The 1999 Technical Panel on Assumptions and Methods

Report to the Social Security Advisory Board

November 1999

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PREFACE

In January 1999, the Social Security Advisory Board convened the 1999 Technical Panel on Assumptions and Methods—the first established by the Advisory Board since its creation and the first since 1995. The Panel met from January to September 1999. In some respects, its mission was similar to that of previous Technical Panels convened in conjunction with Social Security Advisory Councils that themselves were replaced with the permanent Advisory Board.[1] In other respects, the Panel's mission was made much broader by the Board in response to the policy environment at the time the charter was formed (see Charter following this Preface). As is traditionally done, the Board asked the Panel to review the economic and demographic assumptions and the methods used to project the status of the OASDI Trust Funds. In addition, the Board asked the Panel to address issues regarding equity investments, implying that the assumptions and methods in need of investigation for the first time extended to those now being used to evaluate various reform proposals.

…the Panel's mission was made much broader [than that of previous panels in order]…to address issues regarding equity investments.…[T]he assumptions and methods in need of investigation for the first time extended to those now being used to evaluate various reform proposals.

Although the Panel met at a time when discussion of Social Security reform was vigorous, at no time did the Panel discuss or debate any particular reform proposals. Nor was it led by any desire to increase or decrease the estimated actuarial balance in the Old Age, Survivors, and Disability Insurance (OASDI) program. Instead, it focused on providing the best information available for making projections. With respect to reform, the Panel directed its efforts solely to the assumptions and methods used for estimation and how best to evaluate different types of reforms and compare them consistently. That is, the Panel accepted as its mandate providing recommendations in a nonpartisan and objective way in the best tradition of good government, following the lead of offices such as the Office of the Chief Actuary within the Social Security Administration (SSA). Although in other roles some members of the Panel have identified particular concerns with Social Security policy or suggested various reforms, the Panel was able to work together cooperatively to produce this unanimous report.

[1] The role of those Councils in appointing technical panels to advise on the assumptions and methods used in the Trustees Report on the status of the OASDI Trust Funds was assumed by the Social Security Advisory Board created by Congress in 1994. The 1999 Panel was the first technical panel established by the new Board.

While the Panel was meeting, requests came forward to the General Accounting Office and to a private actuarial organization to review the operations of the Office of the Chief Actuary within the Social Security Administration. Although the Panel has made a number of suggestions for improvement, it has found the work of the Office of the Chief Actuary to be outstanding and the projection methodology to be reasonable as a whole. The Office cooperated fully with the Panel and willingly offered assistance, as it has to many others seeking information. To the extent the Panel members have concern here, it is largely that resources were not made available historically to the Office of the Chief Actuary, to the Office of Policy or its predecessors, or to other parts of government to prepare adequately to assess various reform proposals. It is in this area that models and methodologies are in most need of improvement. Despite its limited resources, the Office of the Chief Actuary has provided clear and persuasive warnings of the problems facing the Social Security system in the next century.

…the Panel was able to work together…to produce this unanimous report.

The Panel strongly recommends more research not merely as an academic exercise but as a necessary complement to any reform process. Additional data and analysis are crucial if policy makers are attempting to deal with such issues as providing protection against poverty for older widows and divorcees or reducing the risk of future actuarial imbalance following enactment of any new reform. Many potential improvements will prove almost impossible to achieve until the estimation and evaluation capabilities of several offices within SSA are increased significantly and working relations continue to improve across those offices.

To the extent the Panel members have concern here, it is largely that resources were not made available historically…to prepare adequately to assess various reform proposals.

CHARTER

1999 Technical Panel on Assumptions and Methods

The Panel of expert actuaries, economists, and demographers appointed by the Social Security Advisory Board is charged with providing technical assistance to the Board by reviewing the assumptions and methodology used by the Board of Trustees of the Old Age, Survivors and Disability Insurance Trust Funds to project the future financial status of the funds. Specifically, the Panel is asked to:

- Review key economic assumptions: productivity and labor force participation, real wage growth, and the real interest rate and provide expert opinion regarding the interaction of changes in the Consumer Price Index (CPI) with other economic assumptions.
- Review the assumptions regarding key demographic factors: in particular, mortality; but also fertility, immigration, and disability incidence and duration.
- Provide expert opinion regarding expected growth in equity markets, projected return on equity investments, and effects of possible investments of Social Security funds on equity markets and the national economy.
- Review current forecasting methods. Address concerns about the internal consistency of the Alternative I and III assumptions. Provide expert opinion regarding alternative modeling methodologies that may best illustrate the probability of variations around the central projections.

ACKNOWLEDGMENTS

The Panel thanks the many persons who served this Panel and its mission. We are particularly grateful to Stanford G. Ross, Chair of the Social Security Advisory Board, who led the Board's efforts to organize the Panel and encouraged us in our work, and to Joyce Manchester, staff economist for the Advisory Board, who served as our principal staff person.

We are indebted to the many individuals from the Office of the Chief Actuary, the Office of Policy, and other offices within the Social Security Administration who responded promptly and graciously to our requests and provided us with the information needed to carry out our work. We also thank officials from the Department of the Treasury and other offices who prepared information for the Panel's meetings and otherwise facilitated our work. The staff of the Social Security Advisory Board provided valuable staff assistance and logistical support. Margaret Malone, Beverly Rollins, and Jean Von Ancken were especially helpful.

Special thanks go to the following individuals from the Office of the Chief Actuary at SSA: Harry Ballantyne, Sheldon Baker, Felicitie Bell, Eli Donkar, Steve Goss, Lise Holler, Steve McKay, William Ritchie, Patrick Skirvin, Alice Wade, and Tim Zayatz. We also appreciate the work of individuals in the Office of Research, Evaluation and Statistics at SSA: Barbara Butrica, Lee Cohen, Howard Iams, James Moore, David Pattison, and Mikki Waid. We are especially grateful to those civil servants who devoted many days assisting us behind the scenes and to whom we are unable to extend the recognition they deserve.

