
10	1,333	1,002	493	165	0	.370	.494	.657
11	1,500	1,110	503	220	0	.336	.482	.652
12	1,667	1,215	503	275	0	.302	.467	.640
13	1,917	1,367	503	357	0	.263	.449	.629
14	2,167	1,516	503	439	14	.232	.435	.612
15	2,417	1,656	503	521	29	.208	.424	.601
16	2,667	1,805	503	603	47	.189	.415	.587
17	3,000	1,996	503	713	71	.168	.405	.574
18	3,333	2,175	503	822	96	.151	.398	.565
19	3,750	2,393	503	959	130	.134	.390	.557
20	4,167	2,590	503	1,096	158	.121	.384	.557
21	5,000	2,978	503	1,369	223	.101	.375	.554
22	5,833	3,308	503	1,643	296	.086	.368	.559
23	6,667	3,631	503	1,917	378	.076	.363	.562
24	7,500	3,954	503	2,190	469	.067	.359	.563
25	8,333	4,242	503	2,464	561	.060	.356	.567

Appendix C. Effects of 1977 Social Security Amendments on Earnings Replacement Rates Under Integrated Plans

In response to the deteriorating financial condition of the social security trust funds, legislation was enacted in 1977 which changed the taxable wage base and tax rate. It also revamped the OASDI benefit formula to lessen overcompensation for inflation caused by the manner in which initial benefit amounts were computed upon retirement. These "decoupling provisions," as they are known, are aimed at maintaining the ratio of social security benefits to prior earnings at roughly constant levels through time regardless of inflation. Under the previous law, many future beneficiaries would have received higher annual benefits than their final year's wages. The approach adopted in the 1977 amendments is referred to as "wage indexing." Its principle is that each generation of future retirees should have roughly the same proportion of their preretirement earnings replaced by social security benefits as the preceding generation. For instance, a worker with average earnings retiring at age 65 in 1985 will receive benefits representing approximately 42 percent of his last year's earnings. Under the new "wage-indexing" provisions the typical worker with average earnings retiring at age 65 in the year 2000 also will receive benefits representing about 42 percent of his last year's earnings.

In adopting the shift to the new benefit system, Congress made changes in the benefit formula intended to offset somewhat the increase in replacement rates which occurred in the early and mid-1970's. The replacement rate for the

worker having average earnings in every year retiring at age 65 rose from approximately 39 percent in 1973 to almost 45 percent in 1977. The new benefit formula enacted with the 1977 amendments was designed to reduce that average replacement rate to an ultimate level of 42 percent representing about a 5-percent reduction in the average replacement rate. However, the 1977 amendments allowed the overcompensation for inflation to continue under the old formula for a number of years after enactment in order to provide an orderly administrative transition to the new benefit structure and so as not to affect adversely the expected benefit levels of those approaching retirement at that time. Consequently, the replacement rate for the average worker retiring at age 65 has been allowed to rise above its 1977 level and is estimated to peak at a level of 53.6 percent in 1981. This will result in substantially higher replacement rates for workers retiring in the 1978–1982 period who are still able to use the old law formula for computing benefits than comparable workers retiring under the new formula. This is shown in the following table:

REPLACEMENT RATES[1] AND ANNUAL BENEFIT AMOUNTS IN 1979 DOLLARS[2] FOR SELECTED YEARS 1971–2055
(SINGLE INDIVIDUAL—NO SPOUSE BENEFIT)

Year	Replacement rates (percent)			Annual benefit amount in 1979 dollars		
	Low[3]	Average[4]	Maximum[5]	Low[3]	Average[4]	Maximum[5]
1971	48.6	36.6	32.8	2,758	4,133	4,675
1972	49.9	37.7	35.5	2,791	4,196	4,741
1973	51.7	39.2	35.5	2,823	4,265	4,863
1974	54.0	40.9	33.0	2,894	4,361	5,018
1975	55.3	42.3	30.1	2,921	4,457	5,207
1976	57.1	43.7	32.1	3,028	4,614	5,546
1977	58.0	44.8	33.5	3,097	4,768	5,910
1978	60.0	46.7	34.7	3,197	4,957	6,216
1979	60.4	48.1	36.1	3,327	5,082	6,390
1980	63.5	51.0	32.2	3,334	5,065	6,426
1981	67.3	53.6	32.8	3,494	5,384	6,842
1982	62.7	48.5	28.1	3,274	4,933	6,257
1983	59.7	45.8	27.1	3,196	4,780	6,127
1984	55.9	43.0	25.7	3,074	4,606	5,947
1985	54.1	41.6	24.8	3,070	4,602	5,981
1990	53.9	41.6	24.1	3,415	5,126	6,887
1995	53.7	41.5	24.6	3,730	5,613	7,749
2000	53.9	41.7	25.5	4,078	6,145	8,804
2005	53.7	41.8	26.5	4,412	6,688	9,928
2010	53.3	41.8	27.2	4,765	7,270	11,107
2015	53.0	41.8	27.7	5,147	7,902	12,302
2020	53.0	41.8	27.9	5,595	8,589	13,450
2025	52.9	41.8	27.9	6,076	9,338	14,649
2030	52.9	41.8	27.9	6,605	10,151	15,933
2035	52.9	41.8	27.9	7,180	11,033	17,325
2040	52.9	41.8	27.9	7,804	11,993	18,836
2045	52.9	41.8	27.9	8,483	13,037	20,478
2050	52.9	41.8	27.9	9,221	14,171	22,262
2055	52.9	41.8	27.9	10,024	15,404	24,200

[1] For this table, replacement rate is defined as total benefits in the 1st year of retirement expressed as a percent of earnings in the previous year, for age 65 retirees.

[2] For individuals retiring 1971–78, the benefit is the actual amount they would receive in 1979. For individuals retiring after 1978, the annual benefit amount in 1979 dollars is found in 2 steps. 1st, the January PIA in the year of retirement is deflated to an artificial January 1979 PIA by the increase in CPI from the 1st quarter of 1979 to the 1st quarter of the year of retirement. 2nd, an annual amount is found by summing 5 months at the artificial January 1979 rate plus 7 months at that rate increased by the June 1979 increase of 9.9 percent.

[3] The low earner is assumed to have steady earnings annually equal to 2,080 hours at the Federal minimum wage through 1981, increasing thereafter at the same rate as average wages.

[4] The average earner is assumed to have steady earnings equal to the average annual wage used for indexing purposes.

[5] The maximum earner is assumed to have steady earnings equal to the contribution and benefit base, as legislated through 1981 and as projected thereafter through the action of the automatic provisions.

Note: The above estimates are based on the fiscal year 1981 budget assumptions blended into the long-range intermediate assumptions of the 1979 trustees report.

Source: Office of the Actuary, Social Security Administration.

As can be seen above, the average earner retiring in 1979 will have about 48.1 percent of his or her wages replaced by social security compared to 41.6 percent in the year 1985 when replacement rates stabilize. While future retirees may have lower replacement rates than this current cohort of retirees, it is important to emphasize that this change simply restores the typical ratio of benefits to earnings which existed in the mid-1970's. Thus, 1979 is an abnormally high year to use as a benchmark for comparing replacement rates under the old and new social security benefit formulas.

The amount of the increase in the social security taxable earnings base and the tax rates are as follows:

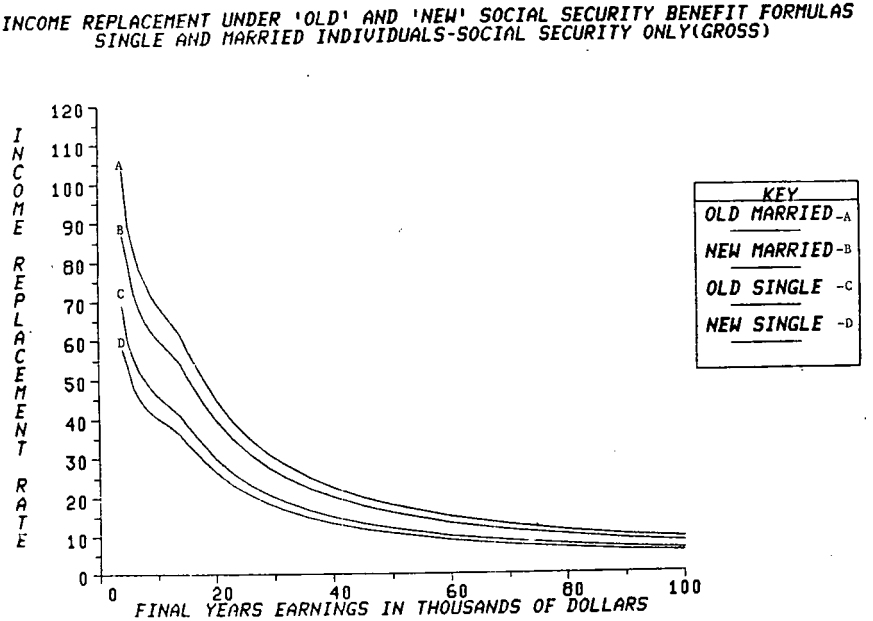
Year	Prior to amendments		After amendments	
	Earnings base	Tax rate	Earnings base[2]	Tax rate
1978	$17,700	6.05	$17,700	6.05
1979	[1] 18,900	6.05	22,900	6.13
1980	[1] 20,400	6.05	25,900	6.13
1981	[1] 21,900	6.30	29,700	6.65

[1] Projected under the automatic adjustment provisions made in December 1977 upon enactment of the 1977 Social Security Amendments. Under current assumptions, the prior-law earnings base as now estimated would be $22,900 for 1981.
[2] The levels for 1979–81 were fixed by law. In future years the amount of earnings subject to tax will rise depending on the increase in average earnings that occurs from one year to the next.

Source: Social Security Financing, Committee Print 96–32, Committee on Finance, U.S. Senate, February 1980.

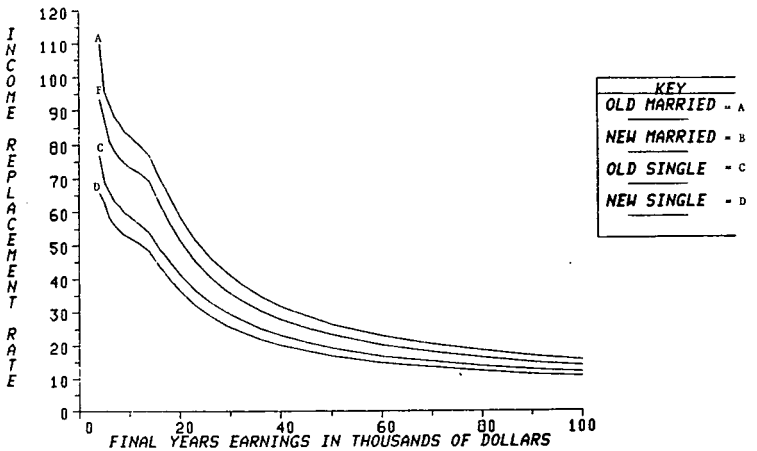
Analysis of Effects of 1977 Amendments on Earnings Replacement

Summary graphs 9 and 10 compare earnings replacement rates under the "old" and "new" social security benefit formulas for single and married individuals. Summary graph 9 shows gross earnings replacement and summary graph 10 net earnings replacement.



SUMMARY GRAPH 9

INCOME REPLACEMENT UNDER 'OLD' AND 'NEW' SOCIAL SECURITY BENEFIT FORMULAS
SINGLE AND MARRIED INDIVIDUALS-SOCIAL SECURITY ONLY(NE1)



SUMMARY GRAPH 10

DETERMINATION OF COMPARABLE WORKERS

The 1987 analysis was conducted on workers whose wage structures were equivalent to the 1979 workers—that is, workers whose relative positions in the economy remain the same. It should be noted that, because the assumed inflation rates over this 8-year period were lower than the assumed wage growth rates (188 percent compared to 195 percent), the 1987 workers will have slightly more purchasing power than the comparable 1979 workers.

OFFSET PLANS

While the 1987 retirees have lower social security earnings replacement rates, they have slightly higher earnings replacement from the 83⅓ percent offset pension plan since their pension benefit is offset by a lower absolute dollar amount. The net effect is only a slight decrease in combined social security-pension plan gross replacement rate. For instance, a 1979 retiree with final earnings of $16,000 (case No. 10) would have a combined gross replacement rate of 45.6 percent compared to a 44.3 percent replacement rate for a comparable worker in 1987—a reduction of only 1.3 percent. This is because the 4.5 percent lower social security replacement rate is countered by a 3.2 percent increase in the pension only replacement rate. As a result of this, at lower earnings levels 1987 retirees start receiving pension benefits while comparable 1979 retirees received none. At the highest earnings level, however, the earnings replacement from the pension is about the same. This is because, at higher earnings levels, social security benefits provide relatively little earnings replacement, so the lower social security offset will have little effect on the pension replacement rate.

In the 50 percent offset formula, the same slight increase in pension replacement rate and slight decrease in overall replacement rate occurs, and for the same reasons.

TABLE 6.—EARNINGS REPLACEMENT FROM SOCIAL SECURITY AND PENSION OF 1.5 PERCENT OF FINAL 5 YEARS' COMPENSATION WITH 83⅓ PERCENT SOCIAL SECURITY OFFSET—SINGLE WORKER WITH 30 YEARS' SERVICE IN 1987 (MONTHLY)

Case No.	Comp base	After tax comp rate	SSA (after CPI)	Pension (after CPI)	Ben taxes (after CPI)	Repl rate (SSA only)	Repl rate (SSA+PP)	Repl rate (SSA+PP−tax)
1	651	573	377	0	0	0.579	0.579	0.659
2	814	691	435	0	0	.534	.534	.629
3	977	806	471	0	0	.482	.482	.584
4	1,140	921	517	12	0	.454	.465	.575
5	1,303	1,035	564	37	0	.433	.461	.581
6	1,465	1,145	611	61	0	.417	.458	.587
7	1,628	1,255	657	86	0	.404	.456	.592
8	1,954	1,483	751	135	0	.384	.453	.597
9	2,280	1,705	825	199	0	.362	.449	.601
10	2,605	1,927	847	307	0	.325	.443	.599
11	2,831	2,157	862	421	0	.294	.438	.595
12	3,257	2,378	869	542	0	.267	.433	.594
13	3,745	2,705	874	728	15	.233	.428	.587
14	4,233	3,016	875	818	51	.207	.428	.578
15	4,722	3,320	875	1,108	91	.185	.420	.570
16	5,210	3,606	875	1,298	133	.168	.417	.566
17	5,862	3,975	875	1,551	192	.149	.414	.562
18	6,513	4,318	875	1,804	251	.134	.411	.563
19	7,327	4,729	875	2,121	321	.119	.409	.566
20	8,141	5,108	875	2,438	387	.107	.407	.571
21	9,770	5,847	875	3,071	570	.090	.401	.577
22	11,398	6,478	875	3,705	770	.077	.402	.588
23	13,026	7,109	875	4,338	981	.067	.400	.595
24	14,654	7,719	875	4,971	1,221	.060	.399	.599
25	16,283	8,271	875	5,605	1,477	.054	.393	.605

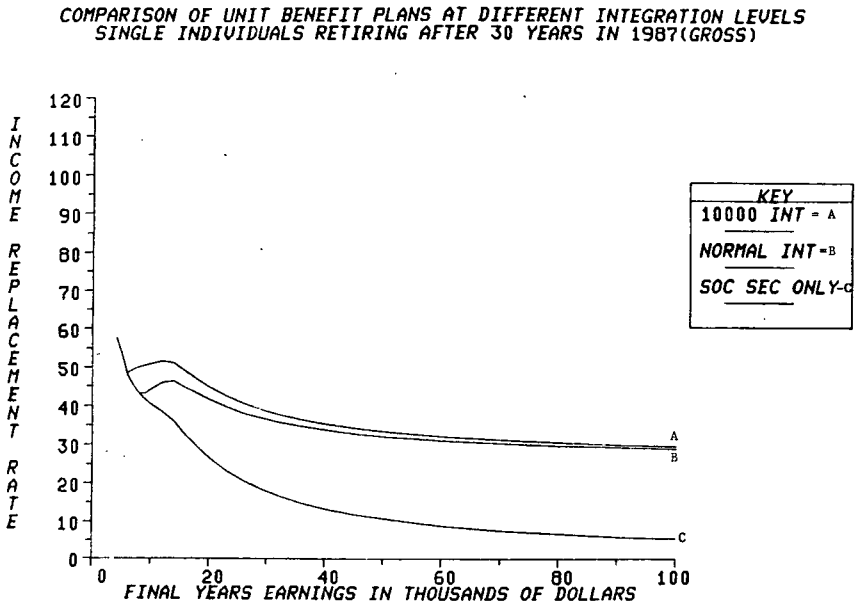
TABLE 7.—EARNINGS REPLACEMENT FROM SOCIAL SECURITY AND PENSION OF 1.5 PERCENT OF FINAL 5 YEARS' COMPENSATION WITH 50 PERCENT SOCIAL SECURITY OFFSET—SINGLE WORKERS WITH 30 YEARS' SERVICE IN 1987 (MONTHLY)

