Social Security Technical Panel Report to the 1991 Advisory Council on Social Security: Appendices

The quadrennial Advisory Council on Society Security convened a panel of economists and actuaries to review the economic and demographic assumptions and the methods used to project the status of the Social Security trust funds. In August 1990, the Panel of Technical Experts submitted a report of their findings and recommendations, which were reprinted in the November **Social Security Bulletin.** In summary, the Panel found the projection work of the Social Security Administration's Offices of the Actuary and Research and Statistics to be "professional and highly competent." However, the Panel recommended the use of new or revised tests of the system's short-run and long-run financial soundness, and changes in three of the major economic assumptions used in projecting the system's future. The Panel did not recommend changes in the demographic assumptions that underlie the projections. Panel members recommended a more thorough external review and validation of the projection methodology than time permitted and cited numerous areas where its members thought further research would be useful.

The full report also contained appendices.

A: Recommendations for Further Study
B: Appropriate Funding Standards for OASDI
C: Summary of Study on OASDI Trust Fund Level Needed to Handle Adverse Contingencies
D: Comparison of Projected OASDI Actuarial Balance for Valuation Periods of Varying Length to Minimum for Close Actuarial Balance
E: Forecast Accuracy
F: Dissenting Opinion Regarding Birth Rate Assumptions
G: Forms of COLA Curtailment

These individual appendices are reprinted in this issue.

Appendix A: Recommendations for Further Study

This Appendix summarizes and suggests priorities for the Panel's research recommendations.

Undoubtedly the most fundamental and thus the most critical review that the Panel proposes is the validation of current cost and revenue and short- and long-range projection methodology. Of particular significance to the Panel are the following issues:

- Developing a clear conceptual framework for the low-cost and high-cost sets of projections, with special emphasis on the way in which inflation rates are reflected.
- Validating the current projection methodology, developing possible simplification, and evaluating alternative methodologies. The specific analyses include, but are not limited to, the following issues:
  - Sensitivity of the results to alternative methodologies. Specific issues to be addressed include:
    - Determination of appropriate differences between the short-range and long-range methodologies, with special emphasis on the merging of the short-range and long-range projections.
    - Determination of the appropriate modifications to the process for simulating earnings histories.
    - Use of stochastic simulations to judge sensitivity and to allow for assumptions and methodology that could differ for the separate low- and high-cost projections.
    - Use of various approaches for integrating assumptions in the projection methodology (e.g., time series, cycles, trends).
    - The appropriate balance between complexity and simplicity.
  - Development of a systematic approach to allow comparison of projection results with subsequent actual experience;
  - Development of methods to quantify the uncertainty of short- and long-range forecasts, both for particular assumptions and projections; and
  - Routinization and documentation sufficient to allow relatively easy determination of the reasonableness of the methodology and the results, and relatively easy identification of areas that would benefit most from continued research.

In addition to the methodological studies, of greatest importance are those pertaining to the most influential assumptions: two demographic assumptions—fertility and mortality—and two economic assumptions—real wage growth and interest rates. The areas relating to these assumptions where it appears additional research would be most fruitful include:

- Achieving better understanding of fertility patterns, including:
  - The relationship between age at first birth and the total fertility rate,
  - The birth rates of immigrants and of their children,
  - The trends in fertility rates for various sectors of the population,
  - The extent to which recent increases in fertility rates are attributable to the increase in the proportion of blacks and

Hispanics among women of childbearing age, and
— The relationship between the level and changes in birth expectations and future fertility.

- Ensuring that:
  - — The differential ultimate rates of change in mortality by cause reflect such factors as the variation in smoking habits by sex, and
  - — The method of moving from the short-range level of an assumption to the ultimate level is appropriate.
- Understanding the determinants of changes in productivity and earnings and developing better methods of projecting future productivity and earnings, including studying:
  - — The growth in earnings to determine whether growth is occurring proportionately across all earnings levels.
  - — The effects of changing quality and demographic mix of the labor force.
  - — The effects of research and development, and capital formation, by both the private and public sectors.
  - — Determinants and projection of the linkages between productivity and earnings, particularly hours of work and fringe benefits.
  - — The appropriate historical periods (and weights to be given to different periods) to determine which averaging period and which averaging methods are most appropriate to determine the various economic assumptions.
- Understanding the determinants of nominal and real interest rates, and how to project them, including studying:
  - — The extent to which the current structure of interest rates can be used to predict future interest rates.
  - — Forecasting future inflation rates.
  - — Strategies for incorporating both historical and current interest rate information in projections.

Also of interest, but of somewhat lower priority, are:

- Determining how best to incorporate interactions among the demographic and economic variables used in forecasting (for example, between marital status and fertility).
- Establishing a more adequate knowledge base concerning immigration, including:
  - — The relationship between labor-force participation rates and rates of total net immigration,
  - — The length of coverage and average earnings of immigrants who remain in the country, as well as those immigrants and natives who emigrate, and
  - — The effect of immigration on the OASDI system, including the extent to which legal and other-than-legal immigrants receive benefits based upon their coverage under the system.
- Establishing relationships between disability incidence rates, mortality rates, recovery rates and early retirement **and** causes of disability and occupational mix.
- Studying the role of and need for an automatic stabilizer to ensure continued financial soundness for the system.

Appendix B: Appropriate Funding Standards for OASDI

Some observers have suggested from time to time that the actuarial status of the OASI and DI trust funds should be measured against the same standards that are used to assess the acceptable level of funding for private pension plans. This would mean, for example, that OASDI funding would be compared with the minimal funding standard defined by the Employee Retirement Income Security Act of 1974 (ERISA).

In general terms, this funding standard for a fully mature private pension plan represents the actuarial present value of all future anticipated benefits, less the actuarial present value of future anticipated normal costs (costs allocated to each working year for each employee) for all active and retired employees and beneficiaries. Some form of advance funding is required to better assure future benefit payments.

Historically, it has been deemed impractical and unwarranted to evaluate the funding of the OASDI program on the same basis as private pension plans for several reasons:

- OASDI is a compulsory national program covering virtually the entire working population. It is intended that the OASDI system will continue through the indefinite future, unlike private pension plans sponsored by employers who may go out of business or terminate the plans for other reasons.
- Valuation of the actuarial liabilities of private pension plans is done on a "closed-group" basis. That is, employers are not permitted to assume the addition of future new entrants to their pension plans, but must assume that the existing group of participants will assure the financial solvency of the plan. Because of the expected permanence of the OASDI system, however, an "open-group" method of valuation is appropriate. Under this method, a continual flow of new entrants is assumed.
- For private pension plans, some form of advance funding is necessary, because private plan sponsors (however large) are not able to fully guarantee future benefit payments. Full advance funding for OASDI, however, is not necessary. OASDI is backed by the "full faith and credit of the U.S. Government." There is an inherent guarantee that future benefit commitments will be met through modifications of future tax levels or appropriate modifications in benefits.
- Based on standard accounting procedures, actuarial valuations of private pension plans are generally presented on an "accrued" basis, under which the cost of providing benefits with respect to an employee is considered to be incurred during his or her working lifetime. However, consistent with the less-than-fully funded nature of OASDI (and with the overall accounting methodology of the Federal Government), OASDI valuations are presented on a "cash-flow basis."

Appendix C: Summary of Study on OASDI Trust Fund Level Needed to Handle Adverse Contingencies*

At the March 12–13 meeting of the Technical Panel on Social Security, the Office of the Actuary was asked to investigate the level of OASDI Trust Fund assets necessary to withstand a temporary period of adverse economic (or other) conditions. A complete description of our investigation was presented in my memorandum of May 15. The purpose of this memorandum is to summarize the key results of the study.

In discussing this topic, it is important to keep in mind the underlying nature of trust fund assets and what it means to "redeem trust fund investments" to cover operating deficits. Specifically, the invested assets represent Federal budget authority held in reserve. Thus, the **legal** ability to continue OASDI benefit payments (when cash income is insufficient) comes from the reserve budget authority, but the actual **cash** comes from Federal revenue sources such as personal and corporate income taxes, and borrowing from the public.

The analysis we performed indicates that OASDI assets of from 55 to 110 percent of annual expenditures would generally be sufficient to cover the effects of a period of adverse economic conditions for about 5 to 10 years. Adding another 10 to 25 percent, for the possibility of simultaneous, noneconomic adverse experience, suggests that a fund ratio of from 65 to 135 percent would guard against short-range adverse contingencies. The midpoint of this range, 100 percent, represents a reasonable "target" ratio for contingency purposes.