I. INTRODUCTION

In 1999, the Board of Trustees of the Old Age, Survivors and Disability Insurance Trust Funds (OASDI) once again reported that Social Security remained out of balance for the long term. Revenues are projected to be insufficient to meet promises of growing benefits under current law. Because of that imbalance, the Social Security Administration (SSA) has been called upon to examine a variety of reform options. The reports on those options, many other SSA documents, and the Trustees Report itself have increasingly come under the spotlight. After all, SSA serves as perhaps the most vital source of information for the public and its elected representatives in seeking to gauge for themselves the extent of any problems, the influence of different economic and demographic conditions on those problems, and the viability of the proposed solutions.

…the Office of the Chief Actuary (OCACT) has been called upon to provide estimates for reform proposals that involve the investment of Social Security funds in private equities.

In recent years the Office of the Chief Actuary (OCACT) has been called upon to provide estimates for reform proposals that involve the investment of Social Security funds in private equities. In light of this significant expansion of OCACT's traditional responsibilities, the actuaries advised the Board that it would be helpful to have the views of outside experts on the assumptions and methods that should be used in estimating those proposals. Accordingly, the Board included in the charter for the 1999 Technical Panel a request that the Panel provide expert opinion regarding expected effects of investment of Social Security funds in equities. Stanford G. Ross, Chair of the Board, emphasized the importance of addressing issues related to both current law and reform proposals. The Panel's report thus includes recommendations that go beyond the evaluation of the existing system in which Trust Fund reserves are invested in government bonds.

The Panel's recommendations centered around the following findings:

- ***Under current law, OASDI may be more out of balance than currently projected under intermediate assumptions.*** This is largely because of a conservative estimate of improvements in life expectancy. But it also reflects a law that has been designed in such a way that the ability to meet the growing cost of its promised benefits is highly sensitive to economic and demographic conditions.
- ***Some vital pieces of information describing current law are missing in the Trustees Report, and some current presentations at times lead to misunderstanding.*** Despite a commendable job of putting out information, the Trustees Report needs to inform the public of such issues as the lifetime value of benefits promised under current law, alternative measures of unfunded obligations, and the predicted growing prevalence of disability insurance receipt within almost all

age groups. Also, tables on life expectancy in the Trustees Report use a technical measure that can easily be misinterpreted to indicate that estimated life expectancy (and number of years of benefits) is less than it is actually projected to be for different cohorts. Finally, the Trustees Report presents levels of future benefits that might not materialize under current law even in the absence of reform.

- ***The public has been unable to obtain many essential pieces of information that would help it weigh the relative merits of alternative reform proposals.*** SSA has been moving heroically to try to meet the demands for analyses of alternative reforms, but major holes still exist. For example, SSA cannot fully evaluate the impact of proposals on predicted poverty levels of future retirees, and on whether the reforms would make promises even more sensitive to changing economic and demographic conditions. Some proposals, such as those that try to improve fairness in the design of spousal benefits, cannot even be included in congressional proposals because cost estimates and distributional consequences are unavailable. No comprehensive standard has been set for comparing proposals and their impact on the government's budget as a whole or even stating their basic parameters in a consistent manner. Responding to this concern goes far beyond the responsibilities of the Office of the Chief Actuary, to the rest of SSA, and to such offices as the Office of Management and Budget and the Congressional Budget Office.

- ***New types of methodologies and models are required to meet today's information requirements.*** SSA has been making strides in this area recently, but the need is great. Newer models would make it possible to assess better the impacts of alternative designs on distribution, on assessing the uncertainty or sustainability of any law, on the total budget of the United States, and on saving and labor supply.

- ***A special challenge is presented by proposals that would involve investment in equities by individuals or by the Trust Funds.*** The 1999 Panel was the first to review the methods adopted by SSA to date in the area of equity investment. It concludes that the assumption on the equity premium (return on stocks over return on bonds) used by the Office of the Chief Actuary should be lowered in the current economic environment. Furthermore, it is especially important not to show high returns for equity investment through additional borrowing without any assessment of the new risks that are involved.

- ***A clear appraisal of the required resources is necessary if these challenges are to be met.*** This requirement extends to all the offices and agencies responsible for assessing Social Security programs and policies within and outside the Social Security Administration.

A. ECONOMIC AND DEMOGRAPHIC PROJECTIONS UNDER CURRENT LAW

The Panel's first task was to review the economic and demographic assumptions and methods currently in use. That has been the traditional role of this type of panel. In basic respects, the Panel strongly supports the work of OCACT. In a few areas, however, the Panel recommends change. First, it concurs with many demographers in noting that projections of life expectancy by OCACT are unduly pessimistic, and that mortality rates will likely decline even more than estimated. Second, it believes that the estimated future increase in real earnings of workers tends to be understated, although the issue is still open as to just how different tomorrow's economy will be from that of yesterday. Third, it suggests that real interest rates on government securities are likely to be somewhat lower in the future than currently assumed.

…[the Panel] concurs with many demographers in noting that projections of life expectancy by OCACT are unduly pessimistic, and that mortality rates will likely decline even more than estimated.

Largely because of the suggested changes in mortality rates, the net effect of the changes would worsen the measured actuarial imbalance of the present system. Longer lives imply more years of Social Security benefits with only a partially offsetting rise in revenues, because the current system does not increase the normal retirement age (NRA) as life expectancy increases.

B. THE PRESENTATION OF INFORMATION ON CURRENT LAW

The Trustees Report helps give Congress sufficient advance notice of any large actuarial imbalance so that it has adequate time to consider the merits of alternative ways of restoring balance. In that regard, it has done a commendable job—one that might be emulated by other programs and agencies that do not attempt to undertake such long-term projections. But the Panel felt that improvements are needed in the presentation of information. The important issue here is that the information conveyed be complete and avoid inadvertently misleading the public and policy makers. For example, do projections under high-cost and low-cost assumptions adequately display the uncertainty of the projections? Are they meaningful? Do they convey how the projections might change in response to different economic and demographic circumstances?

The Panel believes that a modest amount of additional information should be included in the Trustees Report. Suggestions include the lifetime value of benefits provided to different cohorts, the projected prevalence of Disability Insurance receipt in the population as a whole and by age, and alternative measures of the actuarial obligations and unfunded liabilities of the system. In some of these cases, SSA already makes the calculations; in others, it can easily do so. The Panel also recommends that a more

thorough documentation of methods and assumptions be provided by SSA, and a separate report by one panel member, Edward W. (Jed) Frees, will be made available as a first approach at such an effort.