Case No.	Comp base	After tax comp base	SSA (after CPI)	Pension (after CPI)	Ben taxes (after CPI)	Repl rate (SSA only)	Repl rate (SSA+PP)	Repl rate (SSA+PP−tax)
1	651	573	377	65	0	0.579	0.679	0.772
2	814	691	435	99	0	.534	.656	.773
3	977	806	471	145	0	.482	.630	.763
4	1,140	921	517	185	0	.454	.616	.762
5	1,303	1,035	564	225	0	.433	.605	.762
6	1,465	1,145	611	265	0	.417	.597	.764
7	1,628	1,255	657	305	0	.404	.591	.767
8	1,954	1,483	751	385	0	.384	.581	.766
9	2,280	1,705	825	474	0	.362	.570	.762
10	2,605	1,927	847	590	0	.325	.552	.746
11	2,981	2,157	862	709	12	.294	.536	.723
12	3,257	2,378	869	832	34	.267	.522	.701
13	3,745	2,705	874	1,020	72	.233	.506	.674
14	4,233	3,016	875	1,209	114	.207	.492	.653
15	4,722	3,320	875	1,399	157	.185	.482	.638
16	5,210	3,606	875	1,589	201	.168	.473	.628
17	5,862	3,975	875	1,843	259	.149	.464	.619
18	6,513	4,316	875	2,096	315	.134	.456	.615
19	7,327	4,723	875	2,413	381	.119	.449	.613
20	8,141	5,108	875	2,729	471	.107	.443	.613
21	9,770	5,847	875	3,363	657	.090	.434	.612
22	11,398	6,478	875	3,996	867	.077	.427	.618
23	13,026	7,109	875	4,030	1,092	.067	.423	.621
24	14,654	7,719	875	5,263	1,332	.060	.419	.623
25	16,283	8,271	875	5,896	1,602	.054	.416	.625

EXCESS PLANS

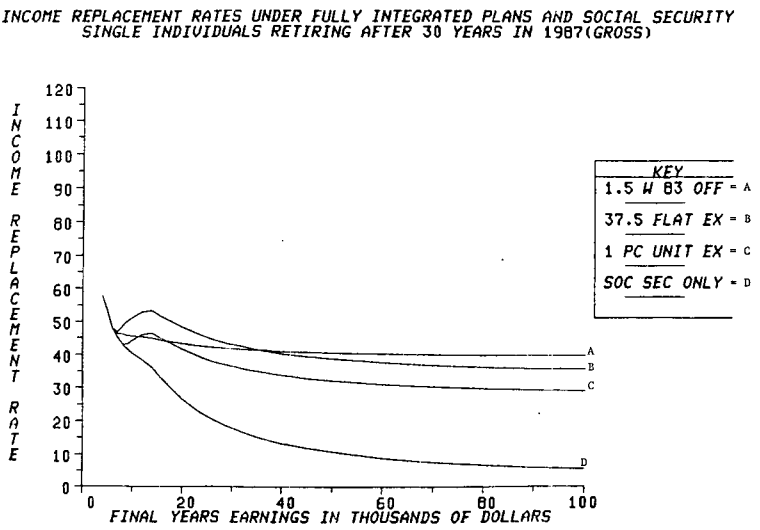
Under both excess plans, the "hump" in the earnings replacement curves for 1987 retirees starts earlier and is broader and higher. More retirees would therefore be covered by the hump and would also receive slightly higher replacement rates. This is because more compensation for purposes of pension benefit calculations is *above* the plan's integration level. Under the *unit benefit* plan, the hump starts with case 6 and rises to 46.4 percent before starting its descent. As was shown in appendix B, the hump for 1979 retirees began with case 7 ($10,000) but peaked higher at 48.7 percent because of the relatively higher social security benefit (see table 4). The hump starts earlier in both the unit benefit and flat

benefit plans for 1987 retirees because final 5 years' earnings increase faster than the plan's maximum permissible integration level. This has the effect of causing a lower integration level relative to the integration level for 1979 retirees. This is demonstrated in the case of the unit benefit plan in summary graph 11, using a $10,000 integration level where the maximum permissible integration level for 1987 retirees age 65 would otherwise be $14,340.



SUMMARY GRAPH 11

The following is summary graph 12 showing earnings replacement under fully integrated plans together with social security for 1987 retirees.



SUMMARY GRAPH 12

PROJECTING COSTS OF PRIVATE PENSION PLANS: AN ANALYTICAL FRAMEWORK

By Bradley R. Schiller and Donald C. Snyder*

CONTENTS

Summary

The purpose of this study is to assess the costs imposed on private employers by public reform of the private pension system. No specific cost projections are provided. Instead, the paper attempts to broaden the framework for making detailed cost estimates. In this regard, the paper emphasizes:

Various cost types.—Changes in private pension plans generate a variety of distinct direct and indirect costs. The most familiar of these include employer contributions, funding outlays, and administrative costs. In addition, however, changes in private pension provisions also alter direct wages, employee turnover, and labor productivity. To assess the true (net) costs of pension changes, all these effects must be considered.

Potential cost offsets.—Many of the secondary effects of pension-plan revision actually *reduce* employer costs. Typically, the growth of direct wage rates declines when improved pension provisions are introduced. Associated changes in labor turnover and productivity may also yield cost savings. Actuarial cost estimates usually ignore such

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labor force adjustments and thus misrepresent the true costs of pension-plan reform. Indeed, under some circumstances, the real net costs of pension reform may be negligible or even negative.

In addition to providing an analytical framework for assessing pension-related costs, this paper provides a brief review of recent and anticipated changes in pension coverage, structure, regulation, and maturation. Chapter 2 highlights the role of the Employee Retirement Income Security Act (ERISA) and other legislation in accelerating the rate of pension-provision change and notes how post-ERISA developments may slow the rate of private pension growth. Despite the volume of recent and anticipated pension-plan changes, the net costs of pension reform have not been calculated, either in the aggregate or for selected industries and firms.

I. Employer Costs of Pension Reform

Private pension plans have become a subject of intensive private and public interest, emanating from two distinct concerns. The first concern relates to financial security. Private pension plans are viewed as a potentially significant source of income security for the growing population of retired persons. From this perspective, public policy seeks to assure that the deferred income bound up in private pension agreements is later accessible on reasonable terms and with certainty. The Employee Retirement Income Security Act (ERISA) of 1974 is a primary manifestation of these concerns.

There is a second dimension to private pension plans. The deferral of income via the mechanism of private pension plans alters employment relationships, tax liability, and savings behavior. This implies that any modifications to existing plans may further alter employee behavior, production costs, savings patterns, and the distribution of income. Hence, pension reform, however desirable from the perspective of retirement income security, must be evaluated in terms of these secondary effects as well.

The primary purpose of this chapter is to assess the implications of these secondary effects for the estimated costs of pension-plan reform. We begin by reviewing typical actuarial practices for generating these cost estimates. In section B, we highlight the secondary cost effects typically omitted from actuarial estimates. When such secondary effects are included, projected costs change substantially and may even become negligible.

A. Actuarial Projections of Pension Costs

The retirement benefits associated with private pension plans represent a continuing financial obligation of the sponsoring employer. Typically, a new plan will specify certain age and service conditions for later benefit eligibility, as well as a formula for determining the level of retirement benefits. As the plan "matures," i.e., as the firm's work force ages and gains service credits, the dollar value of later payout obligations grows. Ultimately, the firm must begin paying promised benefits to its initial work force as well as to any additional workers hired after the plan's inception.

Actuaries estimate the dimensions of these future payout streams. In theory, firms can meet the costs of these streams in one of three ways:

(1) Set aside a pension fund equal to the present discounted value of future pension obligations;

(2) Finance benefit payouts on a current basis, i.e., "pay as you go"; and

(3) Some combination of (1) and (2).

Option (1) represents "full funding" of pension obligations; option (3) represents "partial" funding; and option (2) entails no present funding of future obligations. In practice, ERISA requires that all pension plans move to full funding. The job of the pension actuary is two-fold: First, to estimate future pension liabilities; second, to compute the present value of those liabilities. On the basis of these estimates, the actuary informs the sponsoring employer about the size of the pension fund required, and the rate of annual contributions required to maintain its fully-funded status, as new obligations are incurred.

In estimating future payout obligations, an actuary must construct a longitudinal profile of the employer's work force. Specifically, the actuary must determine the demographic profile of existing employees, new hires, and departing workers (quits as well as retirees). This information, when combined with assumed wage and pension structures, permits the actuary to determine how many workers will be eligible for later pension benefits and at what ages. Mortality tables are used to determine how long vested and retired workers will survive. Finally, assumed rates of return on pension funds and present value tables are used to compute the required level of current funding.

The turnover, mortality and wage assumptions employed in an actuarial model may be either general or specific. General estimates are descriptive of the general population or labor force; specific estimates reflect experiences of the covered population in a particular industry or in the individual firm. Over a period of time, these estimates change necessitating revision of actuarial cost projections. Twenty-five years ago, for example, retirement at age 65 or 66 was commonly assumed. Today, retirement often occurs earlier, and post-retirement survival is longer. This change in retirement behavior required reevaluation of benefit streams and funding requirements. Such reestimation procedures are analogous to experience-rating techniques used in the insurance industry, and result in "true" cost estimates in an iterative fashion.

A.1. PENSION-PROVISION CHANGES

The foregoing description of actuarial procedures is based on a given pension plan. However, the structure of the plan itself may change; indeed, a basic purpose of pension-plan reform is to alter the specific provisions of existing plans. When such changes occur, actuarial cost estimates must be revised, and the resulting change in present-value costs is interpreted as the cost of pension-plan reform. Winklevoss illustrates this procedure, for the imposition of mandatory vesting. Winklevoss also demonstrates that the added costs of such a reform

may be as much as a 25 percent increase in current costs.[1] Such estimates are made not only for the purpose of evaluating statutory public reforms, but also for "expensing" plan changes collectively bargained or initiated by a private employer.

B. Actuarial Versus Economic Projections

Although actuarial procedures for estimating the costs of pension-plan reform may appear eminently reasonable, they may in fact be misleading. The basic shortcoming of such actuarial projections is that they ignore potential *behavioral responses* to pension-plan changes. As noted earlier, these behavioral responses to pension-plan reform may include changes in turnover rates, wages, productivity, savings, and investment behavior.[2] Any of these secondary effects can materially alter the net costs of pension-plan reform.

B.1. PENSION REFORM AND TURNOVER

Consider, for example, the impact of pension-plan reform on labor turnover. Changes in the provisions of private pension plans alter the expected value of retirement benefits. A reduction in the service requirements for normal retirement, for instance, increases the probability that older workers will receive a pension. As a result, the discounted expected value of pension benefits rises. The same is true of vesting changes. A reduction in the service requirements for vesting increases the probability of vesting for younger workers. As a consequence, the value of continued firm attachment increases by the higher expected value of the (vested) benefit.

As the expected value of pension benefits changes, the incentives for quitting a firm are altered as well. In general, plan changes that increase the (discounted) expected value of pension benefits reduce the probability of quitting for workers not yet eligible for vesting or normal retirement. Workers already eligible for full vesting will be unaffected by vesting-provision changes. Likewise, workers already eligible for normal retirement will be unaffected by changes in normal age or service requirements, but will be enticed to retire by improved benefit formulas.

Recent studies suggest that the impact of pension-provision changes on firm attachment can be significant. One such study, by Schiller and Weiss, examined the quit behavior of 35,000 workers in 133 large firms. Among men aged 45–54 in this sample, a one-year reduction in the age or service requirements for normal retirement reduced the probability of quitting by 0.017 percentage points (from a mean of 0.142). Similar

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[1] Howard E. Winklevoss, "Cost Sensitivity of Mandatory Funding and Vesting Standards in Pension Plans." Journal of Risk and Insurance, vol. 41, 1974. Similar conclusions were reported to the Senate Labor Subcommittee; see Donald S. Grubbs, Jr., "Study of the Cost of Mandatory Vesting Provisions," testimony of September 11, 1972.

[2] For reviews of recent pension research, see Bradley R. Schiller, and Donald Snyder, "Private Pension Plans and the Older Worker: Further Analyses" (Washington, D.C.: U.S. Administration on Aging, March 1979); Colleen Campbell, "Recent and Pending Studies and Reports of Possible Interest to the National Commission on Social Security" (Washington, D.C.: National Commission on Social Security, May 1979); Tom Gustafson, "Research Inventory on Work, Income and Retirement of the Aged" (Washington, D.C.: U.S. Department of HEW, December 1978); Robert Clarke and Juanita Kreps, "Economics of Aging: A Survey": Journal of Economic Literature, September 1978.

relationships were observed for other pension provisions and age groups.[3] A study of retirement behavior in the auto industry noted analogous relationships. A 10-percent relative increase in the value of early retirement benefits, for example, increased the probability of retiring by 6.8 percent.[4]

The implicit cost of these changes in quit behavior can be substantial. The recruitment, training and lost output costs of replacing a worker can easily equal a full year's wage, particularly for experienced employees.[5] If the average worker is earning $10,000 per year, then a two-point reduction in the expected quit rate reduces expected *annual* turnover costs by $200 per worker. On a present discounted value basis, such a saving amounts to $200,000 for a firm with 100 employees and a 10-percent discount rate.

Changes in pension-plan provisions will not always reduce quit rates and turnover costs. Indeed, some pension-plan changes (e.g., the introduction of an early retirement option) may actually *increase* quits among some workers while reducing the quit rate of other age groups. What must be emphasized, however, is that reductions in turnover costs *may* result from changes in pension-plan provisions. Such cost savings may offset the more visible costs associated with pension-plan reform.

Winklevoss and others are fully aware of the importance of turnover rates for projecting pension-related costs. Indeed, both the Winklevoss and Grubbs studies noted earlier provide distinct sets of cost estimates for different assumed turnover rates. They do not recognize, however, that the (assumed) turnover rate may *change* as a direct consequence of pension-plan revision. As a result, their actuarial cost projections do not fully reflect probable future payout streams.[6] Over time, as turnover rates respond to pension-plan revision, actuarial projections can be adjusted, of course. But economists attempt to foresee and measure such behaviorial responses, providing more accurate estimates of present-value pension costs.[7]

B. 2. PENSION REFORM AND WAGES

Reduced turnover costs are not the only potential savings associated with liberalized pension provisions. Improved pension provisions also represent an increase in employee compensation. Employers may recover these higher pension costs in the form of reduced direct wage rates. To the extent that employers and unions bargain over a total compensation package, pensions may be regarded as but one element in the package. Hence, any increase in direct pension-related costs may be offset by reductions in other elements of the compensation package. Specifically, *wage rates may be lowered if pension-plan improvements*

[3] The relationships between specific provision changes and quit probabilities are described more completely in Bradley R. Schiller and Randall D. Weiss, "The Impact of Private Pensions on Firm Attachment," Review of Economics and Statistics, August 1979.

[4] Richard Burkhauser, "The Pension Acceptance Decision of Older Workers," Journal of Human Resources, Winter 1979.

[5] See Donald J. Cymrot, "The Role of Employment Tenure Requirements in Private Pension Plans" (Oxford, Ohio: Miami University, 1977, mimeographed) and sources therein. A conceptual model of turnover costs is contained in Howard L. Smith and Larry Watkins, "Managing Manpower Turnover Costs," Personnel Administrator, April 1978.

[6] The same problem is evident in the recent ICF, Inc. forecast of pension coverage and costs for the Office of Pension and Welfare Benefit Programs, U.S. Department of Labor (ICF, "Structure of the ICF Private Pension Forecasting Model," April 1979).

[7] Actuarials are not really to blame for their static behavioral assumptions. Sponsoring employers could in fact ask that secondary behavioral effects be estimated and incorporated into cost projections. Evidently, such requests are rare.

are introduced. These indirect wage savings must be included as an offset in the computation of pension-related costs.