Methodology

Our study was designed to estimate the decrease in assets that would result from experiencing adverse economic conditions comparable to the worst that actually occurred in the 1970's and early 1980's. The decrease in assets would depend not only on the adverse conditions but also on what economic conditions were assumed to occur when financing was established for the program. The more pessimistic the adverse scenario—or the more optimistic the assumptions underlying the financing—the greater the reduction in assets under the adverse conditions. Similarly, the decrease in assets would depend on whether financing is established on a current-cost basis or on some other basis (such as higher tax rates designed to accumulate a substantial fund level).

For purposes of this study, we developed a theoretical "baseline" projection for the OASDI Trust Funds which (i) represents a current-cost financing schedule (maintaining assets equal to 100 percent of annual expenditures) and (ii) is based on alternative II-B assumptions from the 1990 Trustees Report.

Against this baseline, we compared a number of pessimistic economic scenarios with alternative nominal wage increases, benefit increases, and unemployment rates. The pessimistic scenarios were drawn from past economic experience; for example, one scenario replaces the alternative II-B assumptions for 1990–94 with the wage increases, benefit increases, and unemployment rates from 1973–77. Scenarios were based both on actual past data, and on past data adjusted to smooth the transition from current conditions.

The average reduction in the OASDI fund ratio at the end of 5 years, for the three scenarios with the most adverse effect over this period, was 44 percentage points. Over 10 years, the corresponding

*Richard S. Foster, Deputy Chief Actuary, Office of the Actuary, Social Security Administration. Memorandum dated June 13, 1990 to Advisory Council Technical Panel on Social Security.

average was a reduction of 101 percentage points.

It should be noted that the same process could be performed for OASI and DI separately, and might well lead to somewhat different fund ratio targets between the two programs. Given the history of tax rate reallocations between the two trust funds, and the desirability of simplifying the various measures of financial status, it is probably sufficient to reflect only the combined assets.

Other Considerations

The scenarios described above provide a reasonable idea of the effect of temporary adverse conditions, such as recessions and/or high inflation, on trust fund assets. Another consideration is the possibility that the **trend** of actual economic experience will be permanently less favorable than assumed when financing was set. By way of illustration, if the annual wage increase, benefit increase, and unemployment rate are each 0.5 percentage point "worse" than assumed in the baseline assumptions, then the fund ratio declines by about 19 percentage points over 5 years and 53 percentage points over 10 years. These differences are well within the range determined by the temporary adverse scenarios. Thus, one can reasonably conclude that asset levels adequate to handle temporary contingencies will also be sufficient to handle a moderate degree of trend error over a 5- to 10-year time frame.

A contingency reserve might also be called upon to offset the effects of other, noneconomic adverse experience. For example, disability incidence rates, the spread of AIDS, retirement rates, and numerous other factors could vary from their assumed levels and result in higher expenditures or lower income. The alternative III assumptions from the Trustees Report include unfavorable demographic and programmatic assumptions, in addition to the adverse economic assumptions. We estimated the effect on the OASDI fund ratio attributable to just the noneconomic factors in alternative III. Relative to the baseline projection, the fund ratio would decline by 10 percentage points over 5 years, and 26 percentage points over 10 years. For contingency reserve purposes, it would be desirable to include a margin for these noneconomic effects in addition to the potential decline due to adverse economic conditions.

A final consideration is that the fund assets should not go below 8 to 9 percent of annual expenditures at the beginning of any month, or else there would not be sufficient assets to cover the benefit payments falling due on the third of the month.

Conclusion and Recommendations

A key question concerns the time period over which the trust funds should be expected to cover unanticipated shortfalls. On the one hand, there should be sufficient time for Congress to take action, preferably at a time that would not aggravate the unfavorable conditions. On the other hand, the trust funds should not be expected to take the place of adequate financing for very long. The assets, after all, represent only the authority to use other Federal revenue which, in the short run, may represent additional Federal borrowing from the public. As such, the contingency reserve is more of a convenient bookkeeping mechanism that enables the program to continue to operate temporarily at a time that its normal tax income in insufficient.

In my opinion, a fund adequate to cover shortfalls for 5 years is a reasonable minimum; at the upper end, adequacy for anything more than 10 years seems excessive (and potentially misleading). Thus, I would consider it reasonable to establish a target range of 65 to 135 percent of annual expenditures, as developed in the following table. The midpoint of this range, 100 percent, strikes me as a reasonable specific target.

By way of comparison, the financing problems that led to the Social Security Amendments of 1977 were first identified in 1974. The time from Trustees Report issuance to enactment of the legislation was a little less than 4 years. In the case of the 1983 amendments, the problems were first identified in 1979. Several minor sets of legislation helped postpone the need for major corrections. The overall time lag was, again, about 4 years. The actual declines in the OASDI fund ratio during the adverse periods ranged from about 8 to 10 percentage points per year. The recommended range of 65 to 135 percent seems reasonably consistent with this actual past experience.

Contingency	5-year horizon	10-year horizon	Midpoint
Adverse economic conditions	44%	101%	...
Adverse noneconomic conditons	10	26	...
Beginning-of-month requirement	8-9	8-9	...
Total (rounded)	65	135	100%

Appendix D: Comparison of Projected OASDI Actuarial Balance for Valuation Periods of Varying Length to Minimum for Close Actuarial Balance*

This memorandum describes a possible definition for the test of long-range close actuarial balance developed in discussions with the Technical Panel appointed by the 1991 Advisory Council on Social Security. The test would require that actuarial balances computed for valuation periods of varying length meet a series of minimum requirements.

In the 1990 OASDI Trustees Report, the actuarial balance is computed for the first 25 years, 50 years, and 75 years and includes the value of the trust fund balances on hand at the end of December, 1989. The new test would require computation of the actuarial balance for valuation periods of varying length (11 to 75 years) including both the beginning trust fund balances and the cost of attaining a trust fund level by the end of each period, equal to 100 percent of annual expenditures.

The resulting actuarial balances for these valuation periods would be compared to a series of minimum requirements for the test of long-range close actuarial balance. These minimum requirements would provide that the actuarial balance for each period not be less than a specified percentage of the summarized cost rate for the period. A minimum requirement of negative 5 percent would be specified for the 75-year valuation period, consistent with the old test for close actuarial balance. The minimum requirement for shorter periods would be reduced in direct proportion to the length of the valuation period.

The accompanying table and graph present the actuarial balances, expressed as a percentage of the cost rate, in comparison with the suggested requirements for close actuarial balance, all based on the alternative II-B assumptions of the 1990 Trustees Report. While the minimum requirement is not met for period ending in 1990 (because the trust fund balance was not projected to have attained 100 percent of annual expenditures by the end of the year), the suggested test would address only periods of 11 years in length or longer. For valuation periods ending in 1991 through 2049, the actuarial balances calculated on the specified basis would exceed the minimum requirement. However, for valuation periods ending with 2050 or later, the actuarial balances would be below (more negative than) the minimum, and thus the OASDI program would be found to be out of long-range close actuarial balance.

While the test for close actuarial balance has been presented above in terms of the actuarial balance as a percentage of the summarized cost rate, it should be noted that it is equivalent to state the test in terms of the summarized income rate as a percentage of the summarized cost rate. (The actuarial balance for a period is equal to the difference between the summarized income rate and the summarized cost rate for the period. Therefore, the actuarial balance as a percentage of the income rate is equal to the income rate as a percentage of the cost rate, minus 100.)

Expressed in the alternative form, the test for long-range close actuarial balance requires that the summarized income rate for a period be not less than a specified minimum percentage of the summarized cost rate. For the 75-year period, the minimum percentage would be 95 percent (i.e., 100 percent plus the minimum requirement of negative 5 percent for the test presented in terms of actuarial balance as a percentage of the summarized cost rate).

*Steve Goss, Supervisory Actuary, Office of the Actuary, Social Security Administration. Memorandum dated July 27, 1990, to Advisory Council Technical Panel on Social Security.

