Economic Forecasting: Effect of Errors on OASDI Fund Ratios

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A broad range of economic assumptions are used to project the future income and outgo of the Social Security system. The assumptions adopted by the Board of Trustees of the Old-Age and Survivors Insurance and Disability Insurance (OASDI) Trust Fund were rather consistently on the optimistic side of the actual experience that emerged. This article examines the experience of several key economic indicators during the 1970's. Acknowledging that forecasting such quantities is an inexact science at best, the authors present a formula for making estimates of OASDI fund ratios, given the necessary assumptions. The formula is used to project fund ratios from 1981 to 1986. It shows where the fund would stand if forecasting errors were to continue at the magnitudes experienced in 1970–76.

This article analyzes the effects of deviations of actual economic experience from that assumed in making financial projections for the Old-Age and Survivors Insurance and Disability Insurance (OASDI) program. This analysis may be useful to policymakers in making judgments about desirable fund levels and the choice of economic assumptions for alternative projections. It focuses on the OASDI fund ratio—that is, the assets for the two trust funds (OASI and DI) combined at the beginning of a calendar year as a percentage of anticipated expenditures in that year. The fund ratio serves as a convenient, albeit crude, measure of short-range financial stability. In particular, it has been stated that a fund ratio of approximately 9 percent is needed to assure that the current monthly benefits will be paid on time and that a fund ratio of at least 20 percent would be needed to avoid risking cash flow problems due to cyclical fluctuations in the program and its economic environment.

The financial condition of the Social Security system is getting considerable attention. The principal reason for this is that since calendar year 1975, OASDI disbursements have exceeded income in every year. This trend is projected to continue for a few more years.

The OASDI program is financed essentially on a pay-as-you-go basis with the trust funds serving primarily as contingency reserves. In earlier times, when the fund ratio was higher, there was greater capacity for the program to withstand financial adversity. However, with the OASDI fund ratio standing at below 20 percent in early 1981, such safety margins no longer exist. In fact, current projections show that without corrective legislative action it is a virtual certainty that the trust funds will be depleted in late 1982.

Projections and Levels of Economic Activity

Many variables affect the short-range financial operations of the OASDI program. However, short-term behavior is most strongly influenced by those variables relating to levels of economic activity such as increases in the Consumer Price Index (CPI) that result in automatic adjustments in benefits, changes in average annual wages for workers in OASDI-covered employment, and the average unemployment rate. These variables interact subtly. For example, average annual wages are linked to employment levels. In contrast to more stable and predictable variables such as mortality, disability, and retirement rates, these economic variables do not exhibit the same type of gradual and discernible long-term trends. It is now widely recognized that forecasting economic variables, even over short time periods, is likely to produce significant forecasting errors.

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The annual reports of the Board of Trustees of the Federal Old-Age and Survivors Insurance and Disability Insurance Trust Funds have included three sets of financial projections to indicate future income and outgo of the Social Security system under a broad range of economic assumptions.[1] One set of assumptions is designated as optimistic, another pessimistic, and the third intermediate. The particular sets of assumptions are so characterized depending on whether they have a favorable or unfavorable effect on the estimated financial status of the trust funds. The intermediate assumptions and the projections based thereon are intended to be best estimates. The three sets of assumptions and projections together indicate a range of costs under reasonable conditions, and thus are indicators of future financial stability. There cannot, of course, be assurance that costs will actually fall within the range of the projections for any year or period of years.

It should be noted that little discussion to date has been given to setting standards for determining what is a proper spread between the optimistic and intermediate sets of assumptions, or between the intermediate and pessimistic. In recent years, it has also become apparent that greater consideration should be given to short-term economic assumptions and their relationship with OASDI financing. Some questions might include the following:

Can or should the pessimistic set of assumptions be established with the expectation that actual economic experience will be more favorable with some level of confidence?

Should the optimistic set be similarly established?

Should financing of the system be set so that the system will not require additional financing over some minimum period of years even under economic experience significantly more adverse than assumed in the intermediate set?