The important issue here is that the information conveyed be complete and avoid inadvertently misleading the public and policy makers.

At the same time, some items are reported in a way that has led to misunderstanding among the public and elected officials. Thus, the technical measure of life expectancy reported in the Trustees Report—although useful for some analytical purposes—does not reflect the life expectancy of upcoming cohorts of retirees. Tables showing growth in annual benefit levels over time do not demonstrate that succeeding cohorts' lifetime benefits are growing even faster than their annual benefit levels because they will receive more years of benefits by living longer. The Report shows promises of benefits under a legislated formula for benefit growth over time, but the law is simultaneously unclear how such benefits could be paid when the Trust Funds run out of money. A more balanced presentation of alternative benefit and tax streams, therefore, is required to reflect current law. Thus, as the Trustees Report moves from a document used primarily by some technical analysts to one that is used by the broader public to understand the system, it needs to better accommodate their needs.

C. A NEW ENVIRONMENT

Making projections of the Social Security system under current law is only one piece of the work facing analysts today. In the past few years, the Office of the Chief Actuary within SSA has been called upon to make a variety of estimates based on varying proposals for reform. Possible reforms include changes to the benefit formula, the distribution of benefits among different recipients, the retirement age, the tax structure, and the types of securities purchased by the Trust Funds. Other reforms establish individual accounts funded by contributions and invested in a variety of assets, including equities.

In assessing the reform proposals, SSA and other parts of government are being asked for a new and different level of information….Its current models do not address those issues in a satisfactory way.

In assessing the reform proposals, SSA and other parts of government are being asked for a new and different level of information as they evaluate those proposals. Although SSA has been working diligently to try to fulfill the new requirements, many of the efforts are still at an elementary stage. As a consequence, when advising on a variety of policy proposals to date, some vital chores cannot be performed. For example, neither SSA nor the rest of government is able to assess the impact on all revenues of government (rather than just the Social Security Trust Funds). In addition, SSA is unable to examine a variety of behavioral impacts on work and saving, show the possible distributional impacts and the effect on poverty, demonstrate under reasonable assumptions the extent to which various reforms increase or decrease the *probability* of being out of actuarial balance by any given amount, or even estimate the actuarial impact of reforms that would change rules for spouses (such as providing more equal benefits for all married couples with the same level of earnings and taxes paid). Its current models do not address those issues in a satisfactory way.

…a proposal that improved actuarial balance but increased the unified budget deficit might appear superior to one that did less for actuarial balance but reduced the unified budget deficit.

Those are crucial matters. Without such assessments, a proposal that improved actuarial balance but increased the unified budget deficit might appear superior to one that did less for actuarial balance but reduced the unified budget deficit. One that tended to favor increased work or saving might not be credited with an impact on future government revenues. A proposal that reduced the poverty rate overall might be assessed as hurting the poor because one aspect of the proposal by itself did not improve their prospects. A reform might look good because it reduced the actuarial imbalance under intermediate assumptions, but no one would know that it actually increased the probability of being several percentage points of payroll out of balance in the future. And, as has already occurred, proposals that by some standards might improve the fairness of the system in the way it treats different couples with the same level of earnings could not be fairly considered in the context of a complex proposal with many interrelated provisions because the impact of changing the related spousal benefit provisions could not be estimated. SSA is currently working on new methods to fill this need.

D. THE TYPES OF MODELS THAT ARE NEEDED

Evaluation of reform proposals requires a variety of high-powered models. One type of modeling would carefully account for different types of individuals according to income level, work history, or family status. Such models can better display the distributional consequences of reform proposals. For example, many current models are inadequate when evaluating a policy that might provide a choice among a minimum benefit, a new type of spousal benefit, or a benefit based on the worker's own earnings. Only with newer models can the full implications of the proposals be estimated.

Other modeling efforts would better allow an assessment of uncertainty. Improvements would help demonstrate the level of uncertainty under current law as well as assess the robustness or sustainability of any system to changing economic and demographic conditions.

…many current models are inadequate when evaluating a policy that might provide a choice among a minimum benefit, a new type of spousal benefit, or a benefit based on the worker's own earnings.

Still other efforts would attempt to reflect the impact of reforms on different parts of the federal budget as well as on household earnings and returns from saving. Less elaborate models can ensure at least some consistency among economic variables. In sum, these models are intended to provide better guidance on the consequences of steering the ship in a different direction, not merely giving notice that it may be on a collision course.

E. INVESTMENT IN EQUITIES

One of the most complicated of all matters in many newer reform proposals is investment in assets other than government bonds, either directly by the Social Security Trust Funds or by individuals within personal or individual accounts. Once the Office of the Chief Actuary began estimating the effects of proposals with those types of changes, it had to adopt new methods and assumptions. The Panel, therefore, undertook a first review of the methods and assumptions underlying investment issues. The Panel believes that such a review should become standard for future panels or ongoing task forces established by the Advisory Board.

…a review of the methods and assumptions underlying investment issues…should become standard for future panels or ongoing task forces established by the Advisory Board.

Among the Panel's recommendations in the area of investments is a moderate decrease in the expected premium for ownership of stocks over bonds. In addition, the Panel remains concerned that any equity investment be analyzed in a broader model that takes into account other changes in the economy. Those changes could include the effects on risk-bearing of a shift in asset ownership (e.g., the government owns more equities but the public owns more government bonds and less equities), the impact on interest rates arising from sales of government bonds, and the potential impact on net saving in the economy.

The Panel also warns about presentations that derive from arithmetic calculations that tend to show that "financial arbitrage"—borrowing to purchase equities with a higher expected rate of return—creates some sort of free lunch. To properly balance the presentation, various assessments of risk must be undertaken at the same time. While there is no easy way to do this, several options are suggested ranging from simple to more complex.

The Panel also warns about presentations…that tend to show that "financial arbitrage"—borrowing to purchase equities with a higher expected rate of return—creates some sort of free lunch.