OASDI summarized rates* for variable periods: 1990 Trustees Report alternative II-B

Year	Summarized value for period from 1990 through end of current year				Minimum for close actuarial balance as percent of CR
	Income rate*	Cost rate (CR)*	Actuarial balance*		
			Percent of payroll	Percent of CR	
1990	19.72	21.09	−1.37	−6.49	−0.07
1991	16.20	15.84	0.36	2.25	−0.13
1992	15.03	14.10	0.92	6.55	−0.20
1993	14.44	13.24	1.20	9.09	−0.27
1994	14.09	12.72	1.37	10.78	−0.33
1995	13.86	12.37	1.49	12.02	−0.40
1996	13.69	12.12	1.57	12.96	−0.47
1997	13.56	11.93	1.64	13.72	−0.53
1998	13.46	11.78	1.69	14.33	−0.60
1999	13.38	11.65	1.73	14.85	−0.67
2000	13.32	11.56	1.76	15.27	−0.73
2001	13.27	11.48	1.79	15.63	−0.80
2002	13.23	11.41	1.82	15.94	−0.87
2003	13.19	11.35	1.84	16.20	−0.93
2004	13.16	11.31	1.86	16.42	−1.00
2005	13.14	11.27	1.87	16.59	−1.07
2006	13.12	11.24	1.88	16.73	−1.13
2007	13.10	11.21	1.89	16.82	−1.20
2008	13.08	11.20	1.88	16.83	−1.27
2009	13.07	11.19	1.88	16.78	−1.33
2010	13.06	11.19	1.86	16.66	−1.40
2011	13.05	11.20	1.84	16.47	−1.47
2012	13.04	11.22	1.82	16.20	−1.53
2013	13.03	11.25	1.78	15.85	−1.60
2014	13.03	11.29	1.74	15.43	−1.67
2015	13.02	11.33	1.69	14.94	−1.73
2016	13.02	11.38	1.64	14.39	−1.80
2017	13.01	11.44	1.58	13.79	−1.87
2018	13.01	11.50	1.51	13.14	−1.93
2019	13.01	11.57	1.44	12.44	−2.00
2020	13.01	11.65	1.36	11.72	−2.07
2021	13.01	11.72	1.29	10.97	−2.13
2022	13.01	11.80	1.21	10.21	−2.20
2023	13.01	11.89	1.12	9.44	−2.27
2024	13.01	11.97	1.04	8.67	−2.33
2025	13.01	12.06	0.95	7.90	−2.40
2026	13.01	12.15	0.87	7.14	−2.47

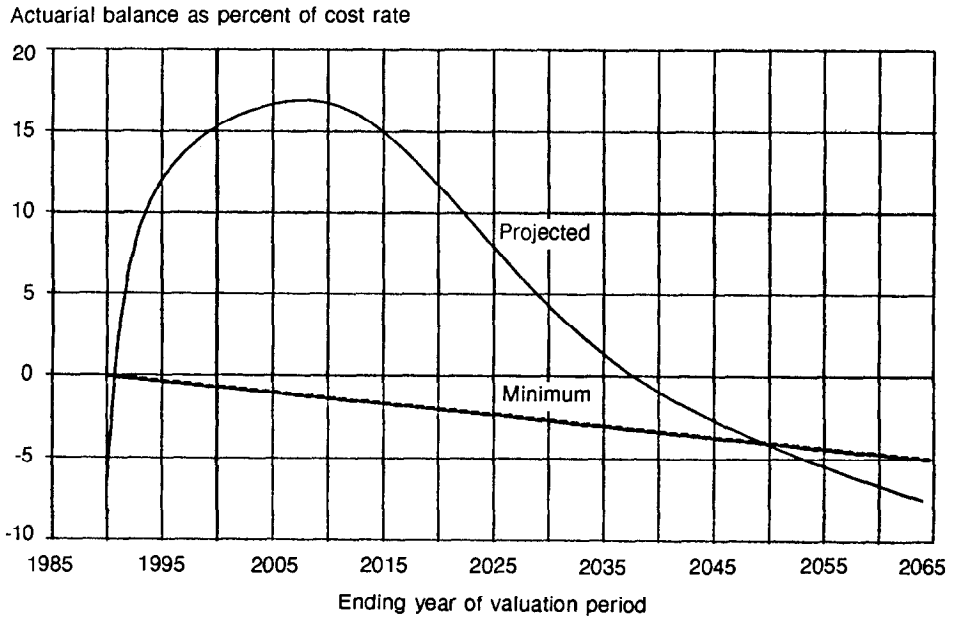
*Cost rate includes fund at end of period equal to 100 percent of following year's outgo. Income rate includes trust fund balance as of December 31, 1989: $163.0 billion.

OASDI summarized rates* for variable periods: 1990 Trustees Report alternative II-B—**Continued**

Year	Summarized value for period from 1990 through end of current year				Minimum for close actuarial balance as percent of CR
	Income rate*	Cost rate (CR)*	Actuarial balance*		
			Percent of payroll	Percent of CR	
2027	13.02	12.23	0.78	6.39	-2.53
2028	13.02	12.32	0.70	5.67	-2.60
2029	13.02	12.40	0.62	4.96	-2.67
2030	13.02	12.49	0.53	4.28	-2.73
2031	13.02	12.57	0.46	3.63	-2.80
2032	13.03	12.65	0.38	3.00	-2.87
2033	13.03	12.72	0.31	2.40	-2.93
2034	13.03	12.79	0.24	1.84	-3.00
2035	13.03	12.86	0.17	1.30	-3.07
2036	13.03	12.93	0.10	0.80	-3.13
2037	13.04	12.99	0.04	0.32	-3.20
2038	13.04	13.05	-0.02	-0.13	-3.27
2039	13.04	13.11	-0.07	-0.55	-3.33
2040	13.04	13.17	-0.13	-0.95	-3.40
2041	13.04	13.22	-0.18	-1.33	-3.47
2042	13.04	13.27	-0.22	-1.70	-3.53
2043	13.05	13.32	-0.27	-2.04	-3.60
2044	13.05	13.36	-0.32	-2.37	-3.67
2045	13.05	13.41	-0.36	-2.69	-3.73
2046	13.05	13.45	-0.40	-3.00	-3.80
2047	13.05	13.50	-0.44	-3.29	-3.87
2048	13.05	13.54	-0.49	-3.58	-3.93
2049	13.05	13.58	-0.53	-3.87	-4.00
2050	13.06	13.62	-0.56	-4.14	-4.07
2051	13.06	13.66	-0.60	-4.42	-4.13
2052	13.06	13.70	-0.64	-4.68	-4.20
2053	13.06	13.74	-0.68	-4.94	-4.27
2054	13.06	13.78	-0.72	-5.20	-4.33
2055	13.06	13.82	-0.75	-5.45	4.40
2056	13.06	13.85	-0.79	-5.69	-4.47
2057	13.07	13.89	-0.82	-5.93	-4.53
2058	13.07	13.93	-0.86	-6.17	-4.60
2059	13.07	13.96	-0.89	-6.40	-4.67
2060	13.07	14.00	-0.93	-6.62	-4.73
2061	13.07	14.03	-0.96	-6.84	-4.80
2062	13.07	14.06	-0.99	-7.05	-4.87
2063	13.07	14.10	-1.02	-7.26	-4.93
2064	13.07	14.13	-1.05	-7.46	-5.00

*Cost rate includes fund at end of period equal to 100 percent of following year's outgo. Income rate includes trust fund balance as of December 31, 1989: $163.0 billion.

Comparison of projected OASDI actuarial balance as percent of cost rate for varying valuation periods to minimum for close actuarial balance: 1990 alternative II-B



Appendix E: Forecast Accuracy*

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Introduction

Because the objective of the OASDI forecasts is to provide useful estimates of future income, cost and trust fund balance, forecast accuracy should be measured by comparing the forecasts of the OASDI income, cost and trust fund levels with the actual values. These comparisons, however, would necessarily be rather limited because of changes in the Social Security law: naturally a forecast of future income or cost will be inaccurate if in the intervening years Social Security tax or benefit rates are changed. For example, the forecast made in 1981 of OASDI income in 1984 is almost certain to be inaccurate because of the 1983 Social Security law changes. The 1977 and 1983 law changes reduced substantially the number of meaningful comparisons between the forecasts and the actual values of OASDI income and costs.

An alternative is to measure the accuracy of the economic and demographic assumptions which underlie the income and cost forecasts. These assumptions which are, themselves, forecasts should be independent of law changes. If they are found to be highly inaccurate, it would be unlikely that the forecasts of OASDI income and costs would be accurate.

The purpose of this report is to give some information about the accuracy of the short-term forecasts of some of the economic variables that underlie the forecasts of income and cost. The report will concentrate on the economic assumptions because in the short term they are more important determinants of the financial status of the OASDI Trust Funds than the demographic forecasts. It is important to learn about the accuracy of the demographic forecasts, but we do not have a sufficiently long historical experience to evaluate the long-term assumptions.

