

Prospects for Social Security Reform

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Pension Research Council
The Wharton School of the University of Pennsylvania

PENN

University of Pennsylvania Press
Philadelphia

Pension Research Council Publications

A complete list of books in the series appears at the back of this volume.

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Printed in the United States of America on acid-free paper

10 9 8 7 6 5 4 3 2 1

Published by

University of Pennsylvania Press

Philadelphia, Pennsylvania 19104-4011

Library of Congress Cataloging-in-Publication Data

Prospects for social security reform / edited by Olivia S. Mitchell,
Robert J. Myers, and Howard Young.

p. cm.

"Pension Research Council Publications."

Includes bibliographical references.

ISBN 0-8122-3479-0 (alk. paper)

I. Social security—United States. I. Mitchell, Olivia S.
II. Myers, Robert J. (Robert Julius), 1912– . III. Young,
Howard, 1932– . IV. Wharton School. Pension Research Council.
HD7125.P733 1998

368.4'3'00973—dc21

98-41908

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Frontispiece: Special Treasury securities, stored in a federal government filing cabinet in West Virginia, represent \$700 billion in Social Security Trust Fund assets. Photo: Jeff Baughan.

Chapter 2

Measuring Solvency in the Social Security System

Stephen C. Goss

Public confidence in the ability of the U.S. social security program to make expected future benefit payments has been an essential component contributing to the success and popularity of the program since its enactment in 1935. The development and application of measures of solvency have successfully provided advance warning of future financing inadequacy. This warning has provided policymakers and legislators the time needed to develop thoughtful modifications of the program.

Defining solvency depends on one's view of the role and design of the social security program. A range of measures of solvency has evolved to address a variety of concepts of solvency. The current assessment that the social security program, as presently specified, will not be solvent over the long-range future has resulted from the application of these measures. Comprehensive amendments to the Social Security Act will be designed to satisfy these measures of solvency. Therefore, an understanding of these measures is useful for the upcoming discussion and development of legislation.

The Social Security Act requires that the Board of Trustees report annually to the Congress providing the expected operations and status of the Old-Age and Survivors Insurance (OASI) and Disability Insurance (DI) Trust Funds for the next 5 fiscal years and "a statement of the actuarial status of the Trust Funds." The particular measures used in assessing the actuarial status of the social security program are the subject of this chapter. Our measures have been developed to be consistent with the nature of the program and the manner of financing, as set forth in the Social Security Act. The Actuarial Standards Board, in its third draft of the Standard of Practice for Social Insurance, has specifically instructed that valuation measures and tests of financial adequacy for social insurance programs be designed to be consistent with the design and intent of the program financing approach. As a government-administered social insurance program, social security has

specifically not been subject to the funding requirements applied for private pensions and insurance. Therefore, the measures described in this paper for assessing the actuarial status and solvency of the social security program differ substantially from the measures used for private pensions and insurance.

Because the social security program is estimated to be inadequately financed over the long run, based on the "best estimate" intermediate assumptions used in the 1997 Trustees Report, future legislative changes are expected to be needed. These changes may retain the basic pay-as-you-go form of the program, as have other amendments over the past 20 years, or they may substantially change the nature of the program and its financing. If substantial changes are made, such as a move toward sustained partial advance funding or a provision for mandatory individual accounts, then new measures may be needed to assess the impact and viability of the new program.

The Nature of Social Insurance and Social Security Financing

Since its enactment in 1935, the social security system has been managed by the federal government with dedicated taxes and, since the 1950's, mandatory participation by nearly the entire population. Unlike private pensions and insurance, this social insurance program is essentially "guaranteed" a stream of new participants indefinitely into the future. For this reason, social insurance can be financed without advance funding for accrued future obligations, contrary to the requirements for private pensions and insurance. While the desirability of such pay-as-you-go financing is debatable, the approach has been implicit in law.

A pay-as-you-go financing approach requires no accumulation of reserves for advance funding, but the lack of authority to borrow makes it prudent for the Social Security Administration to maintain a "contingency reserve fund." Without modest contingency reserves, an unexpected economic downturn could quickly render the program unable to pay full benefits on a timely basis. For example, higher than expected inflation would increase benefits, and lower than expected employment and wages would reduce tax revenues, resulting in an accumulated "loss" equal to 50 to 100 percent of the annual cost of the program within about five years. Thus, a contingency reserve of 100 percent of annual cost (i.e., a 100 percent trust fund ratio) has been accepted as sufficient to "ride out" an unexpected recession or to provide time for the enactment of legislation in the event of a more permanent negative turn in economic trends.

As suggested above, the meaning of solvency, or financial adequacy, for a given period in the context of a social insurance program with pay-as-you-go financing is that all expected benefits will be payable in full when due

throughout the period. Reaching and maintaining a projected contingency reserve of 100 percent of annual cost provides a practical working margin that accommodates moderate cycles around expected conditions, and allows time for corrective legislation in the event of a negative shift in underlying conditions.

The specified level of payroll taxes has been modified throughout the history of the social security program, from initial levels of 1 percent for employers and employees each, to the current level of 6.2 percent each. Most of this increase is the result of the maturation of a program that started by taxing essentially all workers while paying benefits only to recent retirees, but has since reached the state where over 95 percent of the nation's elderly population is eligible for benefits. Benefit levels have risen and benefits have been extended to cover additional contingencies such as disability. Since 1935, however, financing has been maintained on a roughly pay-as-you-go basis with projected reserves rising substantially above 100 percent of annual program cost only for temporary periods.

Measuring Social Security Solvency

The Social Security Act requires an annual report on both the status of the trust funds for the next five years and a statement of the "actuarial status" of the funds for the long-range future. Different measures of solvency, or financial adequacy, have been developed for the (10-year) short range period and the (75-year) long range period.

Short-Range Measures

Solvency is defined as the expectation that benefits will be payable in full when due, so it is sufficient to examine projected trust fund levels over the next decade. If trust funds are not exhausted during this period, then the program is projected to be solvent in the short range period.