The Panel has prepared a tentative list of assumptions that should be stated and analyses that should be applied *consistently* to all proposals and to current law. By adopting such a standardized list, SSA can minimize the chance of unintentionally favoring one type of proposal over another, as well as indicate to policy makers the types of questions and issues that will need to be addressed when trying to design any broad-based reform.

F. THE RESOURCES REQUIRED

Although many of these issues require research by other parts of government, such as the Office of Management and Budget, the Department of the Treasury, the Congressional Budget Office, the Joint Committee on Taxation, the Congressional Research Service, and the General Accounting Office, we believe that the Social Security Administration is in the unique position of having the information, expertise, and integrity to significantly inform the debate. Because of its unique position, however, demands on the agency for information and analysis are escalating. The Panel strongly recommends that resources be made available to enhance SSA's ability to provide analysis in a way that best informs the public; incorporates such considerations as uncertainty, distributional consequences, and risk; and allows for consistent comparison of alternatives. At the same time, the other government agencies must also begin to catch up on their own responsibilities—such as showing the budgetary impact of alternative reforms.

The Panel strongly recommends that resources be made available to enhance SSA's ability to provide analysis in a way that best informs the public;…

When one considers that reform will likely affect almost every individual retiring in the future and likely will shift trillions of dollars' worth of benefits and taxes over the next few decades, these efforts to enhance research and analysis capabilities could be greatly beneficial to the public.

II. EXECUTIVE SUMMARY

A. THE STANDARD ASSUMPTIONS USED TO EVALUATE CURRENT LAW

The Panel recommends a number of changes to the actuarial assumptions underlying the Trustees Report. In each case, the Panel was guided by trying to assess the best information available to it, regardless of the impact on actuarial balance. ***The largest changes recommended—in terms of their impact on actuarial balance—were to increase projections of life expectancy and real earnings growth, and to decrease the real interest rate on government securities.*** The first and last would decrease actuarial balance, the middle one increase it, with a net impact of worsening the actuarial deficit by about 0.5 percent of taxable payroll. At the same time, the Panel recognizes the uncertain nature of any projection based on the uncertainty surrounding the economy and the future demographic characteristics of the population. Several of its later suggestions would attempt to demonstrate how the sensitivity of the program to alternative assumptions is affected by different legal designs, such as indexing for life expectancy, prices, or wages.

Table II.1.—Effect of Panel's Recommended Changes in the Intermediate Assumptions
(Change in OASDI actuarial balance and annual balance as a percent of taxable payroll)

	Change in actuarial balance	Actuarial balance for 75-year period	Annual balance for 75th year
1999 Trustees Report actuarial balance		**-2.07%**	**-6.44%**
Increase ultimate rates of mortality decline	**-0.51%**		
Raise real wage differential	**+0.20%**		
Lower return on government securities	**-0.20%**		
Panel-recommendation actuarial balance (including interactions among recommended changes)		**-2.60%**	**-7.70%**

Source: Office of the Chief Actuary, Social Security Administration.

Despite the variety of recommendations made here, the Panel strongly supports the various modeling efforts that underlie the Social Security projections. Following the recommendations would improve a process that has strong underpinnings and, indeed, is the envy of much of the rest of the world.

1. Real Wage Differential

The real wage differential, or the long-term assumed rate of real annual growth in the average annual wage in covered employment, ***should be raised by 0.2 percentage point to 1.1 percent***. The growth rates for the low- and high-cost options should be raised by equivalent amounts. At this time, the Panel recommends an increase of 0.1 in the assumed rate of growth of long-term productivity, with the remaining 0.1 being allocated to changes in the linkages between productivity growth and the real wage differential (such as hours worked and the share of employee compensation directed to wages). However, the Panel acknowledges significant uncertainty both as to the level of future productivity and our ability to measure it consistently in an economy placing increasing emphasis on services, information, and quality.

2. Fertility

The Panel recommends no change in the assumed long-term fertility rates. However, the shifting composition of the population suggests that the Trustees should continue to monitor fertility rates closely.

3. Mortality

Based upon long-term trends and international comparisons, the Panel recommends that greater improvements in mortality be integrated into the intermediate assumptions. ***Projected life expectancy at birth in 2070 should be raised to the level currently projected for the high-cost assumptions, 3.7 years above the current intermediate projection.*** The Panel recommends maintaining the age distribution of the rates of decline in mortality the same as was assumed for the intermediate assumptions in the 1999 Trustees Report. Those rates of decline are fairly similar across the adult ages, rather than slower at advanced ages as in the historical record. The current spread between the low- and high-cost assumptions should be maintained around the new intermediate assumptions.

4. Immigration

The Panel suggests that the range between the low-cost and high-cost assumptions should increase to perhaps plus or minus 50 percent of the intermediate assumptions.

5. Return on Government Bonds

The Panel recommends using a real annual interest rate of 2.7 percent in both the short- and long-term projection periods for the government bonds purchased by the OASDI Trust Funds. The current intermediate assumption is 3.0 percent. We recommend a high-cost rate of 2.0 percent and a low-cost rate of 3.5 percent.

B. FURTHER RECOMMENDATIONS

The Panel made a variety of recommendations regarding additional economic and demographic variables, investment issues, the ways that data and information are presented, and the types of modeling efforts needed to make better and more informative projections.