A trade-off between wages and pensions need not be confined to collective bargaining agreements. As has been demonstrated elsewhere, competitive firms will also tend, over time, to recover the cost of pension improvements through a reduction in the growth of direct wages. This conclusion was reached in a cross-sectional study of pension and wage behavior among 13,992 workers in 133 large U.S. firms. The question addressed in the study was whether, for workers of comparable ability direct wage rates tended to be lower in the presence of higher-valued pension provisions. It was observed that wage rates are generally lower when pension benefits are higher (again, for workers of comparable ability). Specifically, each added dollar of discounted expected pension benefits appears to be accompanied by $0.60–$1.00 of reduced wages, depending on the age of the affected workers.[8]

From this perspective of offsetting wage reductions alone, the net cost of improved pension plans appears much smaller than most actuarial cost estimates imply. Here again, the different perspectives of the actuary and the economist are evident. The actuary focuses on existing wage and pension structures and independent changes in each. The economist incorporates potential *interactions* between wage and pension structures, i.e., behaviorial responses to pension-plan reform.

B. 3. PENSION REFORM AND PRODUCTIVITY

Another potential behaviorial response to pension-plan reform is changed productivity. As noted in section B. 1, improved pension provisions may reduce labor turnover. Workers who remain with a firm not only maintain a given set of skills, but may improve them. Where on the job learning is significant and continuous, the value of reduced quit rates is greater. Moreover, if workers identify more closely with the firm as a result of an improved pension plan, their individual efforts may increase. This is particularly evident in profit-sharing plans but may also occur when workers feel that they (or their retired co-workers) are getting a "good deal." In large, highly structured firms, the conditions for maximum efficiency may be even more explicit. For example, the seemingly inefficient seniority provisions included in most collective bargaining agreements may actually *enhance* firm efficiency, since they reduce the risk to older workers of being displaced by younger workers. With such assurances, older workers are more willing to transmit their knowledge and skills to younger workers. Generous retirement provisions can have the same effect. By assuring an attractive alternative to continued employment, generous retirement provisions can lessen the resistance of older workers to on-the-job training of younger workers, as well as to increased automation, or additional hiring. Indeed, in isolated cases, firms have offered more generous pension provisions as a "sweetener" to induce acceptance of workplace or labor-force changes.

Finally, changes in pension provisions may alter the investment decisions of the firm. Specifically, improvements in pension plans may induce firms to increase their capital/labor ratio, thereby making re-

[8] Bradley R. Schiller and Randall D. Weiss, "Pensions and Wages: A Test for 'Equalizing Differences'," Review of Economics and Statistics, forthcoming.

maining workers more productive. The response is not dependent on the absence of equalizing differences (offetting direct wage reductions). Even if higher expected pension values do not increase total compensation, they will alter the composition of total compensation. In particular, the fixed (pension-related) costs of employing labor will rise relative to the variable (hourly wages) costs. Thus, the risk of employing a labor force of given size will increase relative to capital costs. Accordingly, an increase in the capital/labor ratio may be an appropriate response by management to improved pensions.

As the foregoing discussion makes clear, behavioral responses to private pension reform do effect the net cost of such reform. Indeed, we have suggested that the secondary effects of pension reform may actually yield cost savings to the sponsoring employer. Any such savings from reduced turnover, lower wage growth, and increased productivity will help offset the direct costs of pension reform that result from higher funding, administrative, or actuarial contribution requirements. In certain circumstances, the secondary cost savings may exceed direct pension-related costs, rendering pension reform costless for the employer. While costless reform is not assured, it is at least possible, as the following section illustrates.

C. Cost interactions

The interaction of actuarial and economic costs can be easily illustrated. Suppose, for example, that a firm introduces a 10-year vesting option where none previously existed. Winklevoss estimates that a firm with "moderate" turnover rates will incur a 25 percent increase in employer contributions as a result of such a change (this is Winklevoss' most expensive case). Assuming that such a firm was paying the typical worker $10.000 per year, with actuarial pension-related costs of $800 per year (the average pension rate), the introduction of 10-year vesting would result in added actuarial contributions of $200 per year for each worker. As noted earlier, direct wage offsets of $120–$200 per year can be expected in this case (equalizing different ratios of 0.6 to 1.0). Hence, the initial net annual cost of the 10-year vesting option would be more than $80 per worker after wage responses alone are considered.

Other secondary behaviorial responses may reduce this cost further. For example, the firm need only experience a modest reduction in turnover rates, especially among younger workers with five or more years of firm attachment. Specifically, if the cost of replacing an experienced worker equals his annual wage ($10,000), then a reduction in turnover by only 1 percentage point yields an annual cost saving to the sponsoring employer of $100. This reduction in turnover costs completely eliminated the net cost residual ($80), rendering the introduction of 10-year vesting a costless addition to the pension plan. If, in addition, labor productivity were to increase after this liberalization of pension provisions, the sponsoring employer would actually enjoy a net cost saving.

It must be emphasized again that net cost savings are not necessarily expected. The point of this example is simply to show that behavioral responses to pension-plan reform are a potentially important determinant of net costs. Therefore, all such responses must be considered when

assessing the desirability of specific pension-plan reforms.[9] In general, we anticipate that actuarial projections which ignore these responses misrepresent, and probably overstate, the true costs of pension-plan reform.

D. Summary

This brief review of the costs associated with pension-plan revision emphasizes several points:

There are a variety of direct and indirect costs associated with any modification of private pension provisions. Cost projections that focus only on the more visible of these costs (e.g., employer contributions, funding, administrative costs) are certain to be in error. In particular, actuarial projections that do not incorporate potential behaviorial responses to pension-plan reform will err by the amount of such secondary effects.

Evidence is accumulating that secondary effects of pension-plan reform may be substantial. In particular, pension-induced changes in turnover rates and wages appear to be significant.

The net costs of pension reform for sponsoring employers depends on the magnitude of both primary and secondary effects. Under some circumstances, the net costs of pension reform may be negligible, or even negative. This outcome is not assured, but it is at least possible and should be given serious consideration.

II. Potential Sources of Future Cost

The preceding chapter emphasized the secondary behavioral responses associated with changes in private pension plans, and outlined a framework for assessing them. This chapter reviews recent and projected changes in private pension plans. It thus provides a basis for evaluating likely sources of future pension-related costs, including:

Changes in coverage;
Changes in structure;
Changes in government regulation; and
Maturation of plans.

Each of these sources of pension-related costs is discussed in the following sections.

A. Changes in Coverage

As table 2.1 reveals, the number of workers covered by private pension plans has grown tremendously in a half century, from almost 3 million in 1930 to over 45 million workers in 1975.[10]

The growth of pension coverage has been uneven across industries. Although most manufacturing employees and nearly all mine workers are now covered by private pension plans (see table 2.2), pension coverage is still rare in retail trade, finance/insurance/real estate, and services. This indicates that future costs of increased pension coverage are likely to be concentrated in specific industries.

[9] The estimation of behavioral responses must also consider the reaction of other firms to changes in the pension provisions and other parameters of those firms that modify their pensions. These general-equilibrium effects complicate but do not vitiate the economic analysis described here.

[10] Reported statistics overstate the actual number of covered workers because of double counting of (1) workers in the basic and supplemental plans of the same employer and (2) workers vested with one firm and active in another and the inclusion of unvested workers who will not attain vesting.

TABLE 2.1—PERSONS COVERED BY MAJOR PENSION PROGRAMS IN THE UNITED STATES

[In thousands]

Year	Private plans (1)	Government Plans: Railroad retirement (2)	Government Plans: Federal civilian employees (3)	Government Plans: State and local employees (4)	Government Plans: OASDI (5)
1930	2,900	1,400	432	800	----------
1940	4,260	1,349	745	1,552	27,622
1950	10,255	1,881	1,873	2,894	44,477
1960	23,015	1,654	2,707	5,160	73,845
1970	36,100	1,633	3,625	8,591	98,935
1975	45,494	1,558	4,278	11,230	110,085

Source: American Council of Life Insurance, Pension Facts, 1977, p. 21.

TABLE 2.2.—1974 PENSION-COVERED EMPLOYMENT BY INDUSTRY

	Total employment	Coverage by single employer plans: Workers	Coverage by single employer plans: Percent	Coverage by multi-employer plans: Workers	Coverage by multi-employer plans: Percent
Total	64.0	17.07	100.0	8.7	100.0
Manufacturing	20.1	12.4	62.0	1.7	8.5
Mining	.7	.6	85.7	.1	14.3
Construction	4.0	.1	2.5	3.0	7.5
Transportation and public utilities	4.7	1.5	31.9	1.5	31.9
Retail trade	17.0	.9	5.3	1.1	6.5
Finance/insurance/real estate	4.1	1.2	29.3	0	0
Services	13.4	.4	3.0	1.3	9.7

Source: 1974 BLS pension file.

A.1 EXTENSION OF COVERAGE

The growth of private pension plans has been fueled by a variety of factors, including favorable tax treatment, unionization, slow growth of Social Security benefits, and a greater interest in earlier retirement. Demographic factors (e.g. aging of the population and decentralization of the family) have also generated increased demand for private pensions. The question now is whether the rapid growth of private pensions will continue.

Problems arise in forecasting future pension coverage because of changes in average plan size, patterns of industrial growth, types of new plans, and terminations of existing plans. To forecast accurately the size and industrial distribution of new plans over the future, recent additions to the types of plans available must also be considered. The creation of Keogh plans and Tax-Sheltered Annuities (TSA's) in 1968, Independent Retirement Accounts (IRA's) in 1975, and, more recently, Simplified Employer Pensions (SEP's), has provided new avenues for expanded pension coverage. The Keogh, TSA, and IRA plans diminish the demand for employer-provided plans. Little is known, however, about the public's response to these new plans, and only rough calculations of their incidence in the future can be made.[11]

Table 2.3 shows growth in these small individual pension plans since 1968. While the growth of Keogh plans has been greater than TSA's,

[11] See ICF, Inc., "Structure of the ICF Private Pensions Forecasting Model" (Washington, D.C.: April 1979) for a discussion of such forecasts.

both have increased steadily over the 10-year period. The number of IRA's has grown most rapidly, nearly doubling in the first 3 years this type of pension was available. If individuals not covered by a plan continue to establish (and contribute to) IRA's, employer-provided pension coverage may not continue to increase in the future. However, as more younger workers become aware of the need to provide for old-age retirement, they may still prefer employers who fund a pension plan, providing an incentive for firms to establish or improve their pension benefits. Also, the newest type of plan (SEP) may make it easier and less expensive for employers to initiate or maintain a pension plan.

TABLE 2.3.—PARTICIPANTS IN OTHER PRIVATE PENSION ARRANGEMENTS, 1968–77

[In thousands of workers]

	IRA's	Keoghs	TSA's	Total
1968		232	183	415
1969		394	207	681
1970		496	245	741
1971		565	262	827
1972		662	319	981
1973		736	371	1, 107
1974		879	424	1, 382
1975	1, 278	1, 166	514	2, 958
1976	1, 800	1, 198	608	3, 606
1977	2, 485	1, 211	665	4, 361

Source: Structure of the ICF Private Pension Forecasting Model, p. 33.

While the institutional environment seems conducive to continued growth of pension coverage, recent research points to a diminished need for even existing pension coverage. Several years ago, Livernash suggested that as the segment of the work force not covered by private pensions grew smaller, its needs would become more conspicuous. He expected greater pressure on government to increase public benefits, thereby relieving pressure on private plans.[12] In separate, more recent papers, Munnell and Logue make a similar argument, noting that the need for private pension plans has diminished as a result of improved Social Security benefits.[13] As the proportion of pre-retirement wages replaced by Social Security retirement benefits has grown from around 30 percent in the 1940's and 1950's to the 60–65 percent range in the 1970's, one of the motivating forces behind growth in private pensions has dissipated. Both Munnell and Logue conclude that further growth in pension coverage does not seem likely. If integrated benefit formulas are disallowed, the reduced growth rate of private pensions will be even more pronounced.

A.2. PLAN TERMINATIONS

The problems of estimating new plan formations and accounting for new types of plans when forecasting future coverage is compounded by terminations of existing plans following passage of ERISA. Approximately 18 percent of small plans terminated be-

[12] E. Robert Livernash, "Wages and Benefits," A Review of Industrial Relations Research, Vol. I (Madison: Industrial Relations Research Association, 1970), p. 121.

[13] Alicia H. Munnell, "The Future of the U.S. Pension System," and Dennis E. Logue, "How Social Security May Undermine the Private Industrial Pension System," in Financing Social Security, ed. Colin D. Campbell (Washington: American Enterprise Institute, 1979).

tween 1975 and 1977.[14] It is too soon to tell whether observed high termination rates are short-term in nature or whether decreased plan formation (relative to the rate before ERISA) and continued plan terminations will be the rule. If terminations continue at a high rate, greater reliance on IRA's and Keogh's will be required for pension coverage to increase. To counter declining trends in new plan formations, Congress may decide to establish greater incentives for small firms to sponsor pension plans or for individuals to establish their own accounts.

It is not clear why so many pension plan terminations have occurred. Understanding this phenomenon may provide a clue as to its duration. For example, firms which sponsor numerous plans may have consolidated their pensions. Some plans may be outdated, with no new participants for many years though they may continue to pay benefits to retired workers, or may cover small numbers of employees. In an attempt to reduce paper work and related administrative costs, firms may have combined such plans into fewer, but larger plans.[15] Thus, it is possible that the observed growth of terminations may be short-run in duration and pose no threat to continued growth in private pension coverage. In fact, evidence that terminations are declining has recently been reported.

B. Changes in Structure

Growth of pension-plan coverage is only one potential source of higher costs. As pension plans have grown, their structure has evolved as well. There is no prototypical plan today, nor has there been one in recent years. At all times, each individual pension plan has been characterized by a unique combination of a score of various provisions defining participation, eligibility, retirement, and benefit conditions. Moreover, these provisions have been subject to continual change by statutory mandate, government regulation, or private initiative. In general, these changes have tended to increase access to retirement benefits, thereby increasing the expected value (and actuarial cost) of private pension benefits.

Mandated modifications to pension structure may require plans to add a provision, or to change existing provisions to fit specific criteria. ERISA's vesting requirement combined both elements, requiring plans to offer vesting and specifying limits on the conditions under which vested benefits are acquired. In another instance, ERISA required that, if a plan were to have a participation age requirement, the age could not be greater than 25. Within two years after Congress passed ERISA many plans added such a requirement, a reaction neither expected or desired by Congress. Another mandated change that will affect some plans, but not others, is the limitation on forced retirement contained in the 1978 amendments to the Age Discrimination in Employment Act (ADEA). Nearly one-half the plans sampled by the Bureau of Labor Statistics (BLS) in 1974 had neither compulsory nor automatic retirement; such plans will incur higher employer-contribution costs.

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[14] "Effects of the Employee Retirement Income Security Act on Pension Plans With Fewer Than 100 Participants," General Accounting Office, Apr. 16, 1979, p. i.

[15] Winklevoss, p. 72. The economies of scale associated with plan size are documented in GAO, op. cit. and Price, Waterhouse, Inc. "Administrative Costs of Small Retirement Plans, 1974–1976," May 1978.

Although mandated changes in private pension plans are an important source of pension-related costs, legislative initiatives are not the only source of structural change. On the contrary, private employers have continuously revised their plans, even in absence of public mandates. Indeed, ERISA and other legislative initiatives have only accelerated the rate of structural change. In their absence, the structure of private pension plans would have continued to evolve. Hence, not all post-ERISA changes in structure (or related costs) should be attributed to legislated mandates.[16]

B.1. SPECIFIC MANDATES

Among the structural changes mandated by law, some examples based on ERISA and ADEA can be used to assess likely cost impacts. For this purpose, we can compare the characteristics of plans in 1974 (as surveyed by BLS) with the characteristics mandated by these two acts. In so doing, we can gauge the extent of mandated change.

The magnitude of provision changes due to ERISA and ADEA is assessed through computing the number of plans that did not meet one or more of the following mandated requirements:

(1) Vesting with no age requirement and less than or equal to 10 years of service, or graded vesting offering at least 25 percent vested rights at 5 years, 50 percent vested rights at 10 years, and 10 percent vested rights at 15 years.

(2) A joint and survivor benefit equal to at least 50 percent of the regular benefit and offered automatically.

(3) Participation requirements with age less than or equal to 25 and service less than or equal to one year.

(4) A break-in-service provision that adds all pre-break service to post-break service unless the period of absence was equal to the pre-break service.

(5) Mandatory retirement age requirements (if any) restricted to 70 years or over.

The BLS survey

The Bureau of Labor Statistics (BLS) analyzed a sample of 1,467 defined benefit plans including all plans with 5,000 or more participants, and one of every 22 plans with fewer than 5,000 participants. The probability sample was drawn from all plans whose administrators reported to the Department of Labor (DOL) in accordance with the Welfare and Pension Plan Disclosure Act of 1959, as amended. Each plan covered at least 100 workers (smaller plans do not have to file) and excluded defined contribution, profit-sharing, and other non-defined benefit plans (thrift, savings, Keogh plans, etc.) The sample covers the bulk of workers in defined benefit plans. The fact that the 1974 BLS sample contains no information on the smallest plans, an important and growing segment of the private pension universe, restricts our analysis to roughly two-thirds of the workers [and firms] with defined benefit plans.