In testing alternative sets of assumptions, it is convenient to have a short-cut method of approximating the fund ratios without preparing a full-scale projection based on all the essential parameters. The formula presented in this article could be used as such a short-cut method. One should recognize that alternative assumptions may affect the individual trust funds (for OASI and DI) in slightly different ways. One should also recognize that other variables—for example, disability incidence rates and rates of retirement—are subject to forecasting error that can also affect OASDI fund ratios, although probably to a lesser extent in the short range than the key economic variables. Furthermore, levels of economic activity may have secondary effects upon those other variables. Therefore, the suggested formula should be regarded as a way of computing a first approximation to the actual change in fund ratio. The formula has been used here to analyze the effect on the OASDI fund ratio of past forecasting errors in the principal economic variables for the intermediate set of assumptions. (A forecasting error is the difference between the actual value of a variable and the value assumed for it in a particular projection.) These "errors" are, of course, an inherent part of forecasting, and the use of the term is not meant to imply mistakes or oversights.

Estimating Fund Ratios

The preparation of the projected OASDI fund ratios under alternative assumptions as to the economic variables used in this analysis was facilitated by use of the following approximation.

Let F_n^a be the fund ratio at the beginning of year n + 1 under the alternative set of economic assumptions a, and let $DF_n^{a,b}$ be the difference in trust fund ratios at the beginning of year n + 1 between alternative sets of economic assumptions a and b.
Clearly,

$$DF_n^{a,b} = F_n^a - F_n^b.$$

The auxiliary function B_t^x is defined as:

$$B_t^x = W_t^x - 0.5\,(A_{t-1}^x + A_t^x) - 1.3\,(U_t^x - U_{t-1}^x),$$

where W_t^x is the change in average annual covered wages in percent in year t under set x of economic assumptions; A_t^x is the percent change in benefits due to an automatic increase in year t; and U_t^x is the average rate of unemployment in year t. Then,

$$\sum_{t=1}^{n} (n - t + 1)(B_t^a - B_t^b)$$

provides a reasonable estimate of $DF_n^{a,b}$.

The principal assumptions in this approximation are:

The benefits, benefit formula, and taxable wages are indexed as in present law;
annual expenditures and income are in approximate balance;
there is a 30-percent excess effect on covered payroll due to changes in unemployment; and,
the interest rate applicable to the trust fund equals the growth in expenditures.

Examination of this formula makes clear the sensitivity of the fund ratios to small changes in the economic variables. Let it be assumed, for example, that two alternative sets of economic assumptions are identical with the single exception that the first year's projected

[1] Five sets of short-range economic assumptions were indicated in the 1981 OASDI report.

change in nominal wages is 1 percentage point greater in set a than set b. In this case,

$$B_t^a - B_t^b = 0, \text{ if } t > 1, \text{ and}$$

$$B_1^a - B_1^b = W_1^a - W_1^b = 1,$$

therefore,

$$DF_n^{a,b} = n.$$

The reasonableness of this result may be seen in the following way: Since outgo will be identical under both sets and since income under a will be 1 percent higher in each year, the fund ratio at the beginning of the second year of the projection under a is 1 percentage point higher, 2 percentage points higher at the beginning of the third year, and so forth. This seemingly minor difference will thus snowball into a fund ratio higher by 5 percentage points after 5 years, not a small change in a period when trust fund exhaustion is imminent in the absence of corrective legislation.

Forecasting Errors

Table 1 shows for each calendar year from 1970 through 1980 the actual values for the following variables: Increase in the implicit gross national product (GNP) price deflator, increase in the CPI, increase in average annual wages in covered employment, real wage differential, and average rate of unemployment. Table 1 also shows for calendar years 1975 through 1980 the automatic OASDI benefit increases that have become effective due to changes in the CPI.

Table 2 shows the intermediate set of assumptions for three key economic variables for each of the first 5 projection years (but not past 1980) in each Trustees Report from 1970 to 1979, inclusive.

Table 3 shows for the first 5 years of the projections the forecasting errors—the differences between actual and assumed experience—in each Trustees Report from 1970 to 1976, inclusive, for three key economic variables.