Based on the recommendation of the Technical Panel on Assumptions and Methods appointed by the 1991 Advisory Council, a short range test of financial adequacy has been adopted that requires that (1) the trust fund ratio remain at or above 100 percent through the next 10 years, if it is at least 100 percent initially; or (2) the trust fund ratio rise to at least 100 percent by the end of 5 years and remain at or above 100 percent for an additional 5 years, and that benefits are payable in full when due throughout the next 10 years, if the trust fund ratio is below 100 percent initially. This test adds the practical requirement that a contingency reserve be developed and maintained. For the 1997 Trustees Report, the combined OASI and DI Trust Funds were projected to remain above 100 percent of annual cost for the next 10 years under the intermediate alternative II assumptions. The

social security program was thus found to meet the test of short range financial adequacy.

Long-Range Measures

The actuarial status over the long term has been analyzed using a number of measures. An examination of annual values for a 75-year period (or longer) being cumbersome, a number of single-value summarized measures and indicators have been developed over the years.

Actuarial Balance. This most basic and useful summarized measure has been designed to provide a value of zero when the program is projected to be financed precisely on a pay-as-you-go basis, on average, over a specified valuation period. The actuarial balance is defined as the difference between the long-range summarized income rate (tax revenue) and the long-range summarized cost rate (benefit payout). However, the method of summarization, the length of the long-range period, and the components included in cost and income have all changed over the years.

Prior to 1965, projections were made into perpetuity. The long-range summarized cost rate was defined as the present value of projected future cost into perpetuity divided by the present value of projected future taxable payroll into perpetuity. Summarized income rates were defined as the present value of projected future payroll taxes divided by the present value of projected future taxable payroll.

In the 1965 Trustees Report, the long-range valuation period was changed to 75 years, reflecting the recommendation of the latest Advisory Council. Estimates had been assumed to level off after 85 or 90 years and the Council felt that it served "no useful purpose to present estimates as if they had validity into perpetuity" (Board of Trustees, 1965: 68). The 75-year period encompasses essentially the entire future life span of all current workers and beneficiaries, even the youngest current workers, at the beginning of the 75-year period. It also provides a projection period long enough to illustrate the complete and mature effects of past amendments and potential future changes to the Social Security Act. Restricting the long-range period to 75 years lowered the estimated long range cost by only about three percent in 1965, largely because estimates were made on a level cost basis, discounted by the full expected trust fund interest rate.

Under the level-cost approach, no increase in either the average wage level or the level of prices was assumed for the future. This approach was developed because the law at that time provided for no automatic increase in either the maximum taxable wage or the benefit formula. While "present law" estimates for the Trustees Report could not explicitly presume the enactment of likely changes in future legislation, the use of constant future price and wage levels made implicit the assumption of such changes.

But when projections were made assuming no increase in either price or average-wage levels, discounting by the full assumed nominal interest rate meant that the summarized long-range cost and income rates put very little weight on benefits, payroll, and taxes for distant future years. Thus, inclusion of estimated values for years beyond the 75th projection year in the summarized rates made little difference.

With the adoption of automatic benefit indexing and automatic indexing of the maximum taxable earnings level in the 1972 Social Security Amendments, dynamic assumptions were used beginning with the 1973 Trustees Report. Under dynamic assumptions, explicit increases in average wage and price levels were specified for the future projections. The 1973 Trustees Report also changed the method of summarizing cost and income rates. As a matter of simplification, an approximation of the present-value approach was adopted. Under this approach, the summarized cost rate was computed as the arithmetic average of the annual cost rates for the 75 years in the long-range period. The summarized income rate was defined similarly. This approach, called the "average cost method," was retained through the 1987 Trustees Report. The average cost method is equivalent to the present value method where the growth rate in the aggregate taxable payroll is used as the annual discount rate. This approach was deemed appropriate at the time because it yielded values that were very close to present-value calculations (the growth in aggregate taxable payroll was very close to the current interest rate on the trust funds), and the summarized rates were more easily replicated without access to main-frame computers.

In 1988, calculation of the summarized cost and income rates returned to the present value method. Trust fund interest rates had become substantially different (larger) than the growth rate in aggregate taxable payroll, and computers and programmable calculators had become widely available. These last two changes in the actuarial balance were to include the starting trust fund balance in the summarized income rate (beginning with the 1988 report) and to include the present value of a target trust fund balance equal to 100 percent of annual cost in the summarized cost rate (beginning with the 1991 report). With these changes, exact actuarial balance (i.e., an actuarial balance of zero) indicates that the present value of projected income over the next 75 years, along with the starting trust fund balance, is enough to cover the present value of all costs over the next 75 years, leaving a trust fund balance equal to 100 percent of annual outgo at the end of the period.

Table 1 indicates the projected actuarial balances for the social security (OASDI) program based on the Trustees' intermediate assumptions of Trustees Reports for years 1973 through 1997. Evident in these estimates of OASDI actuarial balance are the large improvements made at the enactment of the 1977 and 1983 Social Security Amendments, and the deterioration of the actuarial balance before and after these amendments. The size of the actuarial deficit immediately prior to enactment of the 1983

TABLE 1. Summarized Long-Range (75-Year) OASDI Rates Based on Intermediate Assumptions

<i>Year of Report</i>	<i>Summarized Cost Rate</i>	<i>Summarized Income Rate (%)</i>	<i>Actuarial Balance (%)</i>
1973	10.95%	10.63	-0.32
1974	13.89	10.91	-2.98
1975	16.26	10.94	-5.32
1976	18.93	10.97	-7.96
1977	19.19	10.99	-8.20
1978	13.55	12.16	-1.40
1979	13.38	12.19	-1.20
1980	13.74	12.22	-1.52
1981	14.08	12.25	-1.82
1982	14.09	12.27	-1.82
1983	12.84	12.87	0.02
1984	12.95	12.90	-0.06
1985	13.35	12.94	-0.41
1986	13.40	12.96	-0.44
1987	13.51	12.89	-0.62
1988	13.52	12.94	-0.58
1989	13.72	13.02	-0.70
1990	13.95	13.04	-0.91
1991	14.19	13.11	-1.08
1992	14.63	13.16	-1.46
1993	14.67	13.21	-1.46
1994	15.37	13.24	-2.13
1995	15.44	13.27	-2.17
1996	15.52	13.33	-2.19
1997	15.60	13.37	-2.23

Source: Annual OASDI Trustees Reports.