Forecast accuracy will be measured by comparing the 1-year-ahead through 5-year-ahead forecasts of the unemployment rate, the rate of change in real GNP, the rate of change in the real wage (the difference between the change in the covered wage and the inflation rate) and the inflation rate with actual values over the period from 1973 through 1989. The data come from the annual Trustees' Reports and from the Office of the Actuary.

Forecast Bias

A measure of the forecast bias of a variable is the average forecast residual, which is the actual value of the variable minus the forecast value. The following table has average residuals (in percent) for representative forecast horizons.

Estimated standard errors of the average residuals are in parentheses. The estimates are based on 10–14 observations from 1976 through 1989 depending on the variable and forecast horizon. The residuals are measured in the same units as the predicted variables: unemployment is percentage of labor force; GNP change, wage change and inflation are percentage change.

Although no bias (as measured by the average residual) is significantly different from zero, several are economically important. For example, the 4-year-ahead estimates of the change in GNP averaged 1.28 percent more than the actual values. (The actual rates of change in GNP averaged 2.9 percent over the sample period: the forecast rates averaged about 4.2 percent.) If the bias were to persist over long periods it would lead to a substantial overestimate of real GNP. In the 4-year-ahead forecasts, the averages

Table 1.—Average forecast residual (percent)

Forecast	Unemployment	GNP change	Wage change	Inflation
1-year-ahead	−.14	.41	.46	.23
	(.09)	(.33)	(.25)	(.33)
4-year-ahead	.92	−1.28	−.51	.61
	(.59)	(.80)	(.88)	(1.21)

of all the variables are on the optimistic side: unemployment and inflation were underestimated and GNP change and wage change were overestimated.

Forecast Variation

The standard deviation of the forecast error is a measure of the amount by which the forecast differed from the actual value.

Standard deviations of forecast errors

Forecast	Unemployment	GNP change	Wage change	Inflation
1-year-ahead	0.35	1.27	0.93	1.37
4-year-ahead	2.11	2.97	2.77	4.52

If it can be assumed that the forecast errors have a normal distribution, the standard deviation can be used to estimate the fraction of errors that will lie outside of some particular interval. A more conventional use of the standard deviation is to find the interval (a confidence interval) such that a prespecified fraction of observations will lie within that interval. The following table has the 80 percent and 95 percent confidence intervals for the forecast errors under the assumption the errors are normal: that is one would expect that 80 percent of the forecast errors would lie within the 80 percent confidence interval in the first case, and 95 percent in the second case.

The table shows, for example, that the 4-year-ahead forecast error of unemployment should, 80 percent of the time, lie in an interval of width 5.4. If the bias is zero, this means that the forecast of the unemployment rate should be within 2.7 percent of the actual value 80 percent of the time. Thus, if the actual unemployment rate were 6 percent, 80 percent of the forecasts should lie between 3.3 percent and 8.7 percent. This is a rather large confidence interval in that a movement in the unemployment rate of the size of the confidence interval would be a matter of substantial policy interest. The other confidence intervals are similarly large.

Table 2.—Confidence intervals (percent)

Forecast	Unemployment	GNP change	Wage change	Inflation
80 percent interval:				
1-year-ahead	0.9	3.3	2.4	3.5
4-year-ahead	5.4	7.6	7.1	11.6
90 percent interval:				
1-year-ahead	1.4	5.0	3.6	5.4
4-year-ahead	8.3	11.6	10.9	17.7

Note: These confidence intervals are based on the assumption that the forecast bias is zero: because the standard deviations are so large relative to the estimated biases, the assumption is very accurate.

A way to assess the I and III forecasts as confidence intervals is to compare their average spread with the confidence intervals given in table 2.

The average differences between the I and III forecasts are much smaller than the widths of the 80 percent confidence intervals, especially for inflation. This implies that a substantial number of the forecasts should lie outside of the range bounded by I and III.

The actual values and the I and III 4-year-ahead forecasts are shown in figures 1–4. For example, the low cost (I) unemployment rate in 1979 was forecast 4 years earlier (in 1976) to be 5.6 percent and the high cost (III) was forecast to be 7.6 percent. The actual value in 1979 was 5.8 percent. As the figures show, a substantial number of the actual values lie outside of the range bounded by the I and III forecasts.

This is seen more clearly in the following table which gives the percentage of actual values that fall within, on the boundary of, and outside of the range of the I and III forecasts.

For example, 27 percent of the actual unemployment rates were within the range of the 1-year-ahead I and III forecasts. An average over the forecasts of unemployment, GNP change, wage change and inflation shows that just 41 percent of the actual values were within the bounds of the 1-year-ahead I and III forecasts, and 31 percent were within the bounds of the 4-year-ahead forecasts.

Average difference between I and III forecasts (percent)

Forecast	Unemployment	GNP change	Wage change	Inflation
1-year-ahead	0.43	2.14	1.94	1.12
4-year-ahead	1.92	1.42	1.73	2.95

Forecast	Percent within	Percent boundary	Percent outside	Percent total
1-year-ahead:				
Unemployment	27	9	64	100
GNP change	45	9	45	100
Wage change	50	30	20	100
Inflation	42	16	42	100
4-year-ahead:				
Unemployment	36	18	46	100
GNP change	18	0	82	100
Wage change	33	0	56	100
Inflation	36	9	55	100

Forecasts of Levels

The forecasts of the economic variables are in terms of levels of some variables (unemployment) and rates of change of other variables (GNP, real wage, and inflation). This is quite natural in that it is reasonable to predict ultimate levels of some variables and ultimate rates of change of other variables: then the short-term forecasts provide a transition from actual levels and rates of change to the ultimate levels and rates of change. Of course, given a base level, the predicted rates of change cumulate to predict the level of a variable many periods into the future.

The analysis of this report has been of the forecast errors, whether they be of levels or rates of change. Yet, in the short-run levels may be more important in some cases than rates of change: for example, it may be more important to predict the level of GNP in 5 years than the intervening rates of change. It could happen that errors in predicting rates of change are offsetting so that a distant forecast is more accurate than what would appear from simply examining the accuracy of each intervening rate of change forecast. To find if this is true, the predicted levels can be examined directly.

An example of the forecasts of levels is given in figure 5. It has 4-year-ahead forecasts of the level of the real wage and the actual values. The forecasts are found by cumulating the 1- through 4-year forecasts of wage changes from the actual 0th year wage level.

I and III do not appear to form better bounds for the levels than for the rate of change in figure 3. The following table summarized I and III as bounds on the forecasting accuracy of levels.

Forecast	Percent within	Percent boundary	Percent outside	Percent total
4-year-ahead:				
GNP level	55	0	45	100
Wage level	56	0	44	100
Price level	0	36	64	100

Overall, 37 percent of the actual values fell within the I and III range, which is about the same as with the forecasts of rates of change.

Covariation in Forecasts

Forecasts of the income, cost and balance of the trust fund are based on forecasts of the economic (and demographic) variables. If the forecast errors of the economic variables are independent, it is unlikely that all errors will simultaneously be exceptionally optimistic or pessimistic. That is, although the forecasts taken individually could often fall outside the I and III range, the forecasts of OASDI income and cost could often lie inside the I and III range. It appears, however, that the forecast errors of the economic variables are far from independent as shown by the following table of correlation coefficients of 4-year-ahead forecasts.

Table 3.—Correlations among 4-year-ahead forecast errors

Variables	Correlation coefficient
Unemployment and GNP change	−.69
Unemployment and wage change	−.41
Unemployment and inflation	.21
Wage change and GNP change	.76
Wage change and inflation	−.96
GNP change and inflation	−.67

For example, when the actual unemployment rate is higher than the forecast unemployment rate, growth in real GNP and in the real wage are lower than their forecasts. Thus, the economic variables tend to reinforce each other to produce wider variation in income, cost and trust fund balance than would happen if they were independent.

At least in the 4-year-ahead forecasts, this tendency is amplified by the average bias as shown in table 1: the biases have exactly the same pattern of correlation as the correlation coefficients. For example, unemployment was underestimated on average and GNP change was overestimated.

Because each of the economic variables often lies outside the I and III range and they are reinforcing (bad outcomes on one variable are associated with bad outcomes on the other variables), it should be expected that OASDI income, cost and trust fund balance will often lie outside the I and III range in the absence of law changes.

Forecasts of Trust Fund Balance

Although there are only a limited number of valid observations on forecasts of income, cost and balance, the observations show that often the actual values were not bounded by I and III. The following table has all valid (no intervening law change) 4-year-ahead forecasts of OASDI Trust Fund balance (measured by the contingency fund ratio) and actual values.