Table 1.—Actual values for key economic variables, calendar years 1970-80 [1]

[In percent]

Year	Increase in GNP price deflator	Automatic benefit increase	Increase in CPI	Increase in average wages in covered employment	Real wage differential	Average unemployment rate
1970	5.4	...	5.9	4.9	-1.0	4.9
1971	5.0	...	4.3	4.9	.6	5.9
1972	4.2	...	3.3	7.3	4.0	5.6
1973	5.7	...	6.2	6.9	.7	4.9
1974	8.7	...	11.0	7.4	-3.6	5.6
1975	9.3	8.0	9.1	6.6	-2.5	8.5
1976	5.2	6.4	5.8	7.9	2.1	7.7
1977	5.8	5.9	6.5	7.3	.8	7.0
1978	7.3	6.5	7.6	8.0	.4	6.0
1979	8.5	9.9	11.3	9.3	-2.0	5.8
1980	9.0	14.3	13.5	[2] 8.5	[2] -5.0	7.2

[1] Increase is with respect to prior year.
[2] Estimated.

Table 2.—Economic variables for intermediate sets of assumptions in 1970-79 Trustees Reports

[In percent]

Year of Trustees Report	Year	Automatic benefit increase [1]	Prior year's inflation rate [2]	Increase in average annual wages in covered employment	Average unemployment rate
1970	1970	...	4.7	5.5	4.2
	1971	...	4.3	5.2	4.2
	1972	...	3.5	4.4	4.0
	1973	...	2.9	4.4	4.0
	1974	...	2.4	4.4	4.0
1971	1971	...	5.9	6.0	5.2
	1972	...	4.3	8.2	4.4
	1973	...	3.5	6.1	4.0
	1974	...	3.1	5.5	4.0
	1975	...	2.8	5.2	4.0
1972	1972	...	4.3	6.0	5.5
	1973	...	3.1	5.8	5.0
	1974	...	2.9	6.0	4.2
	1975	...	2.8	5.5	4.0
	1976	...	2.7	5.1	4.0
1973	1973	...	3.3	7.1	4.7
	1974	...	4.5	6.9	4.5
	1975	...	3.0	6.3	4.5
	1976	...	2.8	5.2	4.5
	1977	...	2.8	5.2	4.5
1974	1974	...	6.2	7.9	5.8
	1975	...	9.1	8.5	5.8
	1976	...	5.7	8.0	4.8
	1977	...	4.5	7.6	4.5
	1978	...	3.2	5.5	4.5
1975	1975	8.0	...	6.2	8.8
	1976	6.6	...	9.0	8.0
	1977	6.4	...	11.0	7.0
	1978	6.3	...	8.8	6.2
	1979	4.8	...	7.7	5.4
1976	1976	6.4	...	7.7	7.7
	1977	5.9	...	8.5	6.9
	1978	6.0	...	9.4	6.6
	1979	5.8	...	8.5	6.2
	1980	5.2	...	7.7	5.7
1977	1977	5.9	...	8.4	7.1
	1978	5.5	...	8.1	6.3
	1979	5.2	...	7.8	5.7
	1980	5.0	...	7.1	5.2
1978	1978	6.5	...	7.2	6.3
	1979	6.1	...	7.9	5.9
	1980	5.9	...	7.9	5.4
1979	1979	9.8	...	8.3	6.0
	1980	7.8	...	8.0	6.2

[1] Effective starting 1975, based on changes in the Consumer Price Index.
[2] Figures opposite 1970 report represent increase in the implicit GNP price deflator; figures shown opposite the 1971-74 reports represent CPI increases.

These forecasting errors will be used to develop alternative sets of assumptions as described later. Before 1975, there were no automatic increases in Social Security benefits. Thus, the reports of 1970-74 did not make a projection of the automatic benefit increase, but instead projected price increases, either through increases in the GNP price deflator (1970 report), or increases in the CPI (1971-74 reports). It is believed, however, that, based on these variables, the forecasting error of the 1970 report for GNP deflator and the forecasting errors

of the 1971–74 reports for increases in CPI reflect the forecasting errors that would have been made if projections of the increase in the first quarter average CPI (the measure by which benefits are now automatically adjusted) had been made. One should, of course, recognize that the 1970–74 reports were done in an era when OASDI operations were not tied by statute to inflation and so their predictions were of less consequence.