Note: Alternative II-B for years 1981-90, alternative II for all other years.

Amendments, based on preliminary intermediate assumptions for the 1983 Trustees Report, was 2.09 percent of taxable payroll. Estimated actuarial deficits have once again exceeded this level since the 1994 Trustees' Report.

The deterioration of the OASDI actuarial balance since enactment of the 1983 Amendments is the result of changes in five areas. Changes in (1) economic assumptions, (2) disability experience and assumptions, (3) actuarial projection methods, and (4) the starting and ending year of the 75-year valuation period have each worsened the actuarial balance by an amount equal to about one-third of the current actuarial deficit. Changes in (5) demographic experience and assumptions have improved the actuarial balance by an amount equal to about one-third of the current actuarial deficit.

The size of an estimated actuarial deficit may be usefully characterized as the magnitude of the increase in the combined payroll tax rate that would be needed to eliminate the actuarial deficit, effective at the beginning of the valuation period, thus restoring solvency for the program over the long-range period. It must be noted, however, that this is merely a convenient characterization, and that an infinite number of solutions involving benefit reductions and/or revenue increases would similarly eliminate the actuarial deficit.

Advancing the starting and ending year of the valuation period for each annual Trustees' Report currently increases the size of the actuarial deficit by 0.08 percent of taxable payroll. This worsening is the result of the inclusion of an additional year (the 76th year of the prior Trustees Report projection) which has a substantially larger deficit than the other years in the period, on average. The first year of the prior Trustees Report valuation period is not excluded from the new valuation, because the net operations for that year, and for all prior years, are reflected in the starting trust fund balance, which has been included in the summarized income rate since the 1988 Trustees Report.

As mentioned earlier, the long-range valuation period was limited to 75 years, starting in the 1965 report, to avoid dominating the actuarial balance with the level of annual balances at and beyond the 75th projection year. If the actuarial balance had been computed into perpetuity for the 1996 report, an OASDI actuarial deficit of about 4.7 percent of taxable payroll would have been calculated. This value is much closer to the annual deficit of 5.51 percent of payroll estimated for 2070 than it is to the actuarial balance for the 75-year valuation period 1996–2070 of 2.19 percent of payroll.

Annual Cost Rates, Income Rates, and Balances. Annual cost and income rates are computed as the dollar annual cost and annual tax income, respectively, divided by the annual taxable payroll. Cost includes both benefits and administrative expense. Tax income includes both payroll tax receipts and revenue transferred to the trust funds from the general fund of the United States Treasury equal to the amount collected for federal income taxation of OASDI benefits beginning in 1984 (a portion of this amount is also allocated to the Hospital Insurance Trust Fund).

The annual balance is the difference between the annual income rate and the annual cost rate. Because interest income is excluded from the annual income rate, the annual balance indicates how close the program is to operating on a pay-as-you-go basis for the year. Excluding interest from the income rate also makes sense because the interest is needed primarily to maintain the level of the contingency reserve. The interest rate on trust fund assets is close enough to the rate of increase in aggregate program cost so that interest on the assets is just about the amount needed to maintain a constant trust fund ratio (assets to annual cost) from the beginning to the end of the year, particularly for a relatively small contingency reserve fund.

TABLE 2. Projected OASDI Annual Cost Rates, Income Rates and Balances, and Cost as a Percentage of GDP, Based on the Intermediate Assumptions of the 1997 Trustees Report

Year	OASDI Annual Rate as % of Payroll			OASDI Cost as % of GDP
	Income	Cost	Balance	
1996	12.63	11.49	1.14	4.66
2010	12.73	12.48	0.26	4.87
2030	13.09	17.47	-4.38	6.57
2070	13.32	19.18	-5.86	6.68

Source: 1997 OASDI Trustees Report

In addition, annual cost rates are useful as an indication of the cost to society of providing benefits, regardless of how the cost is financed. Similarly, annual cost as a percentage of GDP is a useful indicator of the cost of the program to the society.

Table 2 provides selected annual rates based on the intermediate assumptions of the 1997 Trustees Report. These rates indicate the dramatic rise in the cost rate, both as a percentage of payroll and as a percentage of GDP, as the baby-boom generation retires between 2010 and 2030. Increases both before and after this period are relatively modest. Cost rates do not drop back down to earlier levels as the baby-boom generation dies off. The continuing increase in cost rates after 2030 reflects the assumed continued increase in life expectancy, primarily after reaching retirement age, and the ultimate total fertility rate at a level of 1.9 children per woman. Figure 1 (from the 1997 Trustees Report) illustrates projected annual cost and income rates for the OASDI program under the intermediate alternative II as well as under the low-cost alternative I and the high-cost alternative III assumptions.

The size of the annual balance at the end of the period is of particular interest. If the annual balance at the end of the period differs significantly from the actuarial balance for the period, then the actuarial balance for the next Trustees Report will move in the direction of the ending annual balance. The relationship between the ending (75th year) income rate and cost rate is also indicative of the proportion of projected program cost that is covered by the specified tax revenues in the law. For example, based on the values in Table 2 for the intermediate assumptions of the 1997 Trustees Report, the projected tax revenues alone would cover about 74 percent of program cost in 2029, the year of combined trust fund exhaustion, and about 68 percent of program cost by 2071. The percentage of cost covered by specified tax rates indicates the relative extent that benefits would need to be reduced, or revenue increased, in order to achieve balance between the annual income and cost rates.