The provisions recorded by BLS analysts were in effect on September 1, 1974. Thus, the sample provides a picture of the universe of

[16] See R. Frumkin and D. Schmitt, "Pension Improvements since 1974 Reflect Inflation, New U.S. Law," Monthly Labor Review, April 1979, or Bradley R. Schiller, and Donald Snyder, "Private Pension Plans and the Older Worker: Further Analyses" (Washington, D.C.: U.S. Administration on Aging, March 1979).

plans just before ERISA was signed into law. The 1,467 defined benefit plans in the sample included 46 supplemental plans, leaving 1,421 basic pension plans in the sample. The 16 million active workers in these basic plans were covered either by a single-employer or multiemployer plan.

Table 2.4 indicates the percentage of 1974 plans that did not comply with legislative requirements for vesting, joint and survivor annuity option, participation requirements, break-in-service credit, and mandatory retirement. As is evident, the mandates of ERISA and ADEA required structural change in the majority of private plans; most were required to make multiple provision changes. These changes certainly altered the direct costs of pension provision and probably altered wage, turnover, and productivity behavior as well. To date, no attempt has been made to assess the net cost of these changes, either in the aggregate or for selected firms and industries.

TABLE 2.4.—IMPACT OF POLICY MANDATED CHANGES IN 5 PROVISIONS

Provision	Percentage of plans not meeting standard in 1974	Percentage of affected covered workers
ERISA vesting requirements	73.5	67.9
Automatic joint and survivor option	93.0	83.5
Participation age over 25 or participation service over 1 year	21.1	11.2
Break in service	95.4	88.2
Mandatory retirement less than 70 years of age	49.3	17.3

B.2. FUTURE CHANGES IN STRUCTURE

While many changes have occurred in private pension plans in recent years, more reforms have been proposed and are currently under consideration in Congress. Some examples of proposed reforms include: (1) requiring plans to provide survivor's benefits to the spouses of workers who die after becoming eligible for early retirement but before retirement occurs; (2) further reduction in the period of service required for vesting; (3) liberalized permanent disability retirement benefits; and (4) adjustment for the effects of inflation on the pension benefits paid to retirees. While this list is not exhaustive, it is lengthy enough to indicate that the various reforms proposed will not have an equal impact on all plans. For example, while many plans offer joint and survivor benefits, few make this protection available to early retirees. Thus, such a requirement would affect a majority of plans. Further reductions in vesting service to five years from 10, as has often been suggested, would similarly affect nearly all plans. While over 85 percent of plans offer some form of long-term disability protection, the requirements are often quite stringent. Mandated rules concerning disability would force many plans to liberalize their disability protection. Finally, pension plans sometimes raise benefits to those already retired to compensate them for periods of inflation, but few (if any) plans contain explicit provisions for such an adjustment. Requiring pension plans to pay inflation-indexed benefits similar to Social Security would markedly increase direct pension costs (e.g., employer contributions).

C. Changes in Regulation

Recent changes in pension-related cost cannot be explained fully by changes in pension structure and coverage. Federal regulation of private plans has also contributed directly to employer costs. Regulation of pension plans under ERISA includes reporting, disclosure, and funding requirements. More complex reporting requirements have added to the administrative burdens of pension fund management, particularly in small plans. Disclosure requirements increase direct costs because of printing and distribution. Disclosure requirements also may raise pension costs indirectly by highlighting pension features and thus facilitating interplan comparisons, which in turn may lead to increased pension demands. Such interplan comparisons may also weaken the behavioral responses (secondary effects) previously associated with particular provisions.

Funding requirements do not raise the true economic cost of pension plans. Rather, they force firms to fund future (promised) benefits in the present. Thus, accounting costs of pensions rise when unfunded past liabilities are paid off, but this has no impact on (discounted) current costs of pensions.

D. Maturation of Pension Plans

As a pension plan ages, so do the workers covered, while the number of retirees grows. The initial retirees probably have few years of covered service and receive low benefits. As time passes, both age and service of retirees increase and a steady flow (more or less) of retirements occurs each year. At this time, a plan is "mature" and costs are at a maximum. About one-half of private pensions are mature in this sense.[17] Accordingly, future cost increases will take place as plans mature, even without changes in coverage, structure, or regulation.

D.1. RECIPIENTS

The number of persons receiving private pension benefits has risen sharply over the last two decades, as would be expected in a maturing pension system (see table 2.5). In 1975, over 7 million Americans received private pension payments totalling nearly $15 billion. While the number of persons covered has almost doubled since 1969, the number of annuitants has grown nearly four times, from 1.78 to 7.02 million, reflecting both a maturing of the population *and* the private pension system. The number of annuitants increased from 1 percent of workers in Social Security-covered employment in 1950 to over 6 percent in 1975 as the private pension system matured.

D.2. BENEFITS

In contrast to the greater incidence of pensions as a source of income, real benefits received by retirees have grown little during this period. For example, during the period 1950–75, average private pen-

[17] Winklevoss, p. 72.

sion benefits, in nominal dollars, rose over 150 percent from $822 to $2,115 per year (table 2.5). However, since the Consumer Price Index increased 124 percent during the same period, average real benefits in 1975 were little higher than in 1950.

The increase in real benefits paid is substantially less than oft-quoted increases in *illustrative* benefits, i.e, the benefits available to long-service workers who retire at "normal" retirement age. One reason is that benefits actually *paid* are net offsets excluded from illustrative calculations. For example, early retirement, level income, survivor, and health-offset provisions, if exercised, lower benefits received. Second, benefits paid to retirees are seldom raised sufficiently to counter losses due to inflation. Recent high rates of inflation have drawn attention to the real income losses suffered by pensioners. Only a few plans adjust benefits for inflation and the extent of *ad hoc* increases is unknown.[18] If such increases become institutionalized, employer contributions could rise markedly.[19] Average benefits paid would also rise. Third, greater numbers of short-service workers are now eligible for a pension at retirement, or even two pensions, reducing the size of average real pension benefits paid by private plans.

TABLE 2.5.—PERSONS RECEIVING PRIVATE PENSION BENEFITS AND AMOUNT OF BENEFITS DURING YEAR

Year	In thousands		Average benefit
	Persons not yet receiving pensions	Persons receiving pensions	
1950	9,820	450	$822
1960	21,240	1,780	966
1970	31,350	4,750	1,551
1975	38,480	7,020	2,115

Source: American Council of Life Insurance, Pension Facts, 1977, pp. 30–31, 36.

E. Summary

Future costs of pensions are sensitive to trends in coverage, structure and government regulation. Direct costs of the current pension system will rise in the absence of any change in coverage and structure because the system is maturing. While some analysts cast doubt on the need for continued pension growth, there is little evidence that American firms and workers are willing to abandon their pension plans. As the population ages, workers will become more aware of the need to provide for retirement and may search for pension-covered employment.

Many pension reforms have recently been enacted and more are proposed. These changes will alter the direct (actuarial) costs of pension provision as well as wages, turnover, and productivity behavior. Despite the potential impact of these changes, their net costs have not been measured, either in the aggregate or for selected firms and industries. As a result, policy planning now depends upon anecdotal evidence.

[18] A recent example of an ad hoc adjustment to retirees' benefits was negotiated in the auto industry. See the Washington Post, September 15, 1979, p. 1 and the Wall Street Journal, August 29, 1979, p. 34.

[19] Only 2 percent of defined benefit plans had explicit arrangements to adjust benefits for higher costs of living.

BY THE COMPTROLLER GENERAL

Report To The Chairman, Joint Economic Committee Congress Of The United States

OF THE UNITED STATES

An Actuarial And Economic Analysis Of State And Local Government Pension Plans

At the request of the Joint Economic Committee, GAO estimated the annual cost of future benefit payout to State and local government pension plans. Our analysis of several measures of financial soundness demonstrated an increasing financial burden on these pension plans in the aggregate. An increasing proportion of retirees in population of State and local employees is a basic cause of the problem. Varying the economic parameters does not change this fact, but merely changes the year in which the problem is first evident.

Our analysis is not intended to substitute for a detailed actuarial analysis of the more than 6,600 State and local pension plans, but concentrates on identifying emerging trends that should be brought to the attention of policymakers.

PAD-80-1
FEBRUARY 26, 1980

COMPTROLLER GENERAL OF THE UNITED STATES
WASHINGTON, D.C. 20548

B-164292

The Honorable Lloyd M. Bentsen, Jr.
Chairman, Joint Economic Committee
Congress of the United States

Dear Mr. Chairman:

As part of the Special Study on Economic Change, the Joint Economic Committee has asked the GAO to estimate the annual cost of future benefit payout to State and local government pension plans. This report presents those estimates. Forecasts of other relevant economic and demographic factors are also presented and compared to benefit payout projections to provide perspective. The effect of these factors on the financial viability of State and local government pension plans in the aggregate is discussed. No recommendations are made for action by the Congress.

Copies are also being sent to the Pension Task Force, the President's Commission on Pension Policy, the Social Security Administration, the Department of Labor, and others who participated in our review process.

Sincerely yours,

Elmer B. Staats

Comptroller General
of the United States

COMPTROLLER GENERAL'S REPORT TO THE CONGRESS

AN ACTUARIAL AND ECONOMIC ANALYSIS OF STATE AND LOCAL GOVERNMENT PENSION FUNDS

D I G E S T

State and local government pension plans exert an important and growing influence on the United States' economic, social, and political fabric. These plans held roughly $108 billion in assets in 1975, and their management will affect the economic security of the 13 million current participants as well as of future participants.

The number of active employees in plans administered by State and local governments grew from 1.6 million in 1940 to 11.2 million in 1975. The assets in State and local plans as a percentage of total assets of all pension plans grew from 13.6 percent in 1950 to 26 percent in 1975 and grew from 20 percent of all government-administered plans in 1950 to 55.5 percent in 1975. Thus, State and local plan enrollment and assets have increased at an even faster rate than that of all pension plans. (See p. 2.)

CONCLUSIONS

At the request of the Joint Economic Committee, GAO estimated the annual cost of future benefit payout to State and local government pension plans. Our analysis of several measures of financial soundness showed evidence of an increasing financial burden on State and local government pension plans in the aggregate. In our analysis this problem is caused largely by the increasing proportion of retirees in the population of State and local government employees. Varying the economic parameters does not change this fact but merely changes the year in which the problem is first evident. Furthermore, growth in employment above the levels shown does not seem likely, and the characteristics of the plans were purposely unchanged, since a basic tenet of the review was to see what would happen if current benefit and financing provisions were continued.

Therefore, under the assumptions of this report a worsening financial status for State and local plans in the aggregate is certain.

Aggregating plans masks the differences among them. Our projections are driven by large plans, which are generally better funded (94 percent of the employees surveyed by the Pension Task Force were in large plans). Smaller plans, which often are not as well funded, are given less weight. The Pension Task Force report estimated that only 20 percent of State and local employees are enrolled in plans that are fully funded by actuarial standards. 1/ Furthermore, a recent GAO report 2/ reviewed 72 State and local government pension plans and found that 53 could not meet the funding standards imposed by the Employee Retirement Income Security Act of 1974 on private pension plans. These facts, combined with the inexorable growth in the proportion of retirees, explain why the financial status of the plans in the aggregate begins to deteriorate in the 21st century. Under some conditions, the decline is more rapid but the conclusion is the same: if present funding practices continue, a deterioration in the financial condition of the plans in the aggregate is likely. The few fully funded plans should remain in good shape, but the numerous poorly funded plans can expect financial difficulty in this century.

METHODOLOGY

Our analysis is not intended to be a substitute for a detailed actuarial analysis of the more than 6,600 State and local pension plans, but rather concentrates on

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1/The Pension Task Force was created by the Employee Retirement Income Security Act of 1974 to study public employee retirement systems. See discussion of funding techniques on p. 43, app. II.

2/"Funding of State and Local Government Pension Plans: A National Problem," U.S. General Accounting Office, HRD-79-66, August 30, 1979.

identifying emerging trends that should be brought to the attention of policymakers. The basic approach was to (1) divide the universe of over 6,600 State and local pension plans into homogeneous subdivisions, (2) develop prototypical plans representing the current characteristics of State and local government employees, (3) forecast employment and salary levels for each subdivision using reasonable assumptions about future economic and demographic growth, and (4) create an actuarial model to project cost streams and employment levels for the prototypical plans.

Several scenarios were developed showing the effect of varying the actuarial model's economic and demographic parameters, such as employment growth and the inflation rate. Other scenarios could have been presented showing the effect of varying other parameters, but time and resource constraints prevented further analysis. The projections show what would happen in the aggregate if the conditions that prevailed in the mid-1970s were combined with reasonable assumptions concerning future economic and demographic growth.

Benefit Projections

For the base case assumptions, benefit payments grow steadily through the remainder of the 20th century and then begin to grow more rapidly after the end of the century. (See p. 9.) Total payroll increases steadily, being driven upward mainly by inflation. The ratio of benefits to payroll remains roughly constant throughout the remainder of the 20th century. Benefits begin to grow more rapidly after the year 2000, reaching 17 percent of payroll in 2020. The ratio of retired employees to the total of active and retired employees grows at a roughly linear rate (see p. 11), increasing from 15 percent in 1980 to 24 percent in 2020. These figures indicate an increasing financial burden on State and local government retirement systems.

Flow of Funds Analysis

The review's main focus was projecting the cost to State and local government pension plans of future benefit payout. To place benefit payout in perspective, benefit projections were compared to contribution and asset growth projections which allowed a simplified flow of funds analysis.

The base case assumptions show that assets grow throughout the 20th century but at a much lower rate after the year 2000. (See p. 11.) Benefits exceed estimated contributions after 2012. In the 21st century, the ratio of assets to benefits declines steadily until benefits exceed the sum of asset growth and contributions in 2049. This indicates that the plans in the aggregate would not be able to meet obligations from current income. (See p. 14.)

Contents

CHAPTER 1

INTRODUCTION

State and local government pension plans exert a substantial and growing influence on the economic, social, and political fabric of the United States. Recent experience shows their growth in size and scope to be rapid. Roughly $108 billion in assets were held by these plans in 1975. The way these assets are managed will affect the economic security of the 13 million current participants as well as that of future participants.

The Special Studies on Economic Change Subcommittee of the Joint Economic Committee is directing a study of future economic problems. One goal of the study is to obtain more accurate estimates of future outlays from pension plans and the potential effect of these outlays on the Nation's economic resources. The Joint Economic Committee asked us to estimate the cost of benefit payouts to State and local pension plans through the year 2020. We have based our estimates on actuarial and economic analyses of data obtained from the Pension Task Force Survey, the Bureau of the Census, and other sources.

The projections presented here do not pretend to predict future events exactly. Their purpose is to provide a better understanding of emerging financial problems, given reasonable assumptions about future economic and demographic changes. The projections are a result of aggregating all State and local government pension plans into two prototypes. Aggregating masks differences among plans, but allows a clear look at long-term trends so that problems can be addressed before they become worse. Note, however, that to an extent well-funded plans offset poorly funded plans; even when the plans are financially sound in the aggregate, some plans will be in serious financial straits.

GROWTH OF PUBLIC PENSION PLANS

The development of employee retirement systems began in the public sector. Before the turn of the century, groups of policemen, firemen, and teachers were covered under service-related retirement systems in New York, Boston, and other cities. Over 12 percent of the large State and local plans now in operation were established before 1930.

Social Security was instituted in 1935 but was not extended to State and local government employees. Nearly one-half of large State and local plans were established during

1931 to 1950 when Social Security coverage for public employees was being debated. Over one-third of the large plans began or underwent a major restructuring after 1950 when State and local employees were given the option to join the Social Security System. In contrast, nearly two-thirds of the small plans were started after 1950 and nearly one-fourth since 1970.

The number of active employees in plans administered by State and local governments grew from 1.6 million in 1940 to 11.2 million in 1975. The assets held by all pension plans in the U.S. (including Social Security) totaled over $400 billion in 1975, up from $38 billion in 1950. The assets in State and local plans as a percentage of total assets of all pension plans grew from 13.6 percent in 1950 to 26 percent in 1975. As a percentage of all government-administered plans, State and local plans grew from 20 percent in 1950 to 55.5 percent in 1975. Thus, while enrollment and assets in all pension plans have grown substantially, State and local plan enrollment and assets have increased at an even faster rate. This increase is largely the result of the substantial overall growth of State and local government in the last 20 years.