One should exercise caution in trying to give a probabilistic interpretation to these past errors, since the probability distribution of the different variables is not known. It is noteworthy that errors in the 1970's were consistently on the optimistic side. Nevertheless, an analysis of past forecasting errors should provide some useful indication of the range of deviations in OASDI fund ratios that might be expected in the future due to errors in forecasting of economic variables. Of particular interest is the range of the fund ratios that are likely in the first 5 years of a projection, based on intermediate assumptions.

Table 3.—Forecasting errors for key economic variables in 1970–79 Trustees Reports

[In percent]

Year of report	Year of projection				
	Current	2nd	3rd	4th	5th
	Inflation rate or automatic benefit increase [1]				
1970	0.4	1.1	1.5	1.3	3.3
1971	0	0	−.2	3.1	8.2
1972	0	.2	3.3	8.2	6.4
1973	0	1.7	8.0	6.3	3.0
1974	0	1.9	3.4	1.3	3.3
1975	0	−.2	−.5	.2	5.1
1976	0	0	.5	4.1	9.1
1977	0	1.0	4.7	9.3	...
1978	0	3.8	8.4	...	...
1979	.1	6.5	...	...	...
	Increase in average annual wages in covered employment [2]				
1970	−0.6	−0.3	2.9	2.5	3.0
1971	−1.1	−.9	.8	1.9	1.4
1972	1.3	1.1	1.4	1.1	2.8
1973	−.2	.5	.3	2.7	2.1
1974	−.5	−1.9	−.1	−.3	2.5
1975	.4	−1.1	−3.7	−.8	1.6
1976	.2	−1.2	−1.4	.8	.8
1977	−1.1	−.1	1.5	1.4	...
1978	.8	1.4	.6	...	...
1979	1.0	.5	...	...	...
	Average unemployment rate [3]				
1970	0.7	1.7	1.6	0.9	1.6
1971	.7	1.2	.9	1.6	4.5
1972	.1	−.1	1.4	4.5	3.7
1973	.2	1.1	4.0	3.2	2.5
1974	−.2	2.7	2.9	2.5	1.5
1975	−.3	−.3	0	−.2	.4
1976	0	.1	−.6	−.4	1.5
1977	−.1	−.3	.1	2.0	...
1978	−.3	−.1	1.8	...	...
1979	−.2	1.0	...	...	...

[1] Numbers reflect the difference between actual experience and what the intermediate set assumed as shown in tables 1 and 2, respectively. Numbers shown for 1970 report are the difference between actual and assumed percentage increases in the GNP price deflator. For the 1971–74 reports the numbers are the difference between actual and assumed percentage increases in the CPI. A positive number indicates an underestimate of the inflation rate or an automatic benefit increase.

[2] Numbers reflect the difference between actual experience and what the intermediate set assumed as shown in tables 1 and 2, respectively. A positive number indicates an underestimate of the increase in average annual covered wages.

[3] Numbers reflect the difference between actual experience and what the intermediate set assumed as shown in tables 1 and 2, respectively. A positive number indicates an underestimate of the unemployment rate.

Effect of Repeating Forecasting Errors

Table 4 shows the key economic variables for the intermediate (II-B) and pessimistic sets of assumptions in the 1981 Trustees Report. It also shows the projected OASDI fund ratio for these two sets of assumptions at the beginning of each calendar year from 1981 through 1986.

Table 5 shows seven alternative sets of short-range assumptions for the key economic variables. Each of these alternative sets is obtained by modifying the 1981 intermediate (II-B) set by introducing the forecasting errors shown in table 3 for each Trustees Report from 1970 through 1976. Thus, the "1971" modification changes each value from the 1981 intermediate (II-B) set by adding the corresponding forecasting error from the 1971 Trustees Report according to the number of years projected into the future (duration).

Table 5 also shows OASDI fund ratios for 1981 through 1986 for each of these alternative sets. These figures represent the approximate OASDI fund ratio that would result if the specified economic assumptions were realized, and all other assumptions in the 1981 intermediate (II-B) set were also realized.