Table 4.—Forecast and actual OASDI contingency fund ratio (percent)

Trustees' Report	High (I)	Mid	Low (III)	Actual
1973	...	77	...	57
1974	54	53	...	47
1978	22	21	18	18
1979	25	23	17	15
1983	27	23	19	29
1984	31	27	18	31
1985	39	30	19	41
1986	57	46	37	57

Note: The contingency fund ratio is the ratio (in percent) of trust fund assets at the beginning of a year to the expenditures from the fund during the year in percent.

For example, table 4 shows that in the 1973 Trustees' Report the OASDI Trust Fund was forecast to have assets at the beginning of 1976 equal to 77 percent of expenditures during the year. The actual balance was 57 percent of expenditures. Out of the eight comparisons in the table, three forecasts were outside the range of I and III, three were on the boundary, and the first two probably should be judged to be outside.

As with the economic assumptions, there is no discernible bias: during the 1970's, the trust fund fell short of the predictions, reflecting the overly optimistic forecasts of the economic assumptions; during the 1980's, it exceeded the predictions.

The difference between the I and III forecasts has been increasing: in the 1976 Trustees' Report, the earliest with high, middle, and low forecasts, the difference was 4 percent (not shown in table 4); as shown in the table the difference was 8 percent in 1983 and 20 percent in 1986; the difference was 32 percent in the 1989 report (not shown). The increase in the spread may reflect the recognition that the I and III forecasts have often not bounded the actual values.

Because trust fund balance is the accumulation of the difference between income and expenditure, inaccurate forecasts of trust fund balance could result from inaccurate forecasts of either income or expenditures or both. In the 4-year-ahead forecasts during the 1970's, actual expenditures (measured as dollar amounts) consistently exceeded the high-cost forecasts (III); no such pattern is evident in the forecasts of income. During the 1980's, expenditures were often less than the low-cost forecasts (I), whereas income generally fell between the I and III bounds. This suggests that more attention should be paid to increasing the forecasting accuracy of the components of expenditures rather than the components of income. A first step would be to identify the components that have been least successfully forecast.

The accuracy of the 5-year-ahead forecasts is similar to the accuracy of the 4-year-ahead forecasts with most of the actual values of the trust fund ratio falling outside the I to III range. Even in the 3-year-ahead forecasts, many actual values were outside the range.

Time-Series Aspects of Forecasts

The forecast errors of a particular economic variable over different time horizons have substantial correlation. For example, the correlation coefficients between the 3-year-ahead and 4-year-ahead forecast errors are shown in the following tabulation.

Variable	Correlation coefficient
Unemployment	.93
GNP change	.98
Wage change	.99
Inflation	.94

This happens because the actual variables are strongly serially correlated and the forecasts do not change much as the horizon increases. This implies that a particular forecast error, viewed as a time series, has strong serial correlation. Therefore, the forecast error should not be taken to be a sequence of independent random variables. This has, of course, implications for the accumulation of forecast errors: for example, a positive forecast error in some year will tend to be associated with a positive forecast error the following year. Investigation of the time-series properties of the forecast errors was beyond the scope of this report, but it should be the objective of future research.

Conclusion

The short-term forecasts of the economic variables are often far from the actual values, even when the time horizon is short. This means that the actual values often lie outside the range bounded by the I and III forecasts. The implication is that I and III should not be

considered to bound the actual values of the economic assumptions with high probability. The correlations among the forecast errors of the economic variables lead to the supposition that I and III probably do not bound the trust fund balance. Only limited investigation of the forecast errors of the trust fund balance was undertaken because of intervening law changes, but this was verified in the small sample that is available: often the actual value of the OASDI Trust Fund ratio fell outside the I to III range. The tentative conclusion is that I and III should not be considered to be high-level confidence intervals for the trust fund. This conclusion, however, should be the subject of future investigation. A method would be to use the entire sequence of economic forecasts with the most recent forecasting model of income, cost and balance; this would net out the effects of the law changes.

Future research should try to quantify better the uncertainty of the forecasts. Recognizing the uncertainty would not necessarily make them less useful, but it would encourage their appropriate use.