1. Economic and Demographic Issues

a. Labor Force Participation

The projected labor force participation rates of both older men and older women should be examined carefully (projected rates for older women appear low relative to older men). ***Further model development is needed to deal explicitly and consistently with many types of reforms, such as further changes in the retirement age or changes in levels of benefits, that could affect those participation rates.*** Also, larger variations in participation rates should be incorporated into the assumptions for the low- and high-cost projections.

b. Marital Status and Benefits for Low-Income Survivors and Spouses

The Panel has concerns with the current projections of marital status. Benefits paid to women as spouses or survivors represent a primary method by which the current system deters poverty and near-poverty in old age. Some survey-based projections suggest that the numbers and proportion of women who will collect benefits as wives or widows could be lower than projected by the Office of the Chief Actuary, whereas the number and proportion who will be divorced and never married could be higher. If those projections are correct and the estimates by OCACT of benefits to women are overestimated, two problems arise. Not only would estimates of future actuarial costs to the Social Security system be too high, but poverty rates estimated consistently with OCACT's assumptions would be too low. Thus, ***poverty could rise among older women even as the system becomes more generous over time to other beneficiaries.*** Up-to-date surveys and modeling on this issue have not received priority within the government as a whole, thus making more tentative any

estimation done here. The Panel places a high value on investigating alternative methods and data sources that are demographically representative as support for improved projections related to marital and family status.

c. Disability

The Panel finds the forecasts of the size and cost of the Disability Insurance program to be reasonable but recommends further work in two areas. More research is needed to understand the recent improvement in mortality rates among the DI population. And ***SSA needs to devote more resources to understanding the factors causing the large fluctuations in incidence rates that have occurred in the past and to developing more detailed behavioral models*** that can predict the impact of changes in the DI program.

2. Investment Issues

a. Equity Premium

Evaluating the risks and returns to equity investment is critical to reform proposals that involve investing Social Security funds in publicly traded stocks. ***The Panel recommends that the average equity premium at this time be set to 3 percent over the assumed real rate of interest on special government bonds issued to the Trust Funds. Recent analyses by SSA have used 4 percent.*** However, SSA should be prepared to modify the assumed average equity premium as new insights on the size and determinants of the equity premium become available.

b. Presentation of Results with "Additional" Returns Resulting from the Equity Premium

When examining reform proposals that involve alternative investments, as in equities, results should first be presented reflecting a government bond rate of return on those investments. Doing so will avoid the false inference that the equity premium comes with no corresponding increase in risk or other cost for society. ***Calculations that explicitly incorporate the equity premium should also include a price of risk.*** That can be accomplished by adjusting the discount rate used for investment cash flows, by option pricing methods, or by some other appropriately developed approach. SSA should study those alternatives and further develop and standardize the methodology used to evaluate risky investments.

c. Consistency of Asset Returns with Other Variables

At present, the Trustees Report (as opposed to many reform proposals) does not have to make assumptions on rates of return other than on government bonds. In the future, the Panel suggests that rates of return on financial assets should be checked for compatibility with the rate of inflation, the rate of return on capital, and other relevant variables.

3. Presentation Issues

We suggest several areas of improvement regarding the presentation of material in the Trustees Report: the format of the Trustees Report, the use of cohort versus period life expectancy, the lifetime value of benefits (and possibly costs), sustainability along with 75-year balance, and the prevalence of disability.

a. Format of Trustees Report

Several changes to the format of the Trustees Report would help readers understand and interpret the data. ***The Report should be produced in a manner that provides immediate cross references*** (including point and click references in an electronic version) to the Summary Report, as well as to backup material in other reports such as Actuarial Reports and SSA distributional analyses. Also, graphs should more clearly illustrate the uncertainty that surrounds the 75-year forecast, particularly in distant years.

b. Illustrating Uncertainty

The Trustees Report should use techniques to illustrate that much of the uncertainty in projections can be reduced by targeting policy to specific objectives, such as adjusting for increases in life expectancy so as not to throw the system out of balance. Uncertainty in projections can also be reduced by automatically adjusting benefit or tax formulas over time to reflect actual economic and demographic outcomes.

c. Cohort Versus Period Life Expectancy

The Report should present cohort life expectancy in addition to period life expectancy, as many readers mistakenly believe that the period life expectancy indicates projected life expectancy for particular cohorts at retirement age.

d. Lifetime Value of Benefits

We recommend that the Trustees Report place more emphasis on the lifetime values of benefits that are paid out to typical retiring beneficiaries and how they change over time from one cohort to the next. Some members are interested also in the taxes paid by various types of workers annually and over their lifetimes.

e. Alternative Projections of Benefits Under Current Law

Because current law is vague as to how the full value of current law benefits could be paid when the Trust Funds are exhausted, the Trustees Report should show real annual future benefits under two scenarios. The first scenario would be current law if current benefit levels are maintained and taxes are raised. The second would be current law if current tax rates are maintained and benefits are lowered proportionately so they are just covered by current tax rates.

f. Typical Workers

Current projections do not explicitly take into account the significant number of zero earning years of many individuals. Research shows that almost half the retired workers actually have benefits based on their own earnings that are closer to those of the "low earner" example shown by the Office of the Chief Actuary. ***The presentation in the Trustees Report and other displays should be revised to include both a typical low earner and a typical average earner, as well as a typical family, more representative of the actual population.***

g. Sustainability of the Trust Funds

Emphasis on the 75-year actuarial balance is misleading when the imbalance tends to be greater nearer the end of the period. In such cases, ***we recommend the up-front use of side-by-side comparisons that would emphasize the sustainability of the system alongside the 75-year balance.*** For example, the Trustees Report could show the tax increase required to leave the system in good shape at the end of the 75-year forecast period, perhaps by requiring that the ratio of Trust Fund assets to benefit costs be constant over the last 2 years of the forecast. In addition, the income rate, cost rate, and actuarial imbalance for the last few years (or the 75th year) should be shown side-by-side with the imbalance over 75 years.

h. Unfunded Obligations

The Panel recommends that information on the size of the unfunded obligations of Social Security, measured under alternative assumptions, should be included in the Trustees Report.

i. Reporting on the Distribution of Benefits

SSA should make available when appropriate the distributional analysis it now undertakes. One way to bring that analysis into public view is to mention it in the Trustees Report and refer the interested reader to a specific SSA Website.

j. Disability Insurance Projections of Incidence and Prevalence

The Trustees Report should show historical and projected rates of the prevalence of receipt of disability insurance over time as well as incidence, including the total rate and the total rate adjusted for age composition. In addition, likely causes of movements in the rates of prevalence and incidence should be identified.