Chart 1 displays the formula differences in OASDI

Table 4.—Short-range economic assumptions in 1981 and projected OASDI fund ratios

[In percent]

Assumption set	Year	Automatic benefit increase	Increase in average wages in covered employment	Average unemployment rate	OASDI fund ratio at beginning of year
Intermediate (II-B)	1981	11.2	10.2	7.8	18
	1982	9.7	9.6	7.5	13
	1983	9.2	9.7	7.2	7
	1984	8.5	8.8	7.0	2
	1985	7.7	8.1	6.8	−5
	1986	...	...	...	−8
Pessimistic	1981	11.2	11.5	7.9	18
	1982	13.4	10.9	8.0	13
	1983	11.4	11.1	8.8	7
	1984	11.0	11.4	7.9	−2
	1985	10.1	10.1	7.4	−12
	1986	...	...	...	−17

Chart 1.—Differences in projected OASDI fund ratios based on alternative assumptions of table 5

[Intermediate estimate minus alternative estimate of fund ratio in percentage points]

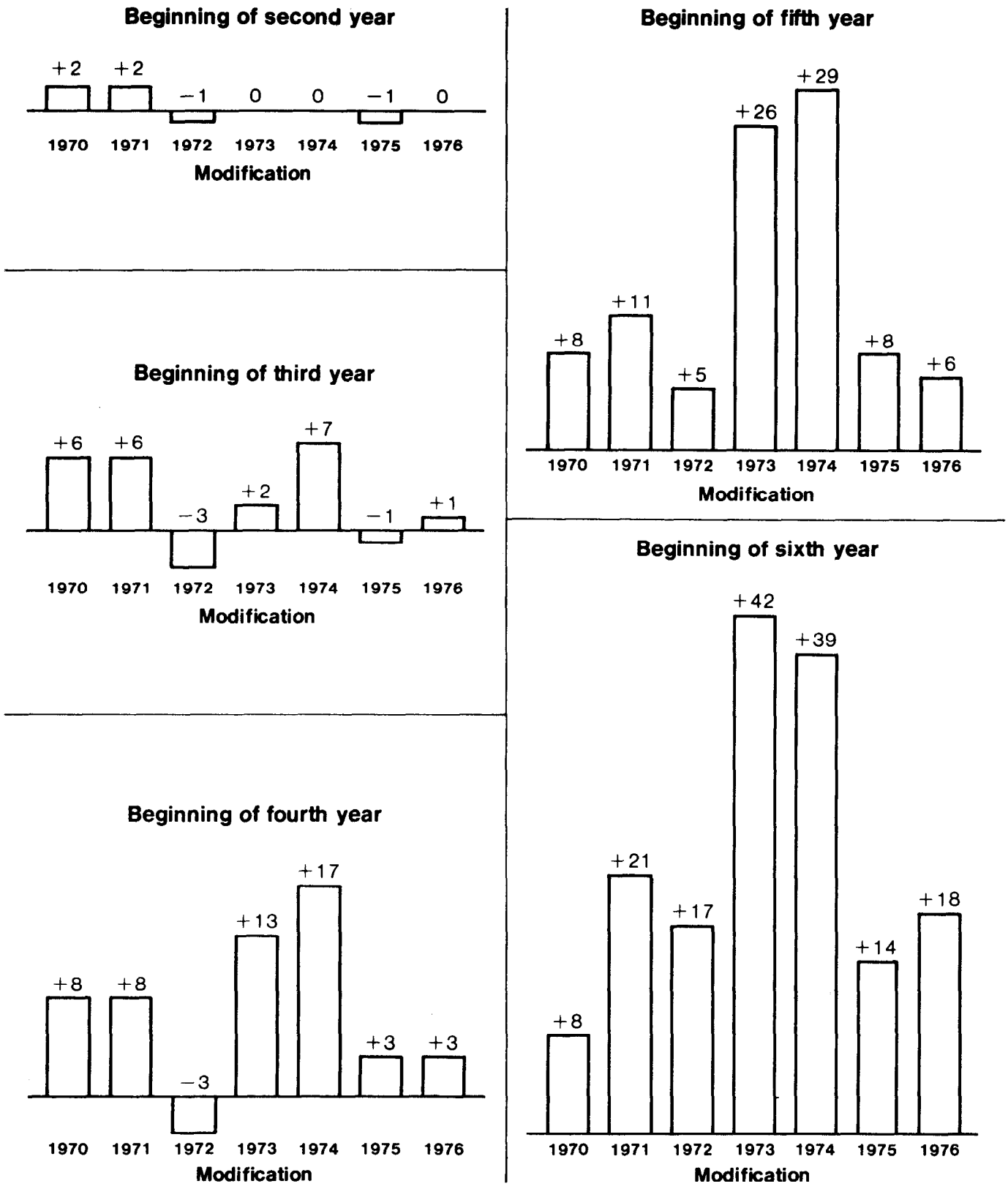

Table 5.—Alternatives to short-range intermediate (II-B) economic assumptions based on 1970-76 forecasting errors and projected OASDI fund ratios

[In percent]

Assumption set [1]	Year	Automatic benefit increase	Increase in average wages in covered employment	Average unemployment rate	OASDI fund ratio at beginning of year
"1970" modification	1981	11.6	9.6	8.5	18
	1982	10.8	9.3	9.2	11
	1983	10.7	12.6	8.8	2
	1984	9.8	11.3	7.9	−6
	1985	11.0	11.1	8.4	−13
	1986	...	...	...	−16
"1971" modification	1981	11.2	9.1	8.5	18
	1982	9.7	8.7	8.7	11
	1983	9.0	10.5	8.1	2
	1984	11.6	10.7	8.6	−6
	1985	15.9	9.5	11.3	−16
	1986	...	...	...	−29
"1972" modification	1981	11.2	11.5	7.9	18
	1982	9.9	10.7	7.4	14
	1983	12.5	11.1	8.6	11
	1984	16.7	9.9	11.5	5
	1985	14.1	10.9	10.5	−10
	1986	...	...	...	−25
"1973" modification	1981	11.2	10.0	8.0	18
	1982	11.4	10.1	8.6	13
	1983	17.2	10.0	11.2	5
	1984	14.8	11.5	10.2	−11
	1985	10.7	10.2	9.3	−32