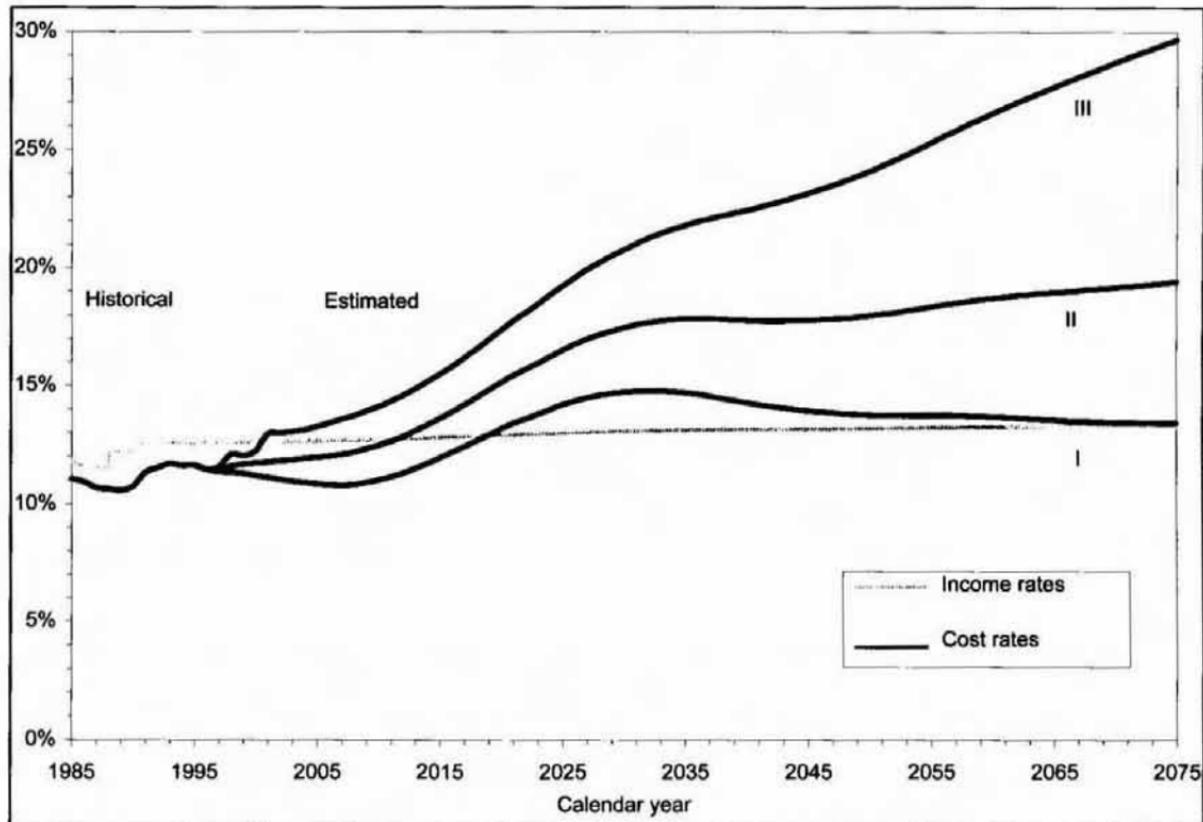


Figure 1. Estimated OASDI income and cost rates by alternative, calendar years 1985–2075 (% of taxable payroll). Source: 1997 OASDI Trustees Report.

Trust Fund Ratios, Year of Trust Fund Exhaustion, and Stability at the End. The trust fund ratio is, of course the ultimate measure of solvency, defined as the ability to pay all benefits in full when due. The date of trust fund exhaustion, which would occur during the year 2029 for the combined OASDI program based on the intermediate assumptions of 1997 Trustees Report, is of particular significance. Figure 2 (from the 1997 Trustees Report) illustrates the projected trust fund ratios under each of the three alternatives.

It is worth noting that the combined trust funds are not exhausted during the 75-year long-range projection period under the low-cost alternative I assumptions (the alternative I and III assumptions will be discussed further below). The trust fund ratios for alternative I serve to illustrate two additional considerations. First, the actuarial balance for a valuation period is directly related to the trust fund ratio at the end of the period. A trust fund ratio of 100 percent is, of course, associated with an actuarial balance of zero, with a positive actuarial balance indicating an ending balance greater than 100 percent and a negative actuarial balance indicating an ending trust fund ratio of less than 100 percent. In practice, under present law, a negative trust fund ratio is not possible because there is no authority to borrow.

The second consideration regarding the ending trust fund ratio is the stability of the ratio around the end of the valuation period. If the trust fund ratio is stable at the end of the long-range period, we can be assured that in the absence of major changes in assumptions, the actuarial balance for the current Trustees Report will change little for subsequent reports for the foreseeable future. This results from the fact that there is a one-to-one correspondence between the trust fund ratio and the actuarial balance. A stable trust fund ratio implies a stable actuarial balance. For this reason, most recent proposals to eliminate the long-range OASDI actuarial deficit have also been designed to achieve a stable trust fund ratio at the end of the long-range period (like that illustrated under alternative I assumptions). This is true for each of the proposals of the 1994–96 Advisory Council and S. 825, proposed earlier by Senators Kerrey and Simpson.

Test of Long-Range Close Actuarial Balance. This test is not a test of solvency or financial adequacy. It represents an attempt to characterize, with a single-value summarized measure, whether the program is at least close to being solvent throughout the long-range 75-year period. The requirement for being only close to solvent is intended to reflect the inherent uncertainty in making projections very far into the future.

For many years the test of close actuarial balance required that the summarized long-range income rate be between 95 and 105 percent of the summarized long-range cost rate. When the income rate was near the lower end of the range, the trust fund would be exhausted prior to the end of the long-range period, but the financing of the program would arguably be within “striking distance” of the level needed to achieve solvency. The range