4. Methodology and Models

a. Comparing Current Law and Reform Proposals Within a Consistent Framework

A common set of assumptions and criteria should be used to compare different reform proposals and current law in a consistent framework. We present a prototype set of assumptions and criteria in the main body of the Report.

b. Macro Effects of Alternative Policies

The Social Security system does not operate in isolation, but has effects on the government's fiscal situation and on the economy at large. ***The Social Security Administration needs a more general capability to illustrate interactions of the macroeconomy and the Social Security system, particularly with regard to saving and labor supply.*** Even without a fully developed model, these behavioral responses need to be treated consistently and more comprehensively across proposals.

c. Micro Models

The Panel feels strongly that evaluation of economic and demographic changes, and of reform proposals, should include an analysis of behavioral and distributional effects. The Panel recommends that SSA

significantly broaden its newly emerging capability to use and integrate microsimulation-based forecasts of the distribution of future incomes and Social Security outcomes, and that distributional results be presented regularly for different types of reform options. In many cases, actuarial costs (e.g., of alternative spousal benefit structures) cannot be made accurately without such models. An outside board of experts should examine the structure of the microsimulation models and evaluate the purposes for which their predictions will be most useful.

d. Public Access and Future Advisory Efforts

Improving the information flow regarding Social Security projections is strongly urged. ***We recommend that the SSA Office of the Chief Actuary be given the resources needed to document further the current projection system.*** In addition, we suggest creating ongoing advisory groups on specific issues such as investment assumptions, or perhaps an ongoing technical panel review.

e. Evaluating the Precision of Projections

The Panel discussed at length how best to evaluate and illustrate the uncertainty of long-term projections. The Panel recommends development of a model that is a stochastic counterpart to the model currently used to forecast financial solvency. ***The model should be used to provide some quantitative assessment to policy makers of the extent to which different policy designs reduce or increase the probability of being out of actuarial balance.*** It should also be used as a tool to understand the extent to which different policy designs reduce or increase the sensitivity of Social Security to economic and demographic changes that cannot be well predicted under any model.

f. Consistency Among Variables

Under current OCACT techniques, relationships among variables for closely related groups are often estimated separately. As a consequence, comparing the results of various equations sometimes leads to the result that relationships are not economically, demographically, or actuarially plausible, and ad hoc adjustments are required. The Panel believes that certain modern statistical and econometric techniques might help in dealing with the situation and recommends that SSA investigate such techniques.

1999 TECHNICAL PANEL ON ASSUMPTIONS AND METHODS

Table of Recommendations

The Standard Assumptions Used to Evaluate Current Law

Real Wage Differential

Raise the real wage differential from 0.9 percent to 1.1 percent. Maintain the same spread for the low- and high-cost options.

Fertility

Maintain the currently assumed rates, and continue close monitoring.

Mortality

Accelerate the improvement in the mortality rate so that life expectancy at birth in 2070 is 3.7 years higher than under the current intermediate assumption. Maintain the current spread between low- and high-cost options.

Immigration

Increase the spread to plus or minus 50 percent of the intermediate assumption.

Return on Government Bonds

Reduce the real annual interest rate from 3.0 percent to 2.7 percent. Use 2.0 and 3.5 as the high-cost and low-cost rates.

Further Recommendations

Economic and Demographic Issues

- Labor force participation rates should be varied more across low-cost, intermediate, and high-cost scenarios.
- Methods for estimating the marital status of future beneficiaries, the labor force participation rates of older workers, the rate of mortality improvement among the Disability Insurance population, and the underlying causes of receipt of Disability Insurance need further development.

Investment Issues

- For investments in stocks, assume an equity premium of 3 percent over the real interest rates on Social Security's bond investments.
- The value or "cost" of the risk associated with equity investment should be displayed and estimated.
- Rates of return on financial assets should be consistent with other economic variables.

Further Recommendations (cont.)

Presentation Issues (for the Trustees Report and elsewhere)

- The format can be improved to allow easier access and understanding.
- The uncertainty of projections should be displayed more clearly and in ways that reflect better the relationship of that uncertainty to the design of the law.
- Cohort life expectancy should be shown (period life expectancy, as now shown, is easily misunderstood).
- The lifetime value of benefits (and possibly taxes) for various types of workers over time should be displayed.
- Alternative estimates of the unfunded obligations of the Social Security system should be presented in the Trustees Report.
- Traditional definitions of "typical workers"—low and average earners—result in an overstatement of the lifetime income and benefits of the typical low-income and average-income worker and should be revised.
- Less emphasis should be placed on the 75-year actuarial balance and more on long-term sustainability (as reflected, for instance, in balance during the last part of the projection period).
- Benefits under existing tax rates and taxes under existing benefit rates should be presented to better reflect consequences of current law.
- Prevalence rates for Disability Insurance, not just incidence rates of new awards, should be displayed.

Methodology and Models

- A published consistent set of criteria is recommended for comparing reform proposals and current law.
- General equilibrium modeling is necessary for consistency and to understand interactions.
- Models (microsimulation) to demonstrate distributional effects, as well as to estimate better those features influenced heavily by distributional factors, are necessary and must be enhanced significantly.
- Greater public access to Social Security information should be encouraged.
- Ongoing technical review of several issues is necessary.
- Modeling capabilities (stochastic modeling) are necessary to display uncertainty and the effect of policy on that uncertainty.
- Estimation methodology would benefit from new techniques to reflect consistency among variables.

III. RECOMMENDATIONS

A. OVERVIEW

As requested in the charter drawn up by the Social Security Advisory Board, the 1999 Technical Panel had two broad objectives. The first was to review the assumptions and methods that go into the annual projections of the Social Security actuarial balance. The second was to offer advice on issues dealing with equity markets and effects of possible alternative investments within the context of reform proposals. In both areas, the Panel also devoted attention to presentational issues and to areas in which the methodology could be improved.

In its review of the assumptions underlying the projections, the Panel made no attempt to target the actuarial balance that would result from choosing different values of key variables. However, those who follow Social Security policy closely will, no doubt, be interested in the effects on the actuarial balance that would arise from adopting the recommended changes in economic and demographic assumptions. We present estimates produced by OCACT of the effects of changing the intermediate assumptions of the 1999 Trustees Report to reflect the Panel's three major recommendations on the actuarial balance, as shown in Table III.1. The estimated change in actuarial balance for each individual recommendation is calculated separately as a single change to the intermediate assumptions of the 1999 Trustees Report. The estimate for the three recommendations combined includes interaction among the recommended changes.