GROWING CONCERN OVER PENSION PLAN PERFORMANCE

As the number of people depending on pensions for future financial security grew, concern developed about the integrity of pension plans. In the 1960s, public awareness was heightened by news articles describing various abuses by the administrators of pension plans. Few plans actually failed. More frequent were complaints about restrictive age and service requirements, mismanagement of funds, and termination of coverage for employees who were close to retirement.

The closing of the Studebaker plant in South Bend, Indiana, in 1964, which inflicted heavy pension losses on workers, led to congressional hearings. Subsequent hearings on related pension concerns preceded the passage of the Employee Retirement Income Security Act (ERISA) on Labor Day, 1974. Although this law does not require that an employer have a pension plan, it does provide partial protection to the participants in plans by setting standards for participation, vesting, funding, and fiduciary responsibility.

The Congress chose not to include public retirement systems in the provisions of ERISA. Two reasons for this decision were the small number of complaints from public beneficiaries and the absence of reliable information about public

plans. However, the Congress did create the Pension Task Force to investigate public pension plans. Data gathered by GAO for the Pension Task Force were a basic data source for this report.

A bill was introduced in the 94th Congress that prompted hearings on public pension systems. Because of its similarity to ERISA, it was referred to as the Public Employee Retirement Income Security Act. PERISA bills have been introduced in subsequent sessions of Congress, and President Carter has appointed a commission to develop a national policy for both public and private pension plans.

SCOPE OF THIS REVIEW

Our primary source of information is data collected by GAO for the Pension Task Force Report issued in March 1978. We also collected data from the Bureau of the Census, the Bureau of Labor Statistics, and other sources. Chapter 2 discusses our methods of estimating future employment and salary levels of State and local government employees, creating prototypical pension plans, and forecasting the future costs of State and local pension plans.

To place the projections of benefit payouts in perspective, we compared them to projections of contribution and asset growth, which allowed us to make a flow of funds analysis. Chapter 3 summarizes the benefit payout projections and the flow of funds analysis. Several scenarios are presented covering a wide range of economic and demographic assumptions. Data limitations prevented a detailed actuarial analysis; our analysis is descriptive of the general financial conditions of the plans in the aggregate as measured by certain rough measures discussed in Chapter 3.

Appendix I contains information on the projections of State and local government employment and salary levels. Appendix II provides technical information on the development of the model to project benefit payout and other actuarial variables.

CHAPTER 2

METHODOLOGY

We developed our estimates of the future cost of State and local government pension plans by

--dividing the universe of 6,630 State and local pension plans into homogeneous subdivisions and determining the characteristics of the two prototypical plans that could be used to estimate the future costs of all plans;

--forecasting employment and salary levels for each subdivision; and

--creating an actuarial model to project benefit streams for these prototypical plans.

To determine the number and characteristics of the prototypical plans, we analyzed the Pension Task Force survey data and other sources. 1/ Forecasts of employment and salary levels for State and local government employees were based on an econometric analysis of historical data from the Bureau of the Census and forecasts from a national economic model. 2/

The characteristics of the prototypical plans and the forecasts of employment and salary levels were used as inputs to the actuarial model that projected benefit payout for State and local government pension plans. We developed the actuarial model for age and service retirees for large plans, and extended the results to the universe of all plans. Social Security benefits are not included in our estimates, because the plans were not integrated with Social Security to any appreciable degree.

CHARACTERISTICS OF PROTOTYPES

A review of the Pension Task Force survey and other material led us to conclude that two prototypes would be necessary--one representing teachers' plans, another representing those of other State and local government employees. We designed the types to conform initially to data collected by the Pension Task Force survey. The prototypes began in the base year 1975 with the characteristics shown in table 1.

1/See appendix II.

2/See appendix I. It was our judgment that historical growth levels would not continue unabated.

Table 1

Membership, Benefits, and Salaries for 1975 for the Two Prototypes

Characteristics	Teachers	Other State and local employees
Active membership	2,480,772	5,333,925
Retired membership a/	401,841	788,024
Total benefit payments (millions)	$2,300	$3,200
Total payroll (millions)	$25,500	$45,100
Average annual salary	$10,275	$8,451

a/Age and service retirees only.

Other data sources were used for areas that the Task Force survey did not cover. The age and sex distributions of the active populations were based on the Census Bureau's "Current Population Survey" (January 1978). For age and benefit distributions of the 1975 retirees, we aggregated data from actuarial valuations of certain large State, local, and teachers' retirement systems. Based on a review of 23 large plans conducted by the Pension Task Force, we set the post-retirement cost-of-living adjustments at half the future increases in the cost-of-living index. The Unisex Pension 1974 Table (adjusted for varying male-female ratios and future improvements in mortality) was used for mortality rates. Information on ancillary benefits was obtained from the Census Bureau.

PROJECTION OF SALARY AND EMPLOYMENT LEVELS

To capture the effect of different growth patterns among different regions of the U.S. and among different categories of State and local employees, we projected salary and employment levels for the four U.S. census regions and for six State and local government employment categories. Employment categories were aggregated into two prototypes for the actuarial model discussed in the next section.

Real per capita income correlates with several factors (such as urbanization, education, real per capita Federal Government transfers) that affect State and local government employment, and therefore is used as a proxy for all these factors. Our econometric model forecasts employment per million population as a function of real per capita income. By constraining the amount of employment per million population, an upper limit to the income effect is achieved, thereby constraining the future growth rate to a level lower than that found in the historical data.

The average annual salary in each employment category of State and local government in each of the six regions is based on fixed salary scales which are periodically increased for cost-of-living adjustments. Increases in the average nominal salary reflect increases in average years of experience, urbanization, cost of living, productivity improvements, and overall labor market conditions. The average nominal salary in each employment category in each region is considered as a function of two broadly classified categories--the cost-of-living index and other factors. Factors other than the cost of living adjustment correlated highly with regional real per capita income, and hence, we used the real per capita income in each region as a proxy for all the independent variables that can explain the variation in the real annual average salary.

The projections of State and local employment and salary levels, along with the national cost-of-living index, were the primary economic and demographic inputs for the actuarial model to project future benefit payout.

MODEL TO PROJECT BENEFIT PAYOUT

The characteristics of the prototypical plans and the projections of employment and salary levels were used as inputs to the actuarial model to estimate future benefit payout. Within each prototype, we projected benefits for three groups--persons retired in 1975, active employees in 1975, and new entrants after 1975. Projections of the growth in teachers' and in State and local governments' work forces determined the number of new pension plan entrants needed each year in the future.

To the first group, those retired in 1975, we assigned an initial age and benefit distribution, and then "aged" the group using our assumed mortality rates. A projection of inflation through 2020 was used to give the surviving retirees post-retirement cost-of-living adjustments. The total payroll (average salary times number of employees) was distributed initially among the active employees using a merit scale to

reflect a typical worker's career salary progression, neglecting inflation.

The active employees in 1975 and the new entrants who "survived" to retirement were accorded a benefit using the average benefit formulas constructed from the Task Force data. Retirement ages were spread uniformly over a 10-year period, with the median age determined by a review of actuarial valuations and plan provisions. Entry ages were set at 30 and 34 for the teachers' and the State and local prototypes. Note that they represent the average entry age for a typical retiree and not for a typical new entrant. The benefit formulas, entry ages, and retirement ages resulted in an average replacement ratio (that is, percentage of final compensation) of 52 percent for teachers and 50 percent for State and local retirees. Final compensation in both prototypes was the average of the last 4 years' salary.

The assumed benefit formulas were applied only to those employees retiring on account of age and service. Furthermore, the benefits so generated were confined to the modeled population--that is, large, defined benefit 1/ teachers' and State and local pension plans. Before a projection for all 6,630 plans could be obtained, the benefits had to be increased to take into account ancillary benefits 2/ and those plans (and members) outside the modeled population.

From 1970 to 1975 contributions to State and local pension plans increased but at a slower rate than benefits. As a percentage of payroll, however, contributions stayed roughly constant while benefits grew steadily. The Pension Task Force survey showed that contributions were approximately 15 percent of payroll in 1975 for large plans. For the flow of funds analysis, we assumed that this rate would continue through 2020. This assumption shows what the 1975 contribution level might lead to if allowed to continue unchanged.

1/A defined benefit plan is one in which a participant's benefit is computed by a formula relating such factors as pay, age, and years of service. In contrast, a defined contribution plan is one in which the contribution is fixed and a participant's benefit is determined by such factors as the plan's investment earnings and annuity purchase rates at retirement.

2/Ancillary benefits include disability and survivor benefits and withdrawal payments. Data were obtained from the Bureau of the Census for 1974 through 1977.

The Pension Task Force survey showed that State and local government pension plans held $108.3 billion in assets in 1975. A rate of return on assets of 7.5 percent 1/ was assumed for the base case, and assets were projected by adding contributions and interest income and subtracting benefit payments each year.

Several scenarios were developed showing the effect of varying several key parameters of the actuarial model. The effect of varying the growth rate for State and local government employment is discussed in the text. The effect of varying the inflation rate is discussed only in general terms because of the subjective judgments involved in applying different inflation rates to the model. Other scenarios could be presented showing the effect of varying other parameters, but time and resource constraints prevented further analysis.

1/Since the assumed average inflation rate is 7.18 percent per year for the projection period, a small amount of real growth (that is, growth above the level of inflation) is allowed although this level of growth has not always been achieved in the recent past.

CHAPTER 3

RESULTS

The review was directed primarily toward projecting the future cost of benefit payout for State and local government pension plans. In the course of the review, projections were also made for the total number of active (contributing) employees, total age and service retirees, and total payroll. Finally, contributions and asset levels were projected to allow a flow of funds analysis that provides perspective for the benefit projections.

BASIC PROJECTIONS

The projection of benefit payout was made using the parameters determined by the analysis of salary and employment levels, the long-term trends estimated by the national economic model, and the basic characteristics of the prototypical plans. The assumptions underlying the national economic model affect the projections of State and local government employment and salary levels. The model's basic economic assumption is that the economy will grow steadily at about 2.5 percent (except for a small downturn in 1980), leading to a balanced Federal budget in the mid-1980s. State and local government employment is projected to continue growing through 2020, but the rate of growth declines sharply after 1990. Nonetheless, employment will increase by 62 percent from 1980 to 2020. (The ratio of State and local government employment to total U.S. population will only increase from 5.3 percent in 1980 to 6.6 percent in 2020.) The average salary in 2020 is 20 times greater than the 1980 salary, the result of an average annual inflation rate of approximately seven percent and a real growth rate of about one percent per year. 1/

The elements of the prototypical plans are summarized in chapter 2 and detailed in appendix II. This information is used as a starting point for the projection of benefit payout. The projections show what would happen in the aggregate if the conditions that prevailed in the mid-1970s were combined with reasonable assumptions concerning future economic and demographic growth.

1/The inflation rate is 7 percent after 1995 and is higher before that year. The average annual inflation rate is 7.18 percent overall. Real salary growth also fluctuates with an average annual growth rate of 0.90.

Table 2

Benefit Payout Projections
Base Case Assumptions

	1980	1985	1990	1995	2000	2005	2010	2015	2020
Total benefit payout (billions of dollars)	13	28	47	69	101	173	341	613	995
Total payroll (billions of dollars)	162	274	466	748	1160	1768	2629	3905	5809
Benefits as a percentage of payroll	8	10	10	9	9	10	13	16	17
Active employees (millions)	11.6	13.0	14.2	15.3	16.1	16.9	17.7	18.4	19.1
Retired employees (millions)	2.0	2.6	2.9	3.0	3.0	3.4	4.3	5.3	6.1
Retired employees as a percentage of total active and retired employees	15	17	17	16	16	17	20	22	24

Average annual percentage increase in salary (inflation)	7.18	Average annual percentage increase in employment growth	1.37
Average annual percentage increase in salary (real)	0.90	Average annual percentage increase in post retirement	3.59

Benefit projections

Table 2 shows the basic projections. Benefit payments grow steadily through the remainder of the 20th century and then begin to grow faster in the 21st century. Total payroll increases steadily, being driven upward primarily by inflation. Benefits as a percentage of payroll remain roughly constant throughout the 20th century and begin increasing after the year 2000, as benefits grow at a more rapid rate. As this ratio increases, the financial burden on State and local government pension systems increases. A steadily increasing ratio of retired employees to the total number of active and retired employees is the basic cause of this phenomenon.

The ratio of retired employees to the total number of active and retired employees grows at a roughly linear rate except for a period early in the 21st century. 1/ As mentioned in chapter 1, pension plan enrollment grew rapidly beginning in the 1940s until, by 1975, over 90 percent of all government workers were enrolled in public pension plans. During this same period, there was a trend toward early retirement and a gradual increase in the average lifespan in the U.S. These factors helped cause an overall "maturing" of State and local government pension plans as evidenced by the growing proportion of retired members. Figure 1 shows that this trend is forecast to continue through 2020.

Flow of funds analysis

To place benefit payout in perspective, we computed a flow of funds analysis. Table 3 shows the results for the base case. Total assets grow throughout, but at a rapidly decreasing rate during the 21st century. Benefit payout exceeds contributions after 2012. The ratio of assets to benefits has been suggested as a rough measure of financial soundness for individual plans, with 15 to 1 or 10 to 1 as a minimal level of funding. 2/ For the base case assumptions,

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1/The downturn around the year 2000 stems from the original distribution of State and local employees. The age groups 35 through 55 start with roughly the same number of employees. Consequently, fewer of the younger ones actually make it to retirement. Because the possible retirement ages are centered at age 60, there is a significant decline in the number of new retirees in the 1990s, causing a corresponding decrease in the total number of retirees.

2/Pension Task Force Report, p. 150.

Figure 1

Retired Employees as a Percentage of Total

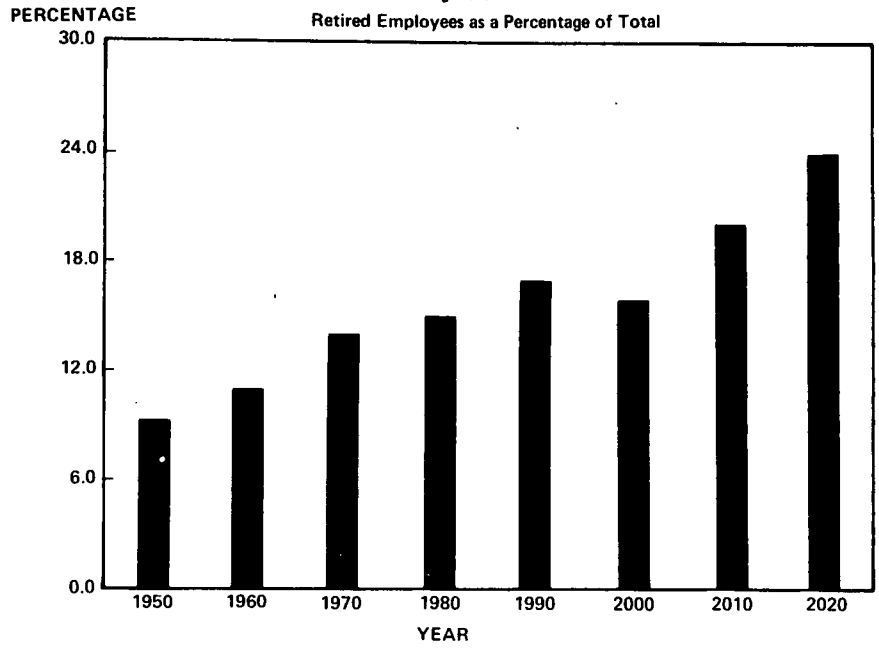

Table 3

Flow of Funds Analysis
Base Case Assumptions

	1980	1985	1990	1995	2000	2005	2010	2015	2020
Assets (billions of dollars)	182	329	562	975	1703	2919	4648	6757	9231
Percentage growth in assets from previous year	14	12	11	12	12	11	9	7	6
Contributions (billions of dollars)	24	40	68	110	170	259	385	572	851
Benefits (billions of dollars)	13	28	47	69	101	173	341	613	995
Ratio of assets to benefits	14	12	12	14	17	17	14	11	9

Average annual percentage increase in salary (inflation) a/	7.18	Average annual percentage increase in cost of living	3.59
Average annual percentage increase in salary (real)	0.90	Assumed average annual rate of return on assets	7.50
Average annual percentage increase in employment growth	1.37		

a/1975 is the base year for all forecasts shown in this report.

this ratio begins at 14 to 1 in 1980 and fluctuates throughout the remainder of the 20th century. In the 21st century, it decreases steadily reaching a level of 9 to 1 in 2020. The analysis was continued to 2050 for the base case. After 2020 the ratio of assets to benefits declines steadily until benefits exceed the sum of asset interest and contributions in 2049, showing that the plans in the aggregate would not be able to meet obligations from current income. The projected decline in the ratio of assets to benefits and the fact that benefit payments exceed the sum of asset interest and contributions in 2049 are evidence of a lack of financial soundness in State and local government pension plans in the aggregate. 1/

THE EFFECT OF VARYING SOME KEY PARAMETERS

The assumptions used to project the economic and demographic factors are deliberately conservative in the sense that they postpone the financial difficulties caused by the increasing proportion of retirees as discussed previously. The employment growth rate used for our basic analysis allows State and local government employment to continue growing throughout the projection period, though at a much slower rate than recent historical rates of growth. Lowering this growth rate has the effect of making the financial decline occur sooner, in the 20th century.