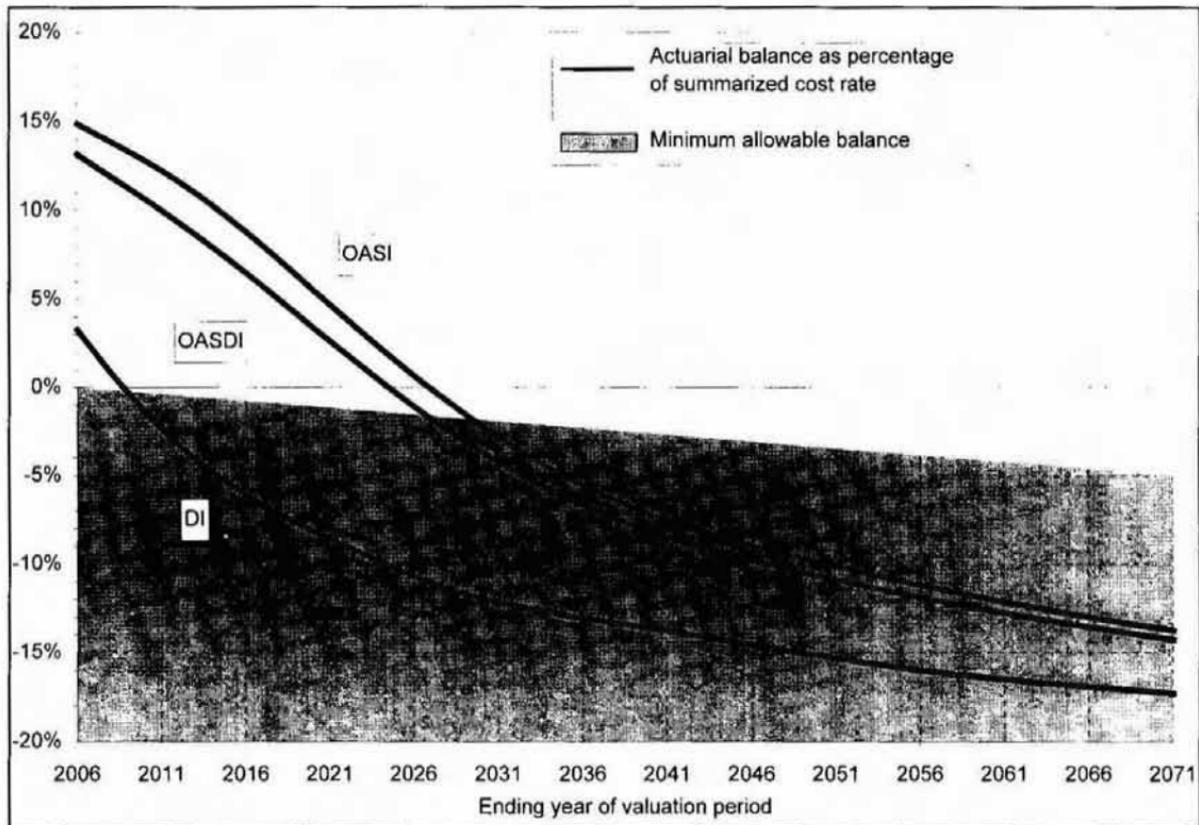


Figure 2. Comparison of estimated long-range actuarial balance with the minimum allowable for close actuarial balance (Alternative II) by trust fund. Source: 1997 OASDI Trustees Report.

of "tolerance" allowed that there would be no call for corrective legislation as long as the size of the actuarial balance or deficit was small. When the size of the actuarial balance or deficit grew larger, more than 5 percent of the cost rate, then a need to begin serious study toward enactment of corrective legislation would be indicated. Significantly, this earlier version of the test called for action not only when the program was significantly under-financed relative to pay-as-you-go financing, but also when the program was significantly over-financed relative to pay-as-you-go financing.

Based on the recommendation of the Technical Panel on Assumptions and Methods appointed by the 1991 Advisory Council, the test for close actuarial balance was modified in two ways. First, the "upper limit" for actuarial balance was removed. This was done in recognition of the fact that the 1977 and 1983 amendments both provided for temporary advance funding substantially in excess of the contingency reserve level. The temporary advance funding was described as a way to alleviate some of the burden on workers during the retirement years of the baby-boom generation by having the baby-boom generation contribute more than necessary for pay-as-you-go financing during their working years to establish reserves that could be utilized when they retired.

Second, the test was subdivided into 66 separate sub-tests, each of which must be passed in order to meet the test of close actuarial balance. These sub-tests are based on the 66 valuation periods, each beginning with the initial projection year, the first ending with the 10th projection year, and each successive period extending one year so that the 66th sub-period encompasses the entire 75-year period. The maximum permissible size for an actuarial deficit is zero percent of the summarized cost rate for the first period and 5 percent of the summarized cost rate for the 66th period; the permissible percentage is linearly interpolated for intervening periods. This expansion of the test assures that a program will not be found to be in close actuarial balance if it meets the test condition for the full long-range period (the 66th sub-period) but has a substantially larger deficit for a shorter period. Figure 3 illustrates how nearly the OASI, DI, and combined OASDI programs meet the test based on the intermediate assumptions of the 1997 Trustees Report.

The OASI program meets the test for valuation periods of length 10 through 33 years. The DI program meets the test only for valuation periods of length 10 through 12 years. The combined OASDI program meets the test for valuation periods of length 10 through 30 years. In each case, the test is not met for longer periods. Therefore, under the intermediate assumptions of the 1997 Trustees Report, each of the programs fails the test for long-range close actuarial balance.

It is not apparent that failure of the test for close actuarial balance alone has been particularly successful in motivating serious movement toward corrective legislation in the social security program. The 1977 Amendments