Table III.1.—Effect of Panel's Recommended Changes in the Intermediate Assumptions
(Change in OASDI actuarial balance and annual balance as a percent of taxable payroll)

	Change in actuarial balance	Actuarial balance for 75-year period	Annual balance for 75th year
1999 Trustees Report actuarial balance		**-2.07%**	**-6.44%**
Increase ultimate rates of mortality decline	**-0.51%**		
Raise real wage differential	**+0.20%**		
Lower return on government securities	**-0.20%**		
Panel-recommendation actuarial balance (including interactions among recommended changes)		**-2.60%**	**-7.70%**

Source: Office of the Chief Actuary, Social Security Administration.

If all three recommended changes in ultimate assumptions were made, OCACT estimates that the OASDI actuarial balance would fall from -2.07 percent of taxable payroll to about -2.60 percent of taxable payroll. Indeed, any measure of sustainability would reflect an even greater absolute increase in imbalance as a percent of taxable payroll. For example, the size of the differential between the income rate and the cost rate in the 75th year would increase by an estimated 1.3 percent of taxable payroll from its currently estimated shortfall of -6.44 percent of taxable payroll.

To put the size of the change in actuarial balance in perspective, Table III.2 reports the change in the 75-year actuarial balance that has occurred in each of the last 10 years in the annual Trustees Reports. While a change of 0.5 percent is relatively large, it is not unprecedented. In 1994, the balance declined by 0.66 percent of taxable payroll, and in 1992 it declined by 0.38 percent of taxable payroll.

Table III.2.—Size of Changes in Actuarial Balance over the Last 10 Years
(As a percentage of taxable payroll)

Publication year	75-year actuarial balance	Change from previous year
1999	-2.07	+0.12
1998	-2.19	+0.04
1997	-2.23	-0.03
1996	-2.19	-0.02
1995	-2.17	-0.04
1994	-2.13	-0.66
1993	-1.46	(1)
1992	-1.46	-0.38
1991	-1.08	-0.17
1990[2]	-0.91	-0.21

[1] Between -0.005 and 0.005 percent of taxable payroll.

[2] In 1990, the Trustees Report showed two "intermediate assumptions," II-A and II-B. The Table reports the actuarial balance associated with II-B, the closer of the two to the current Alternative II.

Source: Office of the Chief Actuary, Social Security Administration.

The Panel wishes to emphasize that its other recommendations, with regard to equity investments, presentational issues, and modeling, deserve as much, if not more, attention than its rough estimates of the economic and demographic assumptions underlying current law. Consider the estimates of the actuarial balance. They can be displayed to reveal more than the uncertainty of the future. They also indicate the ways in which the system design adds to or subtracts from sensitivity to the uncertain future. For example, changes in life expectancies are uncertain, but the sensitivity of the system to

those changes reflects its lack of indexing to those life expectancies. The Panel also identified a variety of important areas in which much future research, analysis, and work needs to be performed. Those areas include poverty rates, particularly of women, under changing marital patterns; the extent to which labor force participation is likely to change in the future; the need for consistent comparisons of reform proposals and current law; and the ways in which equity premiums might be treated under various reforms involving equity investment, to mention only a few.

B. THE STANDARD ASSUMPTIONS USED TO EVALUATE CURRENT LAW

1. Real Wage Differential

Under Social Security law, the benefits for each successive wave of retirees are increased by indexing an individual's earnings up to age 60 by the growth in the economy's average annual earnings. On the other hand, benefits after age 60 are indexed by the Consumer Price Index for Urban Wage Earners and Clerical Workers (CPI-W), as reflected in the cost-of-living adjustment (COLA) to retirees. An increase in economy-wide average earnings will raise both taxable payroll and the benefits of each cohort of new retirees, but the benefits of existing retirees will be unaffected. In effect, the growth in total benefits will lag behind the rise in revenues. Thus, a higher growth of the real wage differential—or the difference between the rate of growth of the nominal average annual wage in covered employment and the rate of growth of prices—will lead to an improvement in the actuarial balance. ***The Panel believes that the intermediate assumption for the long-term rate of growth in the real wage differential should be raised by 0.2 percentage point from 0.90 percent to 1.10 percent.*** The growth rates for the low- and high-cost assumptions should be raised by equivalent amounts.

The adjustment is influenced in part by the Panel's belief that rates of deterioration in the components of the linkage between the growth in labor productivity and the real wage differential will be slower than currently projected, especially over the long term. The Panel recommends shrinking the long-term decline in both the earnings share of labor compensation and annual hours of work by 0.05 percent.

The adjustment also reflects recent revisions in the methodology for computing changes in the Consumer Price Index, which affect both the change in the ratio of inflation as measured in the CPI and the national accounts and the measured rate of productivity growth. Those methodological changes will lower the reported rate of CPI increase, and a portion of the changes will be reflected in the GDP price deflator. It makes little difference, from the perspective of real wage growth, if those methodological reforms are allocated to changes in productivity or the relative price ratio or some combination. The Bureau of Labor Statistics has published an historical index of the CPI that is consistent with the new

methodology. At the time of the Panel's deliberation, similar information on the impact of the CPI revisions on the national accounts was in the process of revision. For the present, the Panel recommends increasing the long-term rate of growth in labor productivity by 0.1 percentage point to 1.4 percent annually and leaving the change in the price ratio (pgdp/cpiw) at -0.1 percent annually. Differences in methodology provide a basis for some decline in the GDP price deflator relative to the CPI, but the two indices cover a different range of goods and services.

The Panel was of mixed mind over how to predict future productivity growth. After examining recent experience, the members concluded that a major change in the assumption on productivity growth would be a bit premature—particularly in view of the imminent revisions of the national accounts. However, the panel did believe that some change could be justified as a reflection of ongoing revisions in the price indices. Therefore, the Panel recommends a small change in the underlying assumed rate of long-term productivity growth of 1.3 percent per year. However, calculations of average productivity in the 1980s and the 1990s so far do not demonstrate a major shift in the rate of productivity growth. (For example, from 1987 to 1997, the average productivity growth was slightly less than 1.0 percent per year.) On the other hand, many members believe that with the introduction of major new technologies, future productivity growth could move back up toward the rates achieved in the postwar period up to 1973. In addition to the uncertainty associated with the evolution of "true" productivity, its measurement in an economy that places so much emphasis on services and information, rather than goods, is extremely difficult. ***Obviously, productivity growth is an item that needs to be monitored closely over time.*** Any projection at any time by its nature will be tenuous because of both economic and measurement uncertainty.