Figure 1.—Unemployment change, four-step forecast

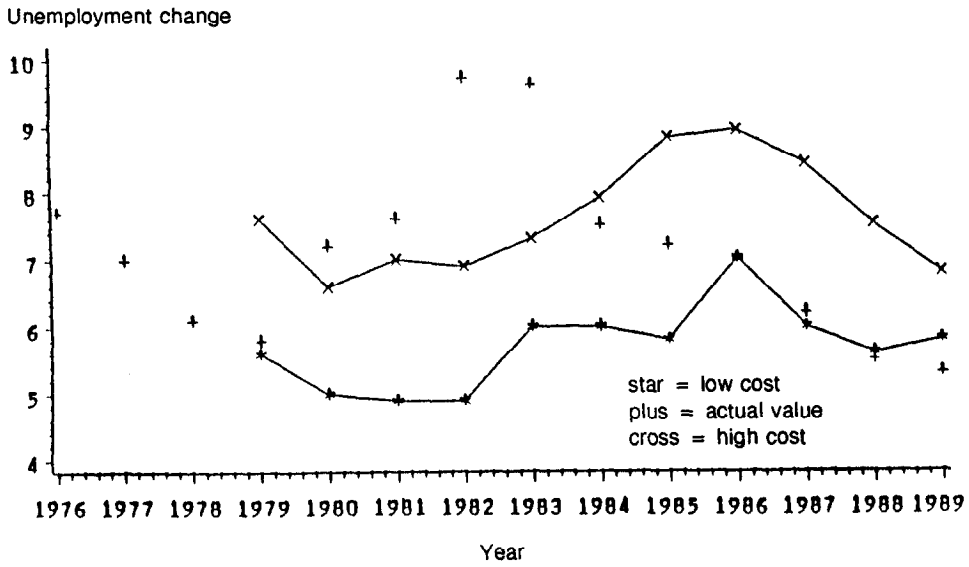


Figure 2.—GNP change, four-step forecast

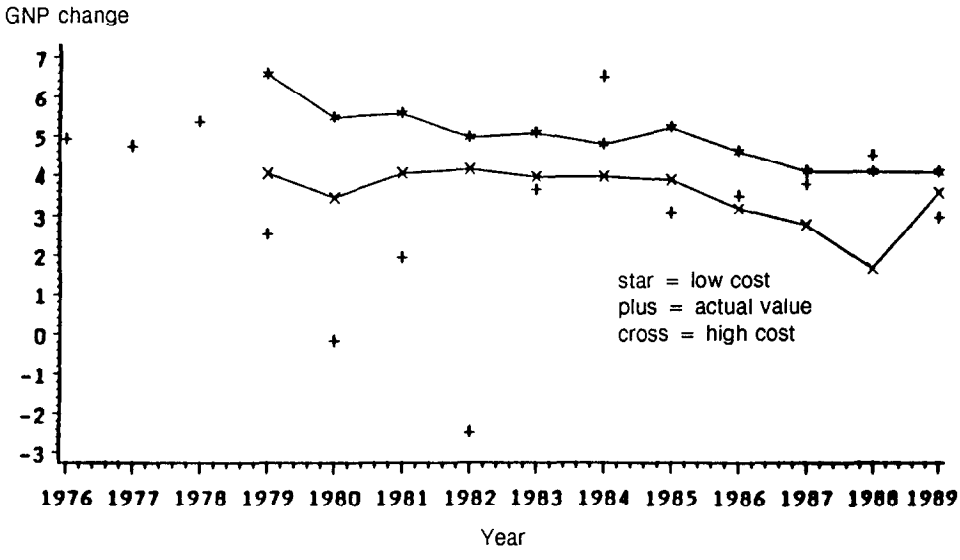


Figure 3.—Wage change, four-step forecast

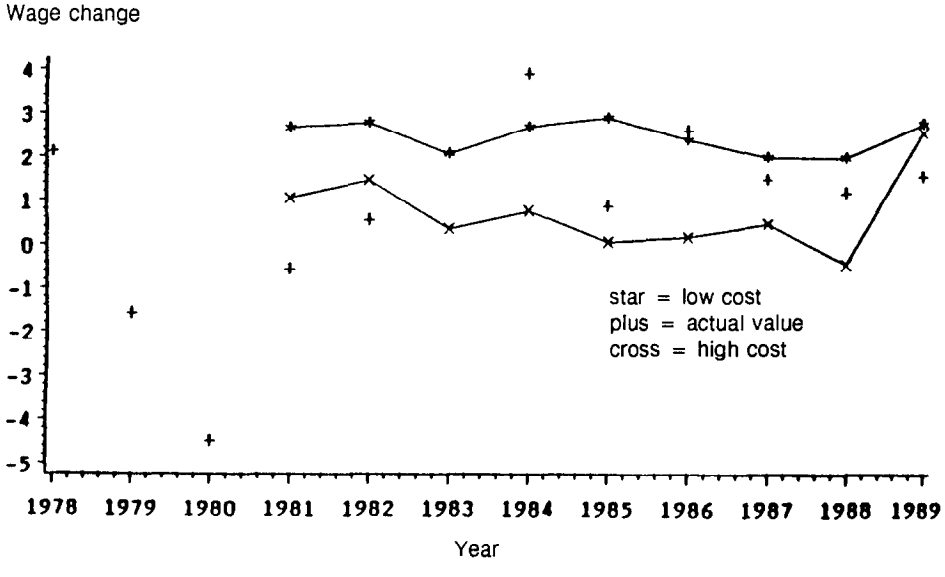


Figure 4.—CPI change, four-step forecast

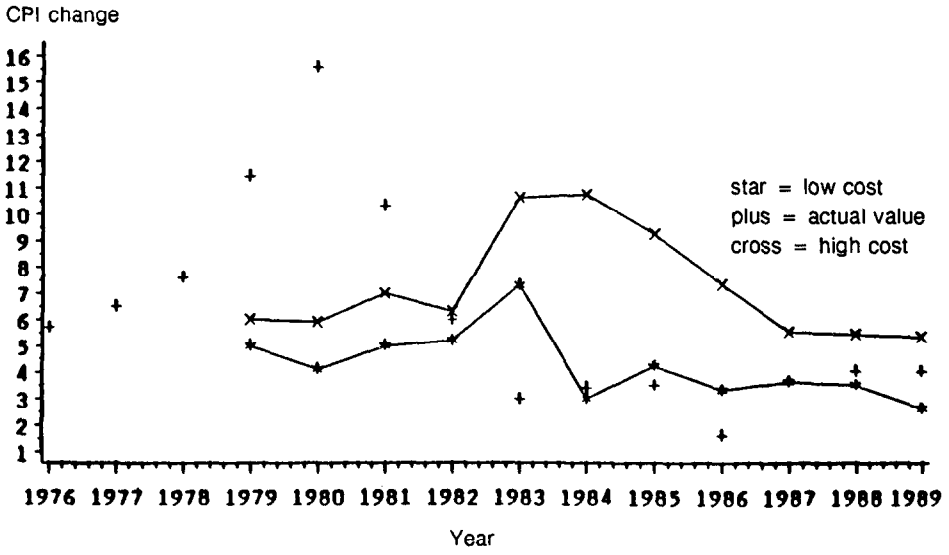
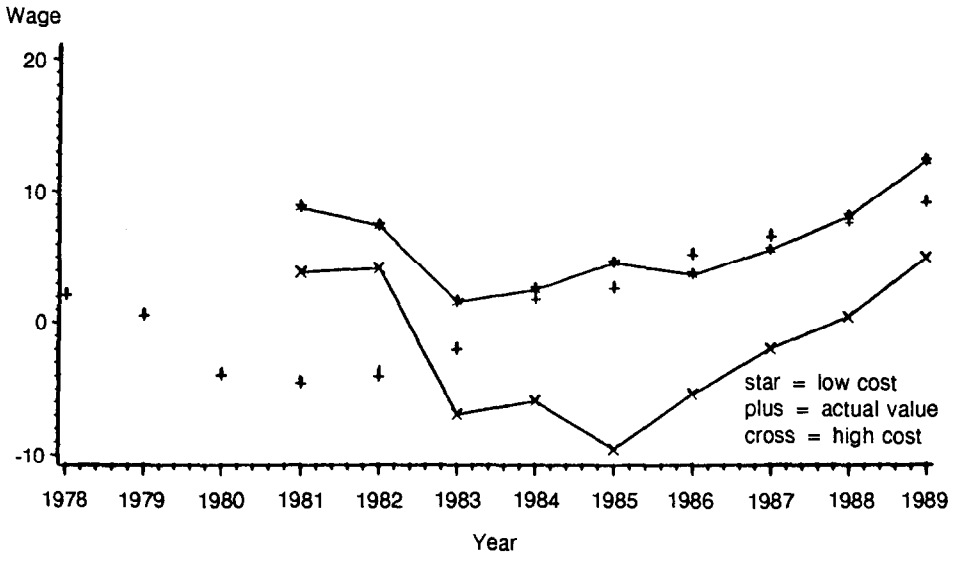


Figure 5.—Wage, four-step forecast



Appendix F: Dissenting Opinion Regarding Birth Rate Assumptions*

The Technical Panel's majority recommendation is to leave the, best guess, assumption unchanged at 1.9 births per woman. I believe 1.7 births would be more appropriate.

Before joining the Panel, I analyzed trends in birth rates and forecast 1.6 births for white women. In the last decade the birth rate for all women exceeded that of white women by .07—.08, so 1.6 plus .07 or .08 gives a number I think is more accurate than the one favored by the majority. This note summarizes the basis for my opinion.

Figure 1 graphs the U.S. total fertility rate for all women from 1917 through 1987. The most prominent features are the tremendous drop in fertility coincident with the Great Depression, the rebound where total fertility grew from a low of 2.17 births in 1933 to a baby boom high of 3.68 births in 1957 and the subsequent decline where total fertility fell from its peak to a twentieth century low of 1.74 births in 1976. The most recent observation is for 1987 when total fertility was 1.87 births. This number approximates the majority recommendation.

The years since 1976 are especially interesting because the total fertility index not only stopped its rapid post-1957 decline but it drifted upward after 1976. If one examines the component age-specific fertility rates for this period a distinct pattern emerges. Simple trend line regressions for the 1976 to 1987 period show falling fertility at each age for women 14 to 27 and for women 42 to 49. The reversal in the total fertility index is restricted to changes among women 28 to 41 years where fertility rates have risen in the last decade.

Figure 2 graphs total fertility (as in figure 1) alongside three component sums of age-specific birth rates for women 14 to 27, 28 to 41, and 42 to 49. If the components are summed they equal the total. Over the full 1917 to 1987 period, birth rates of women 14 to 27 accounted for an average of 60.4 percent of the total in the fertility index, the average share for women aged 28 to 41 is 38.1 percent and it is only 1.5 percent for women 42 to 49.

Because such a small fraction of all births are by women aged 42 or older, changes in their fertility are unlikely to affect conclusions regarding future changes in the aggregate. We are left with two important components, women younger than 28 years where fertility continues to decline and women 28 to 41 where fertility rates have increased. Predictions about future fertility obviously depend on interpretations or reconciliations of these diverse trends.

The key to this apparent puzzle is that women are delaying births to later ages while fertility by birth cohort continues to decline. Although changes in the ages at which women give birth do not affect fertility rates in the long run, they can generate perverse short run swings. As an example of changes in cohort fertility alongside changes in timing, compare women born in 1933 to those born in 1952. The 1933 cohort had the highest fertility of any cohort born this century. By the time this cohort reached 25 years of age it had registered an average of 1.82 births per woman. At age 35, the average was 3.08 and it cumulated to 3.22 births at age 49. Women born in 1952 were 35 years old in 1987. By age 25, this cohort's fertility cumulated to an average of 1.04 births; the corresponding number for the 1933 cohort is 75 percent higher. By age 35, the 1952 cohort's fertility reached 1.85 births. Thus, between ages 25 and 35 the 1933/1952 cohort differential narrowed from 75 to 66 percent. The narrowing as the cohorts aged shows, relative to timing of births for the 1933 cohort, that women in the 1952 cohort are

*Finis Welch, Chairman of the Unicon Research Corporation and Professor of Economics at the University of California—Los Angeles.

deferring to later ages. My remaining comments refer to cohort fertility histories in which the data are organized by the year women are born and fertility rates are summed to give cumulative births to each age as in this example.

When comparing differences among cohorts, we see nothing to suggest that fertility is not continuing to fall. Moreover, the trend in fertility is supported by related trends in marriage and labor-force participation of women. During the period since the 1957 fertility peak, the proportion of women who never married has increased as has the proportion who are divorced. These trends have not reversed in the period since 1976. More importantly, trends in employment of women outside the home also have not reversed since 1976. Rates of outside employment were stable from the end of World War II until the mid-1950's when, coincidentally with the end of the baby boom, they began to increase. Initially, the increase in employment was associated with women in relatively late phases of their fertility careers but in the late 1960's and early 1970's employment started to increase at younger ages where fertility has traditionally been high.