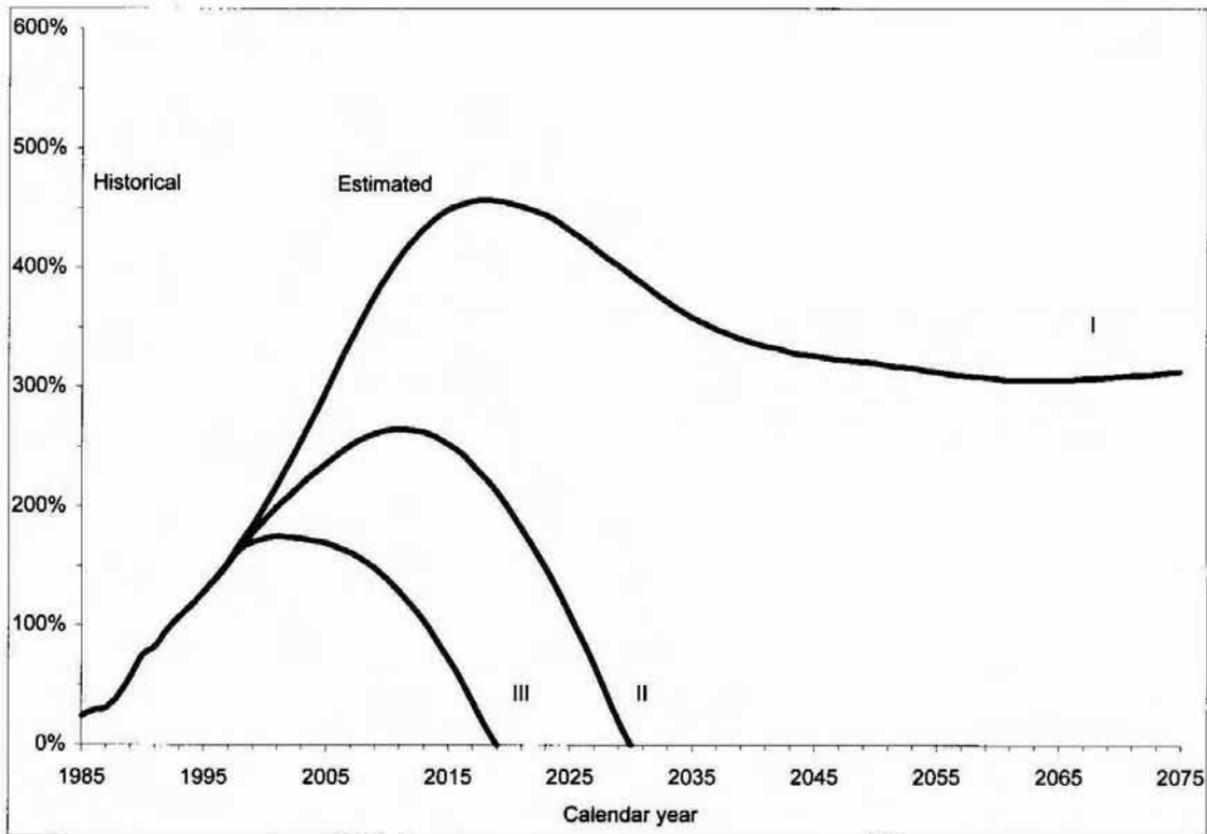


Figure 3. Estimated trust fund ratios, OASDI and DI trust funds combined, by alternative, calendar years 1985–2075 (assets as % of annual expenditures). Source: 1997 OASDI Trustees Report.

failed to bring the OASDI program within the limits of close actuarial balance; the test was not passed until 6 years later when the 1983 Amendments, motivated in part by a near-term solvency crisis, eliminated the long-range deficit altogether. Only six years later, in the 1989 report, the program was again out of close actuarial balance, and continues to be so today without immediate prospect for correction. The lack of a near-term OASDI financing crisis and the greater immediacy of the financial shortfall of the Medicare Hospital Insurance program are largely responsible.

Variation, Stochastic Simulation, and Sensitivity Testing

Due to the inherent uncertainty in projections of future experience, it is desirable to convey some sense of the plausible range of possible future conditions. This can be accomplished either with specified sets of assumptions that are intended to illustrate this variation or with stochastically varying scenarios that provide a sense of how likely it is that the true actuarial status of the program will turn out to be within a given distance range around the actuarial status based on intermediate projections.

Variation in Alternatives

For many years, Trustees Reports have provided projections for at least three full scenarios intended to describe a plausible range of possible long-term outcomes. For this purpose the intermediate alternative II assumptions, which represent the best guess of what future economic and demographic conditions will hold, are modified in each element to create the low-cost alternative I and the high-cost alternative III sets of assumptions. For these variations, the individual elements of the assumption set are varied by selecting levels around the intermediate assumption that are thought to be quite unlikely to be achieved on the average in the long run, but are, nonetheless, plausible. In this manner, each element is modified, generally in the direction that tends to result in lower program cost for alternative I and higher cost for alternative III.

The selection of assumptions on this basis results in variation of many elements from the intermediate assumptions in ways that are inconsistent with interrelationships among elements observed in past data. Thus, the low-cost and high-cost alternatives incorporate, by the method of their construction, an additional reinforcing element that moves toward low or high cost, that of structural change in the historical relationship among elements. In this way it is intended that alternatives will describe a fairly wide range of variation that is likely to encompass future experience.

Figures earlier in this chapter illustrate the range of variation in several measures of solvency based on these assumptions. Alternative I assumptions

result in projected cost rates that are very close to projected income rates, and trust fund ratios that are stable or rising. Alternative III assumptions, on the other hand, result in projected trust fund exhaustion substantially sooner than under the intermediate assumptions.

Stochastic Simulation

Stochastic simulation of future long-range economic and demographic trends and their interrelationships would provide a quantitatively, rather than qualitatively, derived basis for illustrating possible future variation in the measures of solvency of the social security program. On the plus side, it would provide a clearly defined probability distribution of measures like year of trust fund exhaustion and actuarial balance. On the minus side, it would not provide unambiguous sets of assumptions that are consistent with the various points in the distribution.

The initial challenge in developing a meaningful stochastic simulation of long-range ultimate trends is to determine what are reasonable distributions for the various elements in the assumption set. It is quite a different matter to establish a probability distribution for long-range 75-year trends in a variable than it is to establish year-to-year stochastic variation around a specified central trend. The latter distribution is readily specified using data for the past 2 or 3 decades or so. But to specify the distribution of possible 75-year trends requires either data for a *very* long period encompassing a number of independent 75-year periods where underlying conditions are reasonably similar to expected future conditions, or a presumption about the nature of the distribution. Because appropriate long-term data are not available, the distribution for each element must be based on presumption. The validity of the distribution of the measures of solvency can only be as good as the presumed distributions for the elements and their interrelationships.

The more fundamental question, however, is for what specific purpose is the stochastic variation in measures of solvency might be useful. It is clear that for private insurance, where the solvency of the insurer is essential, and the insurer cannot rewrite the terms of the contract after the insurance is issued, a probability distribution of outcomes is needed. The insurer must charge premiums that are large enough to ensure that the risk of having expenses (losses) in excess of premium income is acceptably small. And even a small risk of excessive expense may be covered with reinsurance.