	1986	...	...	...	−50
"1974" modification	1981	11.2	9.7	7.6	18
	1982	11.6	7.7	10.2	13
	1983	12.6	9.6	10.1	0
	1984	9.8	8.5	9.5	−15
	1985	11.0	10.6	8.3	−34
	1986	...	...	...	−47
"1975" modification	1981	11.2	10.6	7.5	18
	1982	9.5	8.5	7.2	14
	1983	8.7	6.0	7.2	8
	1984	8.7	8.0	6.8	−2
	1985	12.8	9.7	7.2	−13
	1986	...	...	...	−22
"1976" modification	1981	11.2	10.4	7.8	18
	1982	9.7	8.4	7.6	13
	1983	9.7	8.3	6.6	7
	1984	12.6	9.6	6.6	−1
	1985	16.8	8.9	8.3	−12
	1986	...	...	...	−26

[1] The value for a variable in a particular modification is obtained by adding to the assumed value from the 1981 intermediate (II-B) set of assumptions, the corresponding forecasting error from table 3.

fund ratios produced by the forecasting errors of the Trustees Reports of 1970 through 1976. As shown, the forecasting errors of those sets of assumptions produce formula differences for fifth year fund ratios that range from 8 percentage points to 42 percentage points. Three of these sets produce formula differences of over 20 percentage points. The interested reader may use these differences to determine OASDI fund ratios if alternative economic sets had been developed from the 1981 intermediate II-A set rather than the II-B set of assumptions.

This article has presented data illustrating the sensitivity of emerging OASDI fund ratios to variations in the level of economic activity and how the effects of forecasting errors will snowball in a few years. In considering the adequacy of program financing, policymakers should take into account the extent to which forecasting errors require financing plans that provide for a degree of safety margin, thereby permitting the program to operate in an orderly manner despite adverse experience.