Further, the inflation rate shown favors the financial soundness of the plans, and the interest rate applied to asset growth is sufficient to allow a small amount of annual real growth. Many State and local government pension funds have not grown more rapidly than the inflation rate in recent years. A lower employment growth rate, inflation rate, or interest rate for asset growth would further exacerbate the financial difficulties.

The characteristics of the prototypical plans used for the benefit projections and the flow of funds analysis are based on our analysis of the Pension Task Force data and other sources and represent typical provisions in the mid-1970s. The effect of lowering the projected growth rate or changing the inflation rate or the manner in which it is applied to the projections is discussed in subsequent sections. Varying

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1/This simplified flow of funds analysis cannot be a substitute for a detailed actuarial analysis of the 6,600 individual pension plans. Our analysis concentrates rather on identifying emerging trends that need to be brought to the attention of policymakers.

the characteristics of the prototypical plans is not discussed: our analysis is designed to show what would happen if the typical characteristics of the pension system in the 1970s was projected into the future. 1/

Lower Employment Growth

For the base case, growth is limited after 1990 by a limit on growth in per capita employment. To test the sensitivity of the projections to a change in the employment level, we developed a second scenario that limits per capita employment in most cases to the average level attained by 1980. In this scenario, we curtailed the growth of per capita employment throughout the projection, and employment grew 47 percent from 1980 to 2020. Table 4 shows the estimates. The total number of active employees reaches 16.9 million by 2020 compared to 19.1 million for the base case estimate. Retirees, who are affected less by this change, reach 5.8 million in 2020 instead of 6.1 million.

The number of retirees is affected less than the number of actives because no new entrants are assumed to retire until the 21st century. During the 20th century, the retirees come primarily from the active employees in 1975. The first new employees hired after 1975 take a minimum of 24 years to retire. Growth in the total number of active employees is achieved by adding new entrants. As a result, the forecast number of retired employees remains the same for any scenario until the year 1999, when the effect of new 1975 entrants retiring is first felt.

An extension of the lower growth-rate scenario is a zero growth-rate scenario. Table 5 presents this result, assuming the 1975 employment level. Retirees as a percentage of the total increase dramatically in this case.

We performed a flow of funds analysis for both the lower-growth and the zero-growth cases. Flow of funds estimates for the lower-growth case (table 6) reveal that benefits exceed contributions after 2010, or 2 years earlier than in the base case, and that the ratio of assets to benefits declines very rapidly in the 21st century, reaching a level of 8 in 2020.

1/The sensitivity to changes in the contribution rate was tested. If the contribution rate is changed from 14.65 percent of payroll (as shown in the historical data) to 16 percent, the asset to benefit ratio changes from 9 to 1 as shown in Table 3 to 12 to 1 for 2020 and the year in which benefits first exceed contributions changes from 2012 in the base case to 2016.

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Table 4

Benefit Payout Projections
Lower Growth Rate Scenario

	1980	1985	1990	1995	2000	2005	2010	2015	2020
Total benefit payout (billions of dollars)	13	28	47	69	101	172	333	583	927
Total payroll (billions of dollars)	159	264	440	696	1067	1605	2361	3476	5134
Benefits as a percentage of payroll	8	11	11	10	9	11	14	17	18
Active employees (millions)	11.5	12.4	13.4	14.2	14.8	15.3	15.9	16.4	16.9
Retired employees (millions)	2.0	2.6	2.9	3.0	3.0	3.3	4.2	5.1	5.8
Retired employees as a percentage of total active and retired employees	15	17	18	17	17	18	21	24	25

Average annual percentage increase in salary (inflation) 7.18

Average annual percentage increase in salary (real) 0.90

Average annual percentage increase in employment growth 1.01

Average annual percentage increase in post-retirement cost of living adjustment 3.59

Table 5

Benefit Payout Projections
Zero Growth Rate Scenario

	1980	1985	1990	1995	2000	2005	2010	2015	2020
Total benefit payout (billions of dollars)	13	28	47	69	101	167	299	478	701
Total payroll (billions of dollars)	148	226	351	524	766	1101	1554	2217	3191
Benefits as a percentage of payroll	9	12	13	13	13	15	20	22	22
Active employees (millions)	10.4	10.4	10.4	10.4	10.4	10.4	10.4	10.4	10.4
Retired employees (millions)	2.0	2.6	2.9	3.0	3.0	3.3	3.9	4.3	4.5
Retired employees as a percentage of total active and retired employees	16	20	22	22	22	24	27	29	30

Average annual percentage increase in salary (inflation)	7.18	Average annual percentage increase in employment growth	0.00
Average annual percentage increase in salary (real)	0.90	Average annual percentage increase in post-retirement cost of living adjustment	3.59

Table 6

Flow of Funds Analysis
Lower Growth Rate Scenario

	1980	1985	1990	1995	2000	2005	2010	2015	2020
Assets (billions of dollars)	182	329	542	915	1559	2611	4048	5702	7522
Percentage growth in assets from previous year	13	11	11	11	11	10	8	6	5
Contributions (billions of dollars)	24	39	65	102	156	235	346	509	752
Benefits (billions of dollars)	13	28	47	69	101	172	333	583	927
Ratio of assets to benefits	14	12	12	13	15	15	12	10	8

Average annual percentage increase in salary (inflation)	7.18
Average annual percentage increase in salary (real)	0.90
Average annual percentage increase in employment growth	1.01
Average annual percentage increase in cost of living	3.59
Assumed average annual rate of return on assets	7.50

Table 7

Flow of Funds Analysis
Zero Growth Rate Scenario

	1980	1985	1990	1995	2000	2005	2010	2015	2020
Assets (billions of dollars)	180	304	465	701	1061	1575	2103	2404	2349
Percentage growth in assets from previous year	13	10	9	9	9	8	5	1	-2
Contributions (billions of dollars)	22	33	51	77	112	261	228	325	467
Benefits (billions of dollars)	13	28	47	69	101	167	299	478	701
Ratio of assets to benefits	14	11	10	10	11	9	7	5	3

Average annual percentage increase in salary (inflation)	7.18	Average annual percentage increase in cost of living	3.59
Average annual percentage increase in salary (real)	0.90	Assumed average annual rate of return on assets	7.50
Average annual percentage increase in employment growth	0.00		

For the zero growth case (table 7), the situation is worse. Lowering the assumed growth rate in State and local government produces a distinct deterioration in the financial condition of the plans in the aggregate. Figure 2 displays this effect.

Inflation

The effect on the forecasts of varying the inflation rate depends on the extent to which the changes in the rate are passed through to the active and retired populations. We based our forecasts of salary increases on historical wage rates adjusted for changes in productivity and the cost of living. A limited survey taken by the Pension Task Force of 23 large retirement systems (with total 1975-76 active membership of 4.5 million) reveals that post-retirement adjustments from 1969 to 1978 averaged about one-half the increase in the Consumer Price Index.

Our analysis of the limited Pension Task Force survey shows that most post-retirement cost-of-living adjustments were either ad hoc or automatic with annual increases. The weighted average of all cost of living adjustments was approximately half the average CPI increase from 1969 to 1978. Accordingly, for the analysis presented in this report, we gave half the annual increase in the cost of living 1/ to retirees. Since inflation rates are currently much higher than in the immediate past, it could be argued that employees will demand cost-of-living increases nearer to the inflation rate.

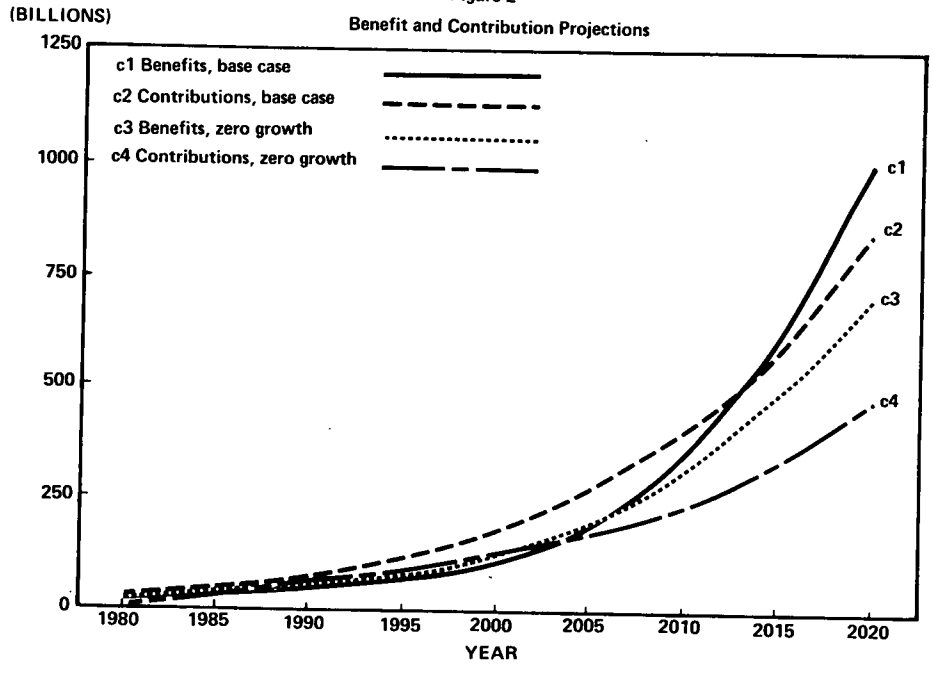
We used a long-term inflation rate of 7 percent. Appropriate monetary and fiscal policy could lower the rate; however, 7 percent is conservative for our purposes: since only half the cost-of-living increases is passed through the model to retirees, a higher inflation rate increases payroll more than benefits and further delays any difficulties that would be encountered by the plans in the aggregate. Giving retirees a higher percentage of future increases in the cost of living or lowering the projected inflation rate would exacerbate the financial difficulties discussed previously in this chapter. 2/

1/See p. 29 of app. I for a discussion of the cost-of-living index used.

2/For example, if the inflation rate is changed to an average yearly rate of approximately 4.5 percent and all other parameters are unchanged, the ratio of benefits to payroll increases to 22 percent in 2020, up from 19 percent in the base case.

Figure 2

Benefit and Contribution Projections



SUMMARY AND CONCLUSIONS

We have concentrated primarily on projecting benefit payout to employees covered by State and local government pension plans through the year 2020. Our base case assumptions estimate that the ratio of benefits to payroll would increase from 8 percent in 1980 to 17 percent in 2020. The ratio of retired employees to the total of retired and active employees increases from 15 percent in 1980 to 24 percent in 2020. These figures indicate an increasing financial burden on State and local government retirement systems.

To place benefit payout in perspective, a simplified flow of funds analysis was also computed. For the base case, the ratio of assets to benefits begins to decline in the 21st century until by 2049 benefits exceed the total of asset growth and contributions, showing that the plans in the aggregate would not be able to meet obligations from current income.

The increasing ratio of benefits to payroll, the decline in the ratio of assets to benefits, and the fact that benefit payout exceeds the sum of asset growth plus contributions in 2049 for the base case are all evidence of an increasing financial burden on State and local government pension plans in the aggregate. In our analysis this problem is caused, to a large extent, by the increasing proportion of retirees in the population of State and local government employees. Varying the economic parameters does not change this fact but merely changes the year in which the problem is first evident. Furthermore, growth in employment above the levels shown does not seem likely and the characteristics of the plans were purposely unchanged. Therefore, under the assumptions of this report a worsening financial status for State and local plans in the aggregate is foreseen.

Aggregating plans masks the differences among them. Our projections are driven by large plans, which are generally better funded (94 percent of the employees surveyed by the Pension Task Force were in large plans). Smaller plans, which often are not as well funded, are given less weight. The Pension Task Force estimated that only 20 percent of State and local employees are enrolled in plans that are fully funded by actuarial standards. 1/ Furthermore, a recent GAO

1/See discussion of funding techniques on p. 43 of app. II.

report 1/ reviewed 72 State and local government pension plans and found that 53 could not meet the funding standards imposed by ERISA on private pension plans. These facts combined with the inexorable growth in the proportion of retirees explain why key measures of the financial status of the plans in the aggregate begin to deteriorate in the 21st century. Under some conditions, the decline is more rapid but the conclusion is the same: if present funding practices continue, a deterioration in the financial condition of the plans in the aggregate is likely. The few fully funded plans should remain in good shape, but the numerous poorly funded plans can expect financial difficulty in this century.

1/"Funding of State and Local Government Pension Plans: A National Problem," U.S. General Accounting Office, HRD-79-66, August 30, 1979.

PROJECTION OF SALARY AND EMPLOYMENT LEVELS FOR STATE AND LOCAL GOVERNMENT EMPLOYEES

State and local government employment and salary levels were estimated based on econometric analysis of long-term economic trends of historical data obtained from the Bureau of the Census. Forecast trends obtained from the Data Resources, Inc., national economic model were used as inputs to forecast future employment and salary levels. To capture the effect of different growth patterns among different regions of the U.S. and among different categories of the State and local government employees, four regions of the U.S. and six employment categories were considered. Employment categories and regions were aggregated for the actuarial model discussed in appendix II.

Table 8 shows the growth in State and local government employment as forecast by our model. State and local government employment is forecast to increase as a percentage of total U.S. population, but the rate of growth is considerably lower after 1990. The Bureau of Labor Statistics has estimated that total State and local government employment for the U.S. will reach 13.7 million by 1990. The estimate of 14.2 million shown in table 8 compares well with that estimate.

Figure 3 and table 9 show expected total State and local government employment by region for the period 1960 to 2020.

Table 8

U.S. Employment and State and Local Government Employment 1960-2020

Year	Total U.S. Population (millions)	Total State and Local Government Employment (millions)	State and Local Government Employment as a Percentage of Total Population
1960	180.4	5.6	3.1
1970	204.1	8.5	4.2
1980	222.0	11.6	5.2
1990	243.3	14.2	5.8
2000	264.1	16.1	6.1
2010	274.8	17.7	6.4
2020	289.6	19.1	6.6

Source: U.S. population is DRI, State and local employment estimated by GAO.