Figure 3 shows women's employment by age in 1963, 1976, and 1987. In the 1963 profile the employment rate drops from .45 to .25 between ages 20 and 30 and, although the rate then increases, the previous high is not regained until age 45. The 1976 profile lies above the 1963 profile. Although employment rates continue to be depressed at ages of peak fertility it is clear from comparing the 1963 and 1976 profiles that the greatest increases are for women 26 to 32 years old. The 1987 profile dominates the profiles for the earlier years and there is only slight evidence of depression at ages of peak fertility. Moreover, there is no evidence to suggest that the trend toward increased employment of women at ages of peak fertility has slowed and it certainly has not reversed in the period since 1976.

Figure 4 presents alternative summaries of the fertility data. In figures 1 and 2 the summaries show birth rates in a given year summed over women of different ages. Although such numbers are standard, they can be misleading. In particular, the total fertility rate has the same units (births per women ages 14–49) as completed fertility but it is neither the completed fertility of any one group nor is it the average for several groups. To see this, note that the 1987 total fertility rate includes women born between 1938 (they were 49 in 1987) and 1973 (they were 14 in 1987). The 1987 total fertility rate is 1.87 births but if we cumulate birth rates for women by cohort starting when they are 14 and continue until the most recent observation, we find that as of 1987 all cohorts aged 36 and over already averaged more than 1.87 births. Thus, the 1987 total fertility rate cannot estimate completed fertility for women born between 1938 and 1951 who were 36 to 49 years old in 1987. Cumulative births to 1987 are less than the total rate for women aged 14 to 35 but since their fertility careers will continue after 1987, there is nothing in principle to prevent them from ultimately exceeding 1.87 births. Thus, every cohort included in the 1987 calculation could exceed the 1987 figure! The total fertility rate is a convenient index but it is based on women born at different times who have very different histories. It is sensitive to trends in completed fertility and to changes in ages at which women give birth.

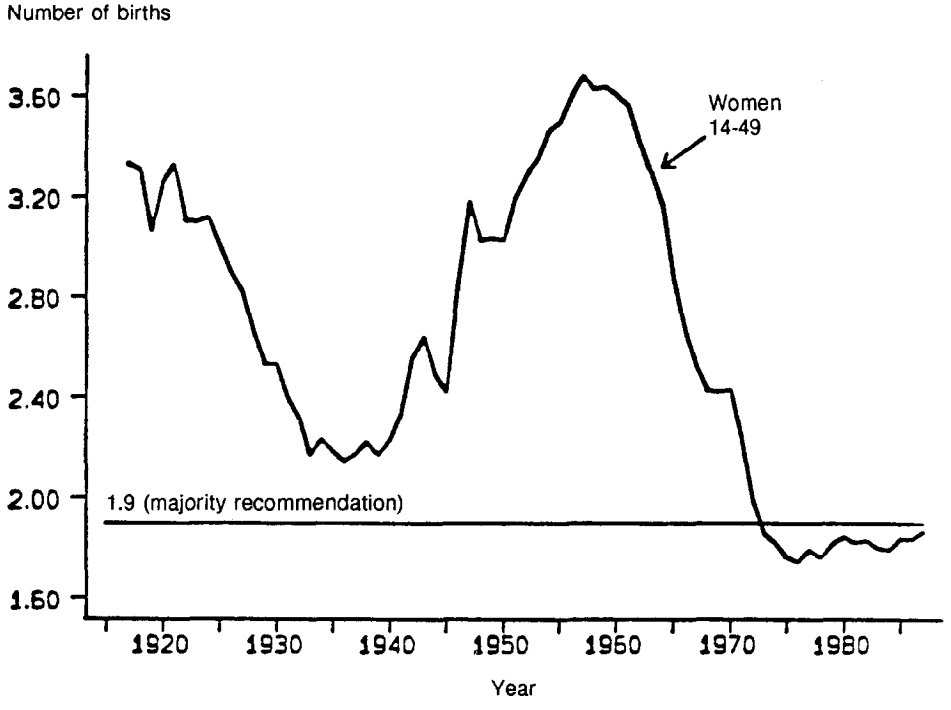
In figure 4 the data are organized around the year women were born and represent the sum of age-specific birth rates from the time a cohort is 14 until it reaches the indicated age. The peaks refer to women born between 1933 and 1935 and there is a definite pattern: when cohorts are compared at similar ages younger, more recent cohorts, have fewer children. This is true for every cohort born after 1934 from age 25 and up. There is absolutely nothing to hint at a reversal showing increasing fertility for younger cohorts.

Forecasts of future fertility can either build on trends in related forces such as employment and marriage or they can be simple extrapolations of lines like those in figure 4. I believe that either method will result in forecasts of future fertility that are below present levels. Although the current fertility rate of white women is approximately 1.8 births, my extrapolation is that the rate will ultimately fall to 1.6 births. The rate for all women, including nonwhites, will be somewhat higher.

Figure 5 is added for those who wonder whether the data in figure 2 and figure 4 are inconsistent. The line in figure 5 refers to cumulative cohort fertility to age 25 as a fraction of cumulative fertility to age 35. Recall that the large majority of births occur among women 35 or younger. For example, among the cohorts included in the 1917–1987 fertility data where numbers are observed for every age from 14 through 49, fertility cumulated to age 35 averages 91 percent of fertility to age 49. Notice in figure 5 that relative to age 35, fertility through age 25 has fallen for the most recent cohorts; i.e., those born after 1940. Increasingly larger fractions of a cohort's lifetime fertility are being deferred to ages above 25 years. But, as is clear from figure 4, the shift to later ages is only a timing phenomenon. Completed fertility continues to decline.

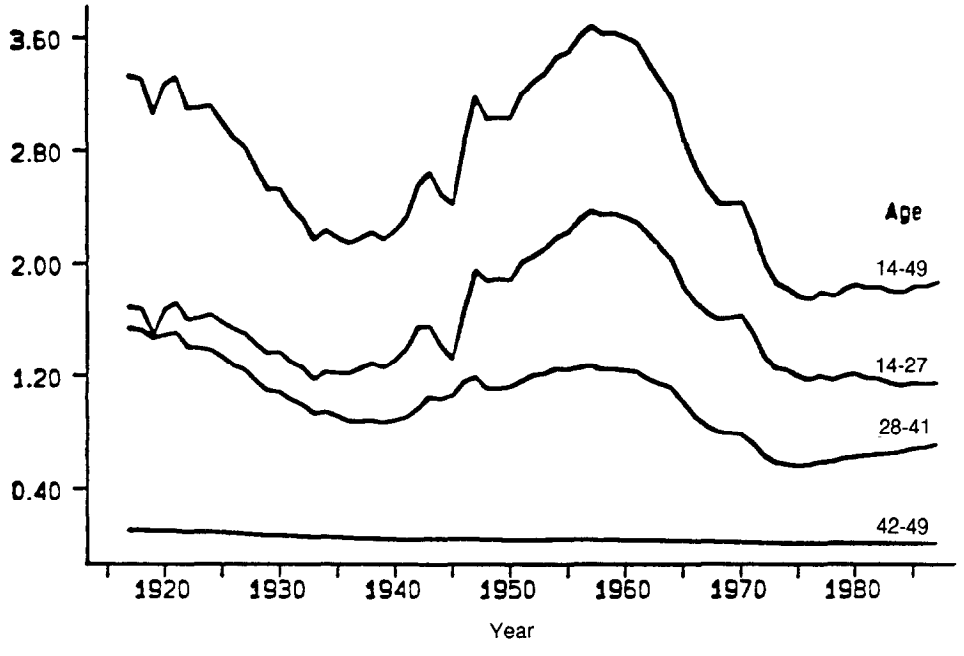
I believe that our forecasts should recognize this fact.

Figure 1.—Observed total fertility



Data from NCHS. Birth rates by single year of age, 1917-1987.