Social insurance is different from private insurance in several ways. First, social insurance is not a contractual obligation, or liability. The insurer, the Federal Government, can unilaterally modify the terms of the plan if expenses turn out to be either higher or lower than expected. The 1977 and 1983 Social Security Amendments are examples of such action by the government where substantial reductions in future benefits were enacted, including benefits for current beneficiaries and fully insured workers. For this

reason, social insurance can be financed based on the expected cost, and not on the basis of something higher in order to avoid unsustainable losses. The government retains the right to lower benefits or raise taxes unilaterally; if either gains or losses occur, the plan can be modified. Moreover, it can be argued that the government should not charge more than the expected cost for social insurance. It is the ultimate reinsurer and does not set premiums with the expectation of profit. If we conclude that the government can, or even should, charge for social insurance on the basis of expected cost, then the prime function of stochastic simulation for private insurance would appear not to apply to social insurance.

Sensitivity Testing

The Trustees Reports provide summarized cost and income rates and actuarial balances projected on the basis of the intermediate assumptions in all respects except that each of the elements of the set of economic and demographic assumptions is, in turn, replaced with the high-cost and the low-cost values. This provides an additional measure of the sensitivity of the program to variation beyond that provided by projections based on the three alternative sets of assumptions.

Specifically, this sensitivity testing allows readers of the Trustees Reports who disagree with one or more of the elements of the assumptions to estimate roughly how much the solvency of the program, as measured by the actuarial balance, would be affected by modifying the assumption(s) in question.

Other Measures of Solvency

Several important measures of solvency for pension and insurance plans are based on and expressed in dollar amounts, generally present-value dollar amounts. These include the open-group surplus or deficit for a social insurance program, the closed group (to new entrants) surplus or deficiency of a plan, and the plan-termination unfunded accrued liability of a private pension or insurance plan. Each of these has a possible application to the social security program.

The open group concept is consistent with the pay-as-you-go financing approach and is thus directly applicable for the social security program. This can be referred to as the open-group unfunded obligation for social security. The term obligation is used in lieu of the term liability, because liability indicates a contractual obligation (as in the case of private insurance) that cannot be altered by the plan sponsor without the agreement of the plan participants.

The closed group (to new entrants, i.e., persons just reaching working age) surplus or deficiency may have specific application in cases like that

of the Federal Government closing the Civil Service Retirement System (CSRS) plan to persons newly hired after 1983. This is a concept that is only appropriate to a plan that has been intended to be fully advance funded, such as plans covered under ERISA. For a social insurance plan that was designed to be financed on a pay-as-you-go basis with the expectation of a continuing pool of new entrants, like social security, this concept cannot apply as a measure of solvency because it is inconsistent with the design and intent of the program. However, the concept can apply in the context of a continuing program that is converting to another form, where there is a desire to keep the financing of the old and new forms of the program separate. In this case the closed group surplus or deficit may be referred to as the closed group (to new entrants) transition gain or cost.

Similarly, the plan-termination unfunded accrued obligation concept may be applied when a continuing plan that has been financed on a pay-as-you-go basis is being converted to a new form that will apply not only for new entrants but also with respect to all future taxes or premiums of still-active workers. In this case, the unfunded obligation of the old form may be referred to as the maximum transition cost.

Open Group Surplus or Deficiency

The open group surplus or deficiency is essentially equivalent to the actuarial balance as it was produced for the 1988 through 1990 Trustees Reports. That is, it is the difference between (a) the present value of the projected tax income over the next 75 years plus trust fund assets at the beginning of the period and (b) the present value of projected cost of the program over the next 75 years. This measure differs from the actuarial balance concept used in 1988–90 only in that the open group surplus or deficiency is not divided by the present value of taxable payroll over the 75-year projection period. It further differs from the concept of actuarial balance used since 1991 in that it excludes the cost of building and maintaining a contingency reserve by the end of the period. Table 3 lists estimates of open group surplus and deficiency provided over the years to the Department of the Treasury for their annual reports “Statement of Liabilities and Other Financial Commitments of United States Government . . .” These values are consistent with estimates based on the intermediate assumptions of the Trustees Report of the year of the valuation date; in some cases estimates of the starting fund balance are updated and the effects of legislation enacted after the Trustees Report are included.

Closed Group (to New Entrants) Transition Gain or Cost

This value was provided to the Department of the Treasury for inclusion in the report cited above through 1994. Since 1995 this value has been judged

TABLE 3. OASDI Open Group Surplus or Deficiency and Closed Group (to New Entrants) for the OASDI Program, for Valuation Years 1973 Through 1997 (billions of \$)

<i>Valuation Year</i>	<i>75-Year Open Group Surplus or Deficiency (-)</i>	<i>100 Year Closed Group (to New Entrants) Transition Gain or Cost (-)</i>	<i>Lowest Age in Closed Group</i>	<i>Ultimate Valuation Interest Rate (%)</i>
7/1/1973	-176	-2,118	23	6.00
7/1/1974	-1,312	-2,460	19	6.00
7/1/1975	-2,027	-2,710	20	7.38
10/1/1976	-4,176	-4,148	21	6.60
10/1/1977	-4,787	-5,362	17	6.60
10/1/1978	-930	-3,971	18	6.60
10/1/1979	-848	-4,225	19	6.60
10/1/1980	-1,464	-5,601	15	6.08
10/1/1981	-1,555	-5,858	16	6.08
10/1/1982	-1,641	-5,808	17	6.08
10/1/1983	+148	-5,059	18	6.08
10/1/1984	+37	-4,208	15	6.08
10/1/1985	-269	-4,647	15	6.08
10/1/1986	-343	-5,394	15	6.08
10/1/1987	-378	-5,580	15	6.08
10/1/1988	-664	-5,740	15	6.08
10/1/1989	-850	-6,098	15	6.08
10/1/1990	-1,244	-7,121	15	6.08
10/1/1991	-1,185	-6,595	15	6.39
10/1/1992	-1,773	-7,376	15	6.39
10/1/1993	-1,864	-7,201	15	6.39
10/1/1994	-2,838	-8,390	15	6.39
10/1/1995	-2,833	-8,129	15	6.39
10/1/1996	-3,094	-8,856	15	6.39
10/1/1997	-2,922	-7,913	15	6.29

Source: Annual Issues of "Statement of Liabilities and Other Financial Commitments of the United States Government . . ." from the Department of the Treasury and unpublished estimates from the Office of the Chief Actuary, Social Security Administration

to be inappropriate for inclusion in the report of liabilities and other commitments. These values are included in Table 3 representing the closed-group transition gain or cost for continuing the social security program in another form for new entrants on the valuation date and later and for evaluating the old and new benefit forms separately.