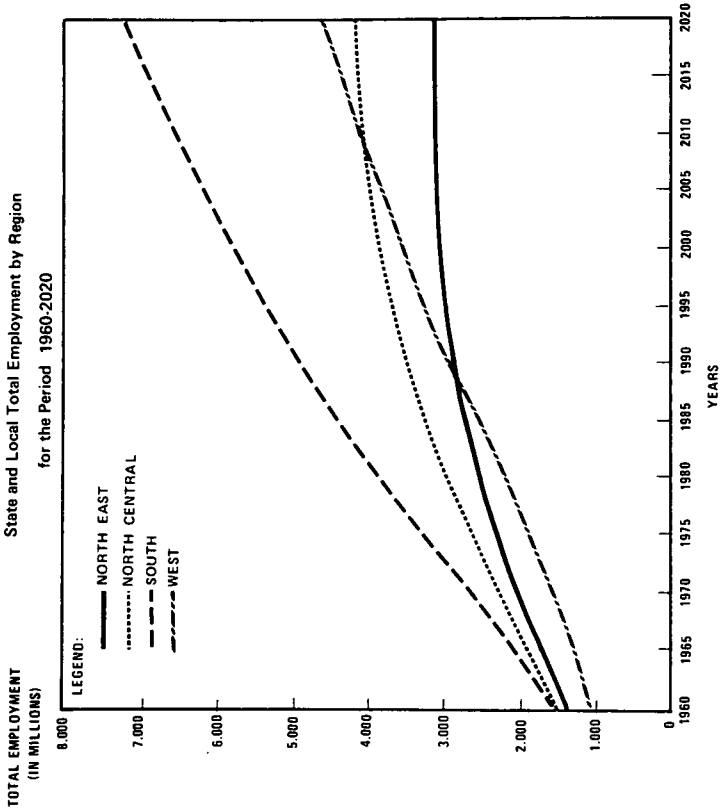


Figure 3
State and Local Total Employment by Region
for the Period 1960-2020
TOTAL EMPLOYMENT
(IN MILLIONS)
LEGEND:
NORTH EAST
NORTH CENTRAL
SOUTH
WEST
8.000
7.000
6.000
5.000
4.000
3.000
2.000
1.000
0
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
YEARS

Table 9

State and Local Government Employment by Region and For U.S. for the Period 1960 - 2020 at an Interval of Five Years (in Millions)

Year	Northeast	North Central	South	West	U.S. Total
1960	1.391	1.530	1.629	1.021	5.571
1965	1.679	1.899	2.061	1.297	6.936
1970	2.079	2.278	2.577	1.594	8.528
1975	2.316	2.596	3.266	1.933	10.111
1980	2.531	2.923	3.866	2.266	11.585
1985	2.724	3.203	4.406	2.608	12.941
1990	2.876	3.455	4.918	2.947	14.196
1995	2.960	3.635	5.356	3.253	15.204
2000 a/	3.016	3.778	5.744	3.538	16.076
2005	3.065	3.903	6.118	3.817	16.903
2010	3.099	4.005	6.488	4.102	17.694
2015	3.127	4.085	6.851	4.392	18.455
2020 b/	3.144	4.132	7.181	4.669	19.126

a/Alicia H. Munnell and Ann M. Connolly of the Federal Reserve Bank of Boston projected local and State government employment of 22.8 million in the year 2000. Their projections are based on: an increasing ratio of employment in education to population in the 5-24 year age group and an increasing ratio of employment in the noneducation sector to population in the 25 year and older age groups. Their projected number is the total of permanent and part-time employment whereas our estimate is for full time equivalent employees. Their ratios are projected to increase by a constant amount whereas ours are nonlinear. The population projections used by them are different than ours. Thus their figures are not comparable with ours.

b/The medium (of low, medium, high) projection of employment by the Social Security Administration for the year 2020 is 149.2 million. This estimate is based on their population projection of 297.4 million. We used the Bureau of Census medium population projection of 289.6 million. The percentage of total local and State government employment (as projected by GAO) to total employment (as projected by Social Security Administration) for the year 2020 is 12.82. This percentage will be a little higher if the GAO estimate of local and State government employment is based on the population projection used by Social Security Administration. This percentage appears to be reasonable in view of the fact that the share of local and State government employment in the total employment is expected to stabilize because of proposition 13. This is also clear from the fact that the percentage of local and State government employment to total population does not substantially increase in the next 45 years. This percentage was 4.74 in 1975 and is projected to be only 6.604 for the year 2020.

Although total State and local government employment for the U.S. is forecast to almost double between 1975 and 2020, the total employment figure hides significant regional variations. The employment growth rates in the South and West are higher during the period 1960 to 1980 because of the rapid increase in population in these two regions. The growth rates in all regions are projected to drop off during the next two periods from 1980 to 2000 and 2000 to 2020. This decline is due to the slower increase in population compared to the previous period and the tapering-off in the growth rate for real per capita income. Figure 4 shows real average annual salaries by region as forecast by GAO based on DRI projections of regional per capita income. The average annual salary is forecast by adjusting the estimated real average annual salary for cost-of-living increases.

INPUTS OBTAINED FROM NATIONAL ECONOMIC MODEL OF U.S. ECONOMY

As described in the previous paragraph, the Data Resources, Inc., national and regional economic models were used to obtain forecasts of U.S. population and real per capita income by census region. These forecasts were in turn used as inputs for our econometric model that estimates employment and salary levels for State and local government employees.

The results of our model are based on the assumption that the underlying trends in the economy are actually reflected in the forecasts produced by the DRI model. This premise requires that the economy not be subject to any major disruptions, such as a curtailment of oil supplies, rampant inflation, war, natural catastrophe, and the like. DRI's basic economic assumption is that the economy will grow steadily at an average annual rate of 2.5 percent, leading to a balanced Federal budget in the mid-1980s.

Two important determinants of long-term economic growth that are critical for our estimates are demographic forecasts and the forecast of the potential output of the economy. Demographic estimates used by the economic model are based on the population statistics contained in the Census Bureau's Series II projections. The dominant element in the Series II projections is the fertility rate. Census forecasts that the total fertility rate will gradually increase from 1.8 in 1976 to 2.1 in 2015. Net immigration is assumed to stabilize at about 20 percent of total population growth.

APPENDIX I

Figure 4
Real Average Salaries of Local and State Government Employees by Region for Selected Years During the Period 1960-2020

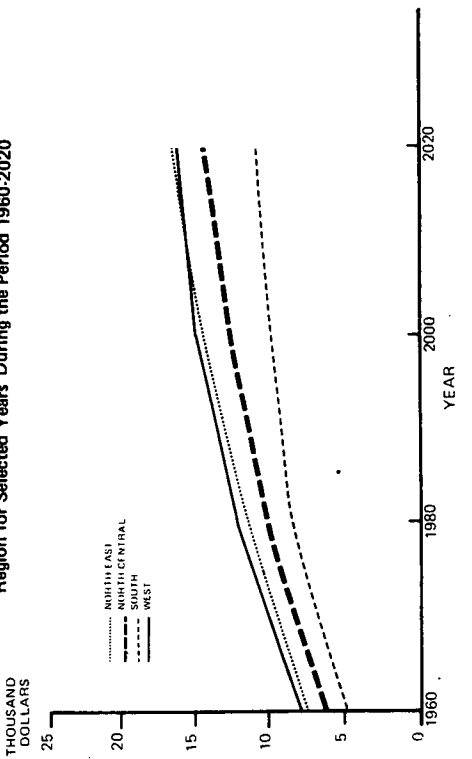


Figure 5 shows the total U.S. population and the population by census region as obtained from the national economic model and a forecast by the Social Security Administration. The Social Security forecast is slightly higher than the national economic model forecast. Both forecasts of total U.S. population show a slowdown in the rate of population growth. Regional population growth as forecast by the DRI national economic model provides for slow growth in the north-central region, substantial growth in the western and southern regions, and a modest decline in the northeast region.

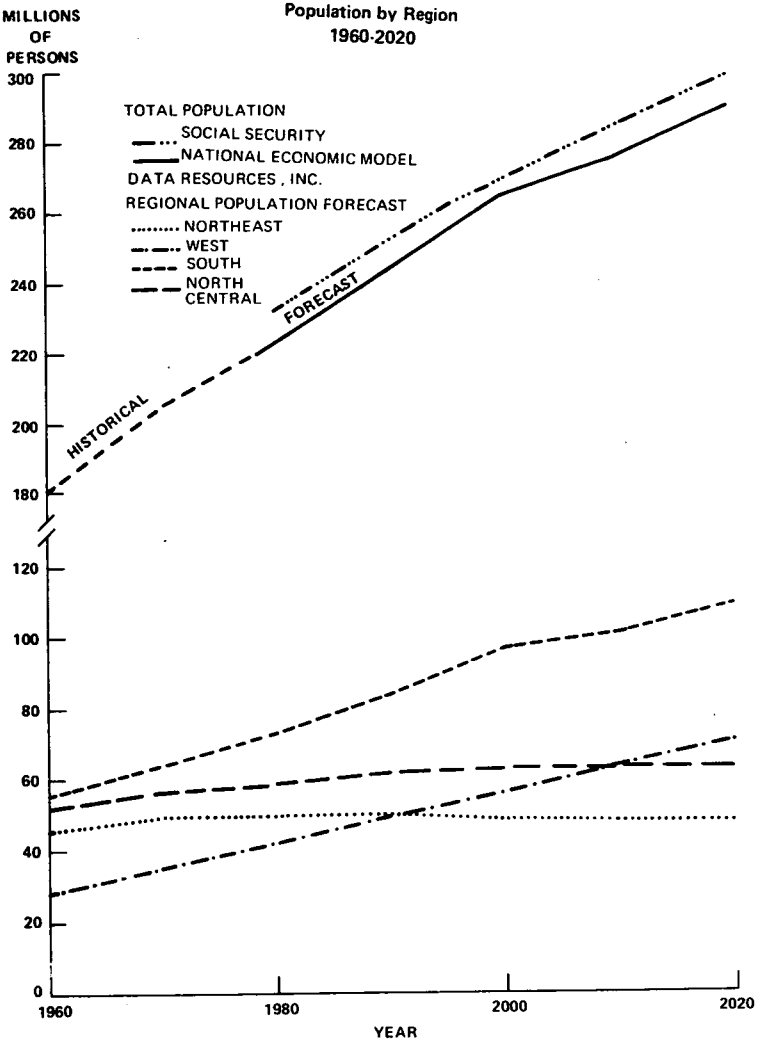
The other important factor is the forecast of the potential output of the economy. The DRI model's forecasts of inflation and real GNP growth rates are similar to Social Security Administration estimates of these variables. The DRI model forecasts a long-term real GNP growth rate of 2.5 percent and a long-term inflation rate of 4.5 percent 1/; the Social Security Administration 2/ forecasts 3.0 percent and 4.0 percent, respectively, for real GNP and inflation. Recent, persistent economic events have forced the choice of a higher inflation rate. An inflation rate of roughly 7 percent was chosen as representative of recent trends.

The following sections present the projections of State and local government employment and salary growth along with a detailed description of the employment and salary model's structure and assumptions.

1/The national economic model uses the personal consumption deflator while Social Security uses CPI. The personal consumption deflator is a broad-based inflation index used to deflate total personal consumption expenditures for all consumers, not just inflation's impact on urban consumers as measured by the Consumer Price Index (CPI). For a 25-year forecast period (1979-2003), the average annual rate of increase in the personal consumption deflator is 0.4 percent below the respective forecast of the Consumer Price Index - All Urban Consumers.

2/1978 Annual Report of the Board of Trustees, Old-Age and Survivors Insurance and Disability Insurance, p. 24. The economic assumptions for the Alternative II forecast for the year 1978-1981 are similar to the economic assumptions underlying the President's FY 1979 Budget.

Figure 5
Population by Region
1960-2020



THE EMPLOYMENT MODEL

The employment model projects six employment categories within each region--police, firemen, local teachers, State teachers, all other local employees, and all other State employees. Projections in each category of employment were made using econometric techniques that accounted for the impact of population and real per capita income on the demand for services from State and local government employees. Real per capita income is highly correlated with a number of other factors which affect local and State government employment, such as urbanization, education, and real per capita Federal Government transfers to State governments. (See figure 6.) These others are not included since they would measure the same effect as measured by real per capita income. Figure 7 shows historical and forecast real per capita income as obtained from the national economic model.

Constraining the employment projections

As the population in a region increases, the demand for additional services from each functional State and local government employment category increases. Rising real per capita income increases the standard of living, which, in turn, increases the demand for police and fire protection, higher education and other State and local government services. In our opinion there is a limit to the demand for services even if real per capita income increases. By constraining the level of employment per million population in the employment model, the effect of increasing real per capita income on the demand for State and local government services is limited. We analyzed historical data on the growth of State and local government employment to establish our employment constraints.

Table 10 shows historical State and local government employment per million population by census region. These figures can be viewed as showing a real income effect on employment of providing a given level of State and local government service. For example, increased real per capita income was associated with an increase in police employment in the northeast region from 2,098 per million in 1957 to 2,956 per million in 1977. This is much higher than in the other regions although other regions have grown faster in the last 20 years. The higher demand for police protection in the northeast compared to other regions can be attributed to higher levels of real per capita income, urbanization and education. Similar regional growth patterns can be seen for firemen.

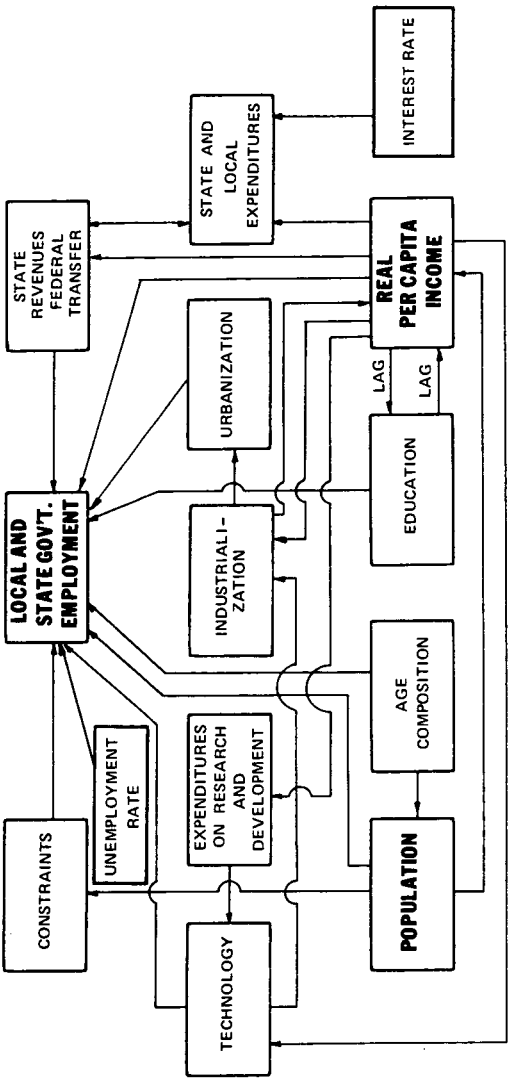
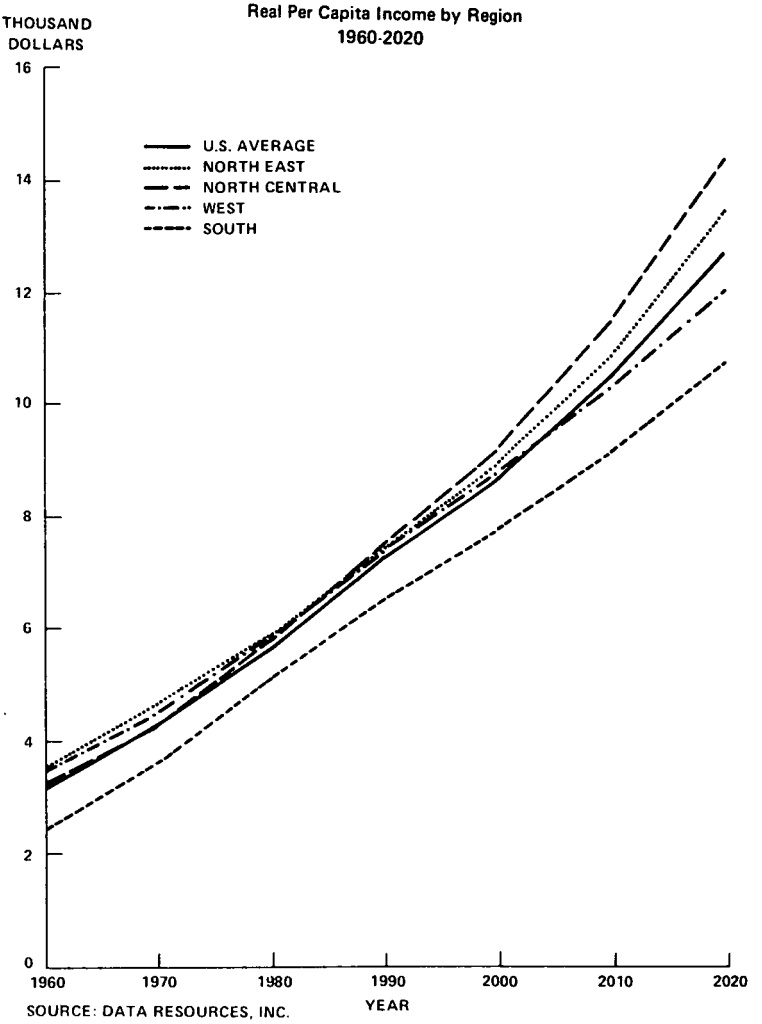


Figure 6
Direct and Indirect Linkages of Population and Real Per Capita Income to Local and State Government Employment

Figure 7

Real Per Capita Income by Region
1960-2020



SOURCE: DATA RESOURCES, INC.