Figure 2.—Observed total and age-specific fertility

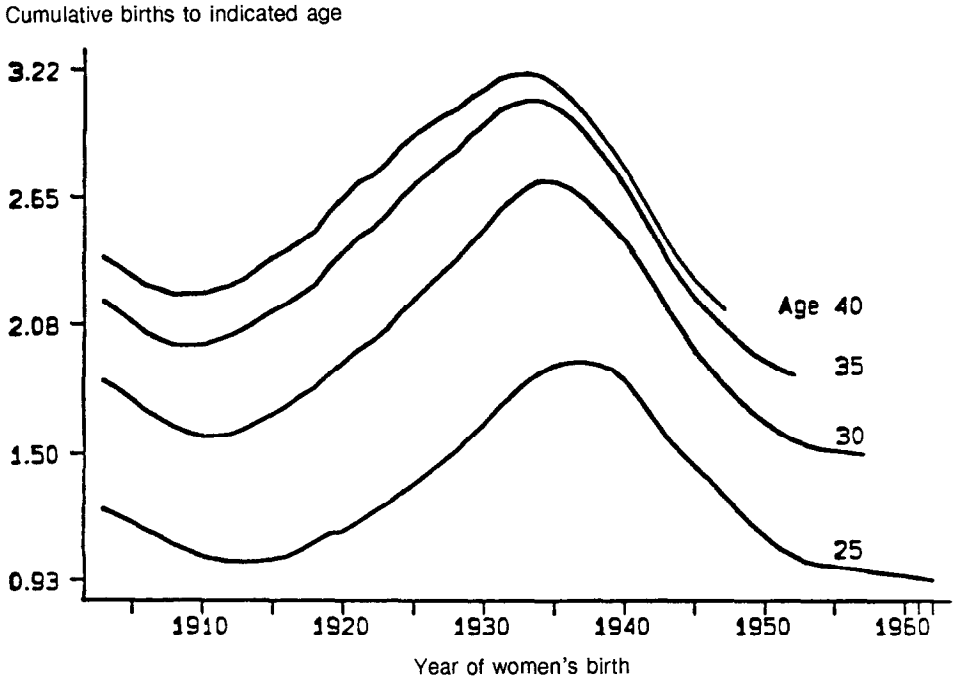


Data from NCHS. Birth rates by single year of age, 1917-1987.

Figure 3.—Women's employment by age: 1963, 1976, 1987

Data from Current Population Surveys, March Supplement 1964-1988. Average weeks worked/52. Women ages 16-69.

Figure 4.—Observed cohort fertility



Data from NCHS. Birth rates by single year of age, 1917-1987.

Figure 5.—Cohort changes in timing of births

Data from NCHS. Birth rates by single year of age, 1917-1987.

Appendix G: Forms of COLA Curtailment*

This paper outlines the different intercohort effects of three forms of curtailment of the Social Security cost-of-living adjustments (COLA's). The numerical illustrations below are simplified by assuming annual increases of 4.0 percent in the cost of living and of 5.3 percent in the average wage for purposes of the automatic adjustment provisions.

The Social Security benefit computation and automatic adjustment provisions are designed to provide slightly higher permanent benefit levels for successively younger age cohorts of workers (and their family members or survivors). For example, suppose that a hypothetical "average worker" reaching age 62 in 1990 is eligible for a monthly benefit of $600. The first applicable COLA (of 4.0 percent) effective for December 1990 will raise this benefit to $624. Effective for workers who reach age 62 in 1991, the indexing factors and benefit formula brackets (bendpoints) used in determining their benefit will also be adjusted automatically in proportion to the increase of 5.3 percent in the average wage. As a result, the monthly benefit of the comparable average worker who reaches age 62 in 1991 will be $631.80.

This amount of $631.80 is 5.3 percent higher than the $600 benefit before the December 1990 COLA, and 1.25 percent higher than the $624 benefit after the COLA, of the 1-year-older average worker. The 1.25-percent difference in their benefit amounts will persist as long as both remain on the benefit rolls because, beginning with the December 1991 COLA, both workers will be subject to the same COLA's year after year.

The rationale underlying this permanent difference in benefit amounts is that, as real earnings in the economy rise over time, largely in response to improvements in productivity, such gains in real earnings should be reflected in the benefit levels of future age cohorts of retirees. By contrast, once workers are on the benefit rolls, their benefits will be adjusted to reflect only increases in the cost of living, not the improvements in real earnings.

If Congress were to enact a benefit reduction through some form of curtailment of one or more COLA's the relationship between the benefit levels of various age cohorts would be altered.

Freezing of COLA

One element of some of the deficit reduction plans being discussed in 1990 is a 1-year freeze on entitlement cost-of-living increases, including the Social Security COLA.

In terms of the above illustration, the benefit of the average worker who reaches age 62 in 1990 would remain at $600 instead of being increased by 4 percent to $624. Inasmuch as $600 represents 96.15 percent of $624, skipping the 4-percent increase in December 1990 would cause the worker's benefit level to be 3.85 percent lower than it otherwise would be. Likewise, the benefits of all workers (and their family members or survivors) who reached age 62 (or became disabled or died) in or before 1990 would be 3.85 percent lower than they would be with a COLA.

The benefit of the average worker who will reach age 62 in 1991 would still be $631.80—it would reflect the full increase of 5.3 percent in wages but would not be affected by the freeze on the December 1990 COLA. Thus the benefits of workers reaching age 62 in 1991 would be 5.3 percent instead of 1.25 percent higher than those of comparable workers who are 1 year older.

This pronounced upward notch in benefit levels between the 1990 and

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1991 age cohorts would be permanent in the absence of a subsequent "catchup." The benefits of workers who attained age 62 in or before 1990 would continue to be 3.85 percent lower than they otherwise would have been for as long as they remain on the benefit rolls.

For purposes of a catchup, the 1991 COLA could be modified to cover a 2-year instead of the usual 1-year base period for workers who reached age 62 before 1990. For example, the December 1991 COLA could raise the illustrative $600 benefit to $648.90, the increase incorporating both the 4-percent adjustment to $624 that was skipped and the regularly scheduled 4-percent adjustment from $624 to $648.90.

Of course such a catchup would also limit budget savings to the one year during which the COLA freeze was in effect.

Postponement of COLA's

One of the provisions of the 1983 Social Security Amendments was the postponement of the 1983 and all subsequent COLA's from June to December. The June 1982 COLA was based on the increase in the cost of living between the first calendar quarters of 1981 and 1982. The December 1983 COLA reflected the increase in the cost of living between the third calendar quarters of 1982 and 1983. Thus there was no adjustment for inflation between the first and third calendar quarters of 1982 for all workers who reached age 62 in or before 1983.

For workers who attained age 62 in 1983, as well as for all subsequent (younger) cohorts, the postponement of COLA's from June to December resulted in the absence of an adjustment for inflation between the first and third calendar quarters of the year in which they attained age 61. The benefit computation itself reflects the earnings level in the year in which the workers attained age 60 while their initial COLA provides inflation protection beginning only with the third calendar quarter of the year in which they attained age 61.

The postponement of COLA's enacted in 1983 accordingly affected workers in all age cohorts—those currently eligible and those eligible in the future—for as long as they remain on the benefit rolls. Those cohorts for whom the period between the first and third quarters of their year of attainment of age 61 (or 1982 if later) represented a period of sharp inflation, however, were or will be affected more than those cohorts for whom inflation over that period was less severe.

Another postponement of the initial COLA for each cohort would further extend the period immediately after the year of attainment of age 60 for which there is no inflation adjustment. Such a COLA postponement again would affect all workers eligible either currently or in the future to a greater or lesser extent depending on the rate of inflation over the additional period for which the inflation protection would be eliminated.

Reduction of One or More COLA's

Another form of COLA curtailment is to subtract, say, 1 or 2-percentage points from one or more COLA's. For example, the Congressional Budget Office recently estimated 5-year savings of $73 billion from reducing the 1990 through 1994 COLA's by 2-percentage points each.

Under that proposal, workers first eligible in or before 1990 would be subject to five successive COLA reductions. In terms of the illustration of the average worker first eligible in 1990 for a benefit of $600, the effect of five COLA's of 2 percent rather than 4 percent would be a benefit of $662.20 instead of $729.70 effective with December 1994. The benefit accordingly would be 9.25 percent lower than it would have been in the absence of the COLA reductions. The benefits of all workers first eligible in or before 1990 would be affected at the same rate.

Workers first eligible in 1991 would have their benefits increased at the rate of 2 percent rather than 4 percent for 4 years in a row. As a result, their benefits would be 7.47 percent lower effective with December 1994 than they otherwise would be. The corresponding benefit reductions for workers first eligible in 1992, 1993, and 1994 would be 5.66, 3.81, and 1.92 percent, respectively. Workers first eligible in or after 1995 would not be affected by the reduced COLA's in the years 1990 through 1994.