The values in Table 3 are present values discounted to the valuation date and thus represent current dollars on the valuation date. Therefore, they tend to increase by the annual valuation interest rate from one valuation to the next, in the absence of any change in assumptions, methods, or the benefit and financing provisions of the program.

Maximum Transition Cost

This value represents the transition cost for continuing the social security program in a different form, with all payroll taxes for work after the valuation date credited to the new benefit form. The maximum transition cost is computed as the difference between (a) the value of the assets on the valuation date plus the present value of revenue from taxation of future benefits payable on the old form and (b) the present value of all future benefits payable after the valuation date based on earnings credited under the old form, that is, based on earnings prior to the valuation date. Based on the intermediate assumptions of the 1997 Trustees Report, the maximum transition cost computed on this basis is \$8,927 billion for a valuation date of 10/1/97 and a 100-year valuation period.

This value is only 13 percent greater than the closed-group-to-new-entrant transition cost for the same period and valuation date. The difference between these two measures is equal to the difference between (a) the present value of future payroll taxes payable by the closed group after the valuation date plus the present value of revenue from taxation of benefits earned based on these payroll taxes, and (b) the present value of additional benefits earned under the old form (beyond the past service credits described below) based on these payroll taxes. This means that the incremental revenue (a) is only slightly larger than the incremental benefits (b) described above.

Future benefits under the old form for workers who have not yet reached benefit eligibility age (62) are calculated on a proportional past service credit basis. The approach is similar to the approach developed for past service credits under the Personal Security Account (PSA) plan for the 1994–96 Advisory Council. The balance of this section describes the detailed method for computing the past service credits for the interested reader.

For each such worker, a monthly benefit amount based on the old form would be computed on the valuation date as if the worker had become disabled. For workers who survive without disability to retirement eligibility age (62), this amount would be indexed by the average wage in the national economy and multiplied by the proportioning factor derived as $P = (\text{age on valuation date} - 22) / 40$.

For individuals who are disabled continuously from the valuation date until the earlier of death or reaching retirement conversion age (their normal retirement age under the old form), all future benefits payable on the account will be as under the old form. For individuals disabled on the valuation date who recover from disability before reaching retirement eligibility age (62) and survive, disability benefits before retirement age continue under the old form and benefits after reaching retirement eligibility age are the combination of (a) the final disability monthly benefit payment

wage indexed to retirement age and multiplied by the factor $D = (\text{years disabled between 22 and 62})/40$, and (b) the monthly disability benefit payable on the valuation date, wage indexed to retirement age and multiplied by the factor $P' = (\text{non-disabled years between 22 and the valuation date})/40$. Finally, for individuals who are not disabled on the valuation date but who become disabled thereafter, but before retirement eligibility age, disability benefits are equal to the old form disability benefit computed as if disabled on the valuation date, wage indexed to the date of disability, and multiplied by the factor $D' = (\text{age on valuation date} - 22) / (\text{age at disability} - 22)$. Benefits at retirement conversion are computed in the same manner as for the individual who is disabled on the valuation date but recovers.

Conclusion

As with any pension or insurance plan, measuring the solvency of the social security system requires careful attention to the nature of the program and its intended financing method. The U.S. social security program is a social insurance plan, meaning that it expects a steady stream of mandatory participants in the future. For this reason, the program has been financed essentially on a pay-as-you-go basis since its early years, with only temporary periods of partial advance funding like the one we are entering as a result of the provisions of the 1977 and 1983 Amendments.

Because the social security program is financed on an essentially pay-as-you-go basis and has a guaranteed stream of new participants in the future, appropriate measures of solvency have been developed and are presented annually by the Trustees in their report to the Congress. These measures include the actuarial balance, annual cost and income rates and balances, annual trust fund ratios and the projected year of trust fund exhaustion, the short range test of financial adequacy and the long-range test of close actuarial balance, and of more recent interest, the size of the annual balance (deficit) at the end of the long-range 75-year projection period and the stability of the trust fund ratio at the end of the period. The combination of these measures provides an array of analytical information intended to assist policymakers, including the President and the Congress, in assessing the actuarial status of the program under current law and the financial implications of the numerous changes to the program that are considered each year.

Absent from the list of measures generally used to assess the solvency of the social security program are such measures as unfunded accrued liability. This measure is entirely appropriate in assessing the solvency of a private pension or insurance program that must by law be fully advance funded at all times, because a cessation of new entrants is always a possibility.

Among the proposals being studied for the correction of the current projected actuarial deficit for social security are a variety of plans that would

fundamentally modify the social security program. These proposals would not terminate social security but would modify its form, retaining a substantial mandatory plan providing retirement, survivors, and disability benefits as does the current system. Interestingly, these proposals do present a use for a measure like the unfunded accrued liability that is necessary for fully advance funded plans. The usefulness of the deficit measure in the context of social security is that it represents the maximum potential transition cost that may be incurred in modifying the current social security program into a fully advance-funded defined contribution individual savings plan. This fact was pointed out by Carolyn Weaver and others during the proceedings of the 1994–96 Advisory Council.

Any measure of solvency, especially in the long run (75 years), can only be as accurate as the assumptions used in its application, but the measures described above appear to be accomplishing their purpose. Interest in the long-range financing of the program has seldom been greater. And with the tools now available to make more exhaustive calculations more rapidly than ever before, there is every prospect that the next comprehensive amendments to the Social Security Act will produce a financing structure more robust than any previous one.

Of course, this does not mean that the social security program will be either fixed or “set” forever by the next amendments. Members of every generation have had and will have their own ideas about the type of social insurance system they desire. After all, it is the system’s ability to be re-tailored to some extent for each generation that has helped maintain its broad appeal for over 60 years.

The author wishes to acknowledge members of the Office of the Chief Actuary at the Social Security Administration, past and present, for their dedication and effort in developing the measures discussed in this chapter. Seung An, Orlo Nichols, and William Ritchie have been instrumental in developing the measures and estimates of solvency presented here and in the annual reports of the Social Security Board of Trustees. Opinions are solely those of the author.

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