Table 10

Employment Per One Million Population by Region in Each Functional Category of Local and State Government for 1957, 1967, and 1977

Year	Northeast	North-Central	South	West
		POLICE		
1957	2,098	1,444	1,261	1,600
1967	2,437	1,762	1,675	2,005
1977	2,956	2,384	2,395	2,777
		FIREMEN		
1957	1,084	685	569	879
1967	1,121	852	770	918
1977	1,144	876	979	1,135
		LOCAL TEACHERS		
1957	9,382	10,657	10,374	12,009
1967	15,373	15,562	15,992	17,370
1977	17,980	18,963	19,614	18,900
		STATE TEACHERS		
1957	688	1,773	2,580	2,261
1967	1,695	3,461	3,292	4,303
1977	2,494	4,890	5,322	5,741
		LOCAL ALL OTHERS		
1957	9,817	8,214	6,767	9,638
1967	10,936	9,768	9,143	11,199
1977	13,448	11,845	12,227	14,694
		STATE ALL OTHERS		
1957	5,769	4,278	5,182	5,320
1967	6,984	5,488	6,723	6,804
1977	8,845	6,961	9,487	8,249

The growth in real per capita income from 1957 to 1977 in all the regions has created a substantial demand for higher education, as evidenced by a dramatic increase in local and State government employment in education in all the regions. Similarly, increased real per capita income and the parallel

growth in urbanization and education in all the regions has caused substantial increases in the demand for various traditional services. It has also created a demand for new types of services in all the regions in the last 20 years. This is substantiated by the increase in all other local and State government employment.

Increases in regional employment per million population have been substantial. This trend is not forecast to continue at the historical rate. The employment model constrains employment per million not to exceed the limits shown in table 11.

Table 11

Constraints on Employment Per Million by Functional Category

Functional category	Employment per million people	Number of persons served by one job
Police	3,498	286
Firemen	1,210	826
Local teachers	26,871	37
State teachers	7,250	138
All other local	17,464	57
All other State	11,805	85

Statistical estimation

Employment is projected taking into account both the population effect and a constrained real income effect. The employment model traces the real income effect on each category of State and local government employment in each region when population is kept constant. By limiting the amount of employment per million population, an upper limit to the income effect was incorporated into the model. The model is

$$\left(\frac{E}{P}\right)_t = e^{(B_0 + B_1 / X_t)}$$

Where $\frac{E}{P}$ is the employment per million people in the year t and X_t is the real per capita income in the year t. B_0 and B_1 are the parameters to be estimated. B_0 is positive and B_1 is negative. The functional upper limit for $\frac{E}{P}$ is e^{B_0};

judgmental limits were added as discussed in the previous section. The model was estimated in logarithmic form and adjusted for serial correlation for the six functional State and local government employment categories and the four Census regions.

Table 12 shows the regression coeffficient, $\bar{R}^2$ and rho values for the regression equations fitted for all the functional categories of employment in all the regions. All the coefficients are statistically significant at the five percent level. The $\bar{R}^2$ values are generally higher than 0.90, indicating that the real per capita income serves to explain more than 90 percent of the variation of the ratio of employment to population in all functional categories in all regions except two cases during the past 20 years.

THE SALARY MODEL

Real annual salaries for State and local government employees correlated with real per capita income in each region. Hence, real per capita income in each region was used as a proxy for all the independent variables which can explain the variation in the real annual average salary:

$$Z_t = e^{(B_0 + B_1/X_t)}$$

where: Z_t = real average annual salary

X_t = real per capita income.

B_0 and B_1 are the parameters to be estimated. The equations were adjusted for serial correlation. Using the reciprocal of real per capita income in the equation provides estimates of real average annual salary increasing at a decreasing rate. The nominal average annual salary is estimated by inflating the estimated real average annual salary by the estimated cost-of-living adjustment.

Statistical estimation

Table 13 shows the regression coefficients, $\bar{R}^2$ and rho values for the regression equations fitted in all the functional categories of employment in all the regions. The t-statistic values are not specifically given in the table because all the coefficients are statistically different from zero even at the 1 percent level of significance. In most cases, the $\bar{R}^2$ values are higher than 0.90 indicating that the real per capita income in the reciprocal form explains more than 90 percent of the variation in real annual average salary in most functional categories in most of the regions during the past 20 years.

Table 12

The Regression Coefficients, $\bar{R}^2$ and rho Values in the Functions Fitted in All Functional Categories of Employment in all Regions

Region	Constant Term	Coefficient	$\bar{R}^2$	rho
		POLICE		
Northeast	9.02753	-0.514545	0.9557	0.769005
North Central	8.35954	-0.247047	0.9671	0.822922
South	8.43121	-0.304263	0.9816	0.824848
West	9.18427	-0.487819	0.9727	0.725204
		FIREMEN		
Northeast	6.92650	-0.606711	0.6534	0.568054
North Central	6.68000	-0.181161	0.4672	0.024509
South	7.44157	-0.424566	0.9714	0.729988
West	8.76935	-0.815335	0.9104	0.508397
		STATE TEACHERS		
Northeast	9.42259	-0.186327	0.9877	0.150395
North Central	9.89154	-0.420489	0.9718	0.410339
South	9.45790	-0.401093	0.9623	0.783857
West	10.4506	-0.609410	0.9718	0.699416
		LOCAL TEACHERS		
Northeast	11.0924	-0.388012	0.9691	0.479518
North Central	10.7469	-0.361185	0.9591	0.131219
South	10.5037	-0.359309	0.9854	0.517653
West	10.5314	-0.304363	0.9591	0.576608
		ALL OTHER STATE EMPLOYMENT		
Northeast	9.91185	-0.351661	0.9735	0.708181
North Central	9.50252	-0.190730	0.9610	0.408203
South	9.74615	-0.414401	0.9786	0.874219
West	9.56413	-0.253079	0.9198	0.500326
		ALL OTHER LOCAL EMPLOYMENT		
Northeast	10.1113	-0.333090	0.9433	0.708823
North Central	9.76047	-0.207495	0.9205	0.595405
South	9.93314	-0.287703	0.9743	0.826614
West	10.6485	-0.497117	0.9526	0.727322

Table 13

The Regression Coefficients, $\bar{R}^2$ and rho Values in the Functions Fitted in all the Functional Forms in all Regions for Real Average Annual Salaries

Region	Constant term	Coefficient	$\bar{R}^2$	rho
		POLICE		
Northeast	10.4465	-5.49074	0.9460	-0.12388
North Central	9.96977	-3.57118	0.9632	0.579616
South	9.58124	-2.23339	0.9854	0.310168
West	10.1709	-4.00828	0.9644	0.709396
		FIREMEN		
Northeast	10.4286	-5.33522	0.9790	0.29997
North Central	10.0186	-3.53814	0.9570	0.604772
South	9.64333	-2.24138	0.9887	0.59363
West	10.3759	-4.46636	0.9598	0.71527
		LOCAL TEACHERS		
Northeast	9.95138	-3.39246	0.9386	0.56105
North Central	9.79694	-2.96925	0.9135	0.53234
South	9.40977	-1.78034	0.9276	0.748328
West	9.97067	-3.44135	0.9548	0.884518
		STATE TEACHERS		
Northeast	10.16230	-4.22144	0.9298	0.511627
North Central	9.89789	-2.89829	0.8908	0.575996
South	9.70700	-2.35806	0.9525	0.824976
West	10.00500	-3.31563	0.8293	0.531574
		ALL OTHER STATE		
Northeast	10.00230	-4.47651	0.9780	0.77894
North Central	9.83174	-3.59774	0.9570	0.60509
South	9.52789	-2.47126	0.9863	0.55148
West a/	10.0543	-3.91404	0.9344	OLS
		ALL OTHER LOCAL		
Northeast	9.93239	-4.271930	0.9721	0.70312
North Central	9.51163	-2.55642	0.8630	0.28098
South	9.31501	-2.15596	0.9870	0.49750
West	9.84193	-3.41135	0.9839	0.92258

a/The equation was estimated using ordinary least squares.

MODEL TO FORECAST BENEFIT PAYMENTS

In 1975, the Pension Task Force and the GAO undertook a study of State and local government retirement systems, as required under Section 3031 of the Employee Retirement Income Security Act of 1974 (ERISA). An integral part of the study was a survey of pension plan membership characteristics and requirements, contributions, vesting, benefits, portability, and financing. The survey generated a large data base, with information representing 6,630 State and local pension plans.

The Task Force data base was used as the starting point to project benefit payout. To that extent, the data merit a discussion because of the picture they present of the overall characteristics of State and local government retirement systems in 1975. Table 14 shows the membership in all State and local plans, in all large plans (those with 1,000 or more active employees), and in all large defined benefit plans. Large plans, although only 6 percent of all plans, represent about 94 percent of the total active membership, while the 297 defined benefit plans contain over three-fourths of the total membership.

In 1975 active membership in large defined plans was 8.1 million, of whom 70 percent were also covered by Social Security. Social Security benefits were not included in any of our projections because they were not integrated with the State and local plans to any appreciable degree. In addition, there were 1.6 million retirees, over three-fourths of whom were retired because of age and service.

Most of the 82 large plans that are not defined benefit plans have features of both defined contribution and defined benefit plans and are referred to as "combination" plans. As might be expected, the large State and local government

Table 14

Membership in
State and Local Retirement Systems in 1975

	Number of plans	Membership (thousands) Active	Inactive	Total	Percentage of Total	Number of Members per Plan
All	6,630	10,387	2,347	12,734	100.0	1,920
All large	379	9,859	2,112	11,971	93.9	21,600
Large defined benefit	279	8,070	1,612	9,682	76.0	32,600

retirement systems have a financial impact commensurate with the size of their membership.

Table 15 shows that large defined benefit plans account for about three-fourths of the total of all State and local government plans in key financial areas, while all large plans are over 90 percent of the total. We restricted our detailed analysis to the large defined benefit plans in an effort to ensure a level of homogeneity that would make projections practical. The intention was to use the information from the Task Force survey to build prototypes of State and local government plans and then project pension costs for State and local government retirement systems as a whole. Defined benefit plans exhibited sufficient similarities in provisions, experience, and funding to allow the construction of "typical" plans.

Most of the active members were in plans whose benefit formulas were a simple percentage (rate) of final compensation times years of service. Post-retirement cost-of-living adjustments took various forms, including ad hoc increases, automatic increases with the cost of living (but subject to

Table 15

General Financial Characteristics
(in billions of dollars)

	Large Defined Benefit Plans	Percent of all Plans	All Large Plans	Percent of all Plans	All Plans
Assets	$80.7	75	$101.5	94	$108.3
Investment Income	4.3	72	5.5	93	5.9
Benefit Payout	5.8	73	7.5	95	7.9
Employer Contributions	7.4	73	9.3	92	10.1
Employee Mandatory Contributions	4.1	77	5.1	95	5.4
Payroll	74.2	76	92.6	95	97.5

a limit), and constant percentage increases. The Task Force's limited survey of 23 very large retirement systems (with total 1975-76 active membership of 4.5 million) revealed that post-retirement adjustments averaged, from 1969 to 1978, about one-half the increase in the Consumer Price Index. At least 87 percent of the large defined benefit plans featured mandatory employee contributions, usually at a simple percentage of salary, and 92 percent of the employees were in plans with some advanced funding.

MODEL TO FORECAST BENEFIT PAYOUT

The large defined benefit plans were divided into two groups--teachers' plans and other plans. A review of the responses to the Task Force survey and other actuarial material led to the conclusion that these two types of plans were too dissimilar to combine. For example, the teachers had in general more generous benefits, higher salaries, a different age and sex distribution, and higher withdrawal rates. Because each of these characteristics weighs heavily in a benefit projection, we developed two separate prototypical plans whose 1975 membership, total benefits, and average annual salaries are shown in table 1, page 5. Each prototype was designed to conform initially to these characteristics. In addition, we used the Task Force data to determine the number of years on which to base "final compensation" and to construct the two prototypical benefit formulas.

Other data sources were used in those areas that the Task Force survey had not covered. The age and sex distributions of the active populations were based upon information in the Census Bureau's "Current Population Survey" (January 1978). For age and benefit distributions of the 1975 retirees, data were aggregated from actuarial valuations of several large State, local and teachers' retirement systems. These valuations also supplied us some data on retirement ages, entry ages, withdrawal and disability rates, and salary scales. Post-retirement cost-of-living adjustments were set at half the future increases in the cost of living. We used the Unisex Pension 1984 Table, adjusted for varying male-female ratios and future improvements in mortality.

PROJECTING BENEFITS

Within each prototype, benefits were projected for three groups: persons retired in 1975, active employees in 1975, and new entrants after 1975. Projections through the year 2020 of the growth both in teachers' and in other State and local governments' work forces were incorporated into the model and served to predetermine the number of new entrants needed each year in the future.

The 1975 retirees were assigned an initial age and benefit distribution and then "aged" using the assumed mortality rates. A projection through 2020 of the cost of living was used in computing the remaining retirees' post-retirement cost-of-living adjustments. 1/

An age distribution from the BLS "Current Population Survey" was imposed on the 1975 active employees in each prototype. The total payroll (average salary times number of employees) was distributed initially among the age groups using a merit scale to reflect a typical worker's career salary progression, neglecting inflation. The career average annual merit increase was 1 percent for State and local government employees and 1-1/2 percent for teachers, with accelerated increases in the early years. At each year of the projection, salary growth forecasts were applied across the board to the total payroll.

Those actives who "survived" to retirement were accorded a benefit using the average benefit formulas constructed from the Task Force data. Retirement ages were spread uniformly over a 10-year period, with the median age determined by a review of actuarial valuations and plan provisions.

Entry ages were set at 30 and 34 for the teachers' and the State and local prototypes, respectively, and represent the average entry age for a typical retiree. The benefit formulas, entry ages, and retirement ages result in an average replacement ratio (that is, percentage of final compensation) of 52 percent for teachers and 50 percent for other State and local retirees. Final compensation in both prototypes was the average of the last 4 years of salary.

Augmenting the benefits

The average benefit formulas as computed could be applied directly only to those employees retiring because of age and service. Furthermore, the benefits so generated were confined to the modeled population--that is, large defined benefit teachers' and other State and local pension plans. To obtain projection for all 6,630 plans, the prototypical benefits had to be augmented first for ancillary benefits and second for all those plans outside the modeled population. Four augmentations were made in each year of the projections.

The prototypes dealt exclusively with members who retired because of age and service. Survivor benefits, disability

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1/See p. 29, app. I.

benefits, and returns of contribution were not separately calculated. Instead, we augmented the average benefit going to age and service retirees to take into account the payments for these ancillary benefits. The augmentation factors we used were based on the Bureau of the Census data for 1974 to 1977.

Among the 297 large defined benefit plans were 46 plans for police and firemen. Although 15 percent of the plans, they represented just 3 percent of the active employees and as such were considered too insignificant to merit their own prototype. To take these plans into account, total benefits were increased proportionately.

The combination and defined contribution plans were found to be similar to the large defined benefit plans in key financial areas. Differences in average benefit and average salary for 1975 were recognized before augmenting the prototypes' benefits by the ratio of total actives in all 379 plans to total actives in the 297 defined benefit plans. 1/

The 6,251 small plans accounted in 1975 for less than 5 percent of the active membership in State and local government pension plans. The model's total benefit payments were increased proportionately to take into account these additional plans and thereby extend the model to the known 1975 universe of State and local government retirement systems. Table 16 summarizes the assumptions used.

About 42 percent of State and local government systems of all types were funded on a nonactuarial basis. Moreover, many claiming to use an actuarial basis were not using the "dynamic normal cost" approach 2/ recommended by GAO for all Federal plans. The Task Force went on to estimate that only 20 to 25 percent of all State and local government pension plans would meet ERISA's minimum funding standards.

1/See table 14.

2/This approach takes into account future cost-of-living increases and general pay hikes.

APPENDIX II

Table 16

Base Case
Projection Assumptions

Age at retirement

Median age 60 for teachers, with 10-year spreading
Median age 62 for State and local employees, with 10-year spreading

Entry age

30 for teachers
34 for State and local employees

Rates of mortality

Unisex Pension-1984 Table, with one-year setback for every 17 years of projection

Sample annual rates of termination are as follows:

Rates of withdrawal (original actives)

Age	Teachers	State & local
25	15.9%	16.0%
30	5.7%	11.4%
35	2.6%	7.4%
40	1.2%	5.1%
45	0.6%	3.9%
50	0.3%	3.0%
(New entrants)		
35	5.4%	13.9%
40	1.1%	5.3%
45	0.4%	3.2%
50	0.2%	1.6%
55	0.1%	1.0%

Rates of disability

Age	Rate per thousand
25	0.600
30	0.672
35	0.768
40	0.920
45	1.926
50	1.920

Benefit formulas

Teachers
1.85% x years of service x final compensation.

State & local
1.78% x years of service x final compensation.

APPENDIX II

Table 16--Cont.

Final compensation	Average of last 4 years of salary.
Average service at retirement	28 years
Replacement ratios	Teachers 51.8%
	State & local 49.7%
Ancillary benefits	Teachers Projected as a constant 7.6% of total payout.
	State & local Projected as a constant 16.4% of total payout.
Withdrawal payments (Return of contributions)	Teachers Projected at 9.5% of total payout.
	State & local Projected at 15.2% of total payout.