2. Consumer Price Index

In recent years, the projected rate of increase in the Consumer Price Index has been reduced from 4.0 percent to 3.3 percent per year. Most of the reduction reflects changes in the methodology of computing the CPI that will lower future reported rates of price inflation. The Panel recommends no changes in those assumptions.

3. Fertility

The Panel acknowledges the uncertainty of future fertility trends but recommends no change now in the intermediate assumption. The persistence of rates above 2.0 during the past decade suggests that the assumed intermediate rate of 1.9 may be too low, but that rate appears to be reasonable over long periods of time. This observation reflects demographers' attempts to take into account important changes in birth timing. Shifting to a different average age for first birth temporarily distorts the total fertility rate (TFR), as it did in the United States more

than a decade ago and seems to be doing so now in other industrialized countries. It also takes into account relatively higher fertility rates for population groups that are (or have been) changing more rapidly in size or composition through immigration. ***Rather than recommend changes in the rates currently assumed, we suggest continued efforts to monitor the shifting composition of the population.*** We also recommend continued study of hypotheses on whether and how fast new immigrant or existing minority groups will in the future reflect the average behavior of the population as it was composed in the past.

4. Mortality

a. General Population Mortality

The Panel recommends more rapid improvement in mortality rates under the intermediate (Alternative II) assumptions so that life expectancy at birth projected for 2070 is about at the level currently projected for the high-cost (Alternative III) assumptions (85.2 years). ***This would be 3.7 years higher than the projection of 81.5 under the current intermediate assumptions.*** The Panel supports the approach used under the intermediate assumptions for making a gradual transition during the first 25 projection years from the average rate of mortality decline for the period 1968-96 to ultimate assumed rates of decline. Achieving the recommended life expectancy for 2070 would require ultimate age-specific rates of mortality decline that are faster than currently assumed for the intermediate assumptions. The Panel recommends maintaining the age distribution of the rates of decline in mortality the same as was assumed for the intermediate assumptions in the 1999 Trustees Report. Those rates of decline are fairly similar across the adult ages, rather than slower at advanced ages as in the historical record.

The Panel's recommendation is based on examination of long-term trends in U.S. mortality, on examination of international evidence, and on consideration of recent research on the biodemography of mortality and aging. Although a case can be made for either slower or more rapid mortality decline, the recommended path appears most prudent, and it approximates the view of a substantial share of demographers. The size of the current range from low-cost assumptions to high-cost assumptions appears to be appropriate, and a similar spread should be retained for the future. We provide a justification for those recommendations in the Explanatory Material.

b. Mortality for the Disabled Population

The current actuarial projections imply a large and immediate reduction in the rate of improvement in mortality rates of DI beneficiaries, relative to the unusually rapid improvement in mortality rates in recent years. We recommend further research into the causes of this unusually large recent improvement in

mortality rates to determine if the trends are likely to continue. The long-term projected rates of improvement should be increased to be consistent with the Panel's recommendations for more rapid improvement in mortality for the general population, and a more gradual transition between historical and projected rates of mortality improvement should be considered.

5. Immigration

The Panel does not recommend any change in the intermediate forecast of net immigration. The assumption of 900,000 persons annually is consistent with recent experience and immigration law (keeping in mind that changes in the law, such as occasional amnesties or new legal allowances for humanitarian admissions are not projected). However, the range of uncertainty expressed in the Trustees' low- and high-cost assumptions is too narrow. ***Therefore the Panel recommends that the Trustees allow for a significantly broader range of possibilities in the alternative population projections, perhaps on the order of plus or minus 50 percent of the central assumption.***

6. Return on Government Bonds

The Panel recommends that in choosing a value for the real interest rate, SSA use information available in financial market prices, moderated by consideration of historical trends. Specifically, the term structure of nominal interest rates and forecasts of future inflation imply a market forecast of future values of the real interest rate. An effort should be made to make projections of future real interest rates consistent with the term structure and with SSA forecasts for inflation. Consistent with the Technical Panel's recommendation of 3.3 percent per year for the rate of inflation, the long-term real interest rate should be about 3.3 percent less than the long-term nominal interest rate. ***With current long-term interest rates close to 6 percent, the Panel recommends a real rate assumption of 2.7 percent.*** To bracket the range of likely deviations from this value, we further recommend that the rate be set to 2 percent in the high-cost scenario and 3.5 percent in the low-cost scenario.

Because factors other than expectations of future real rates can temporarily influence the term structure, it is prudent to compare the real interest rate obtained as discussed with historical experience. In fact, over the period 1926 to 1997, the real return on long-term government investments has averaged approximately 2.4 percent, which is close to the 2.7 percent that we recommend as a median value. Realized real rates in the 1990s, however, have been closer to the recommended low-cost scenario. Therefore, it may become necessary to adjust the assumed rate upward if the higher real rates of recent years persist.

C. FURTHER RECOMMENDATIONS

1. Economic and Demographic Issues

a. Labor Force Participation

With some exceptions, SSA is projecting that labor force participation for future age and sex groups will remain fairly similar to what it is today. One implication is reflected in projections that effectively assert that the labor force participation rates of future cohorts of women of all ages have leveled out relative to men, and that most of the catch-up has been achieved. While the Panel for the most part finds the labor force participation projections reasonable, it believes two areas need to be examined in more depth to determine if improvements could be made. First, by examining the behavior of successive cohorts, it has concluded that in older ages the participation rate of women may move closer to that of men than has recently been projected by the Social Security Administration. More recent cohorts of women have attained higher levels of education and accumulated more experience in the workforce relative to earlier cohorts. Some evidence suggests, therefore, that the catch-up by younger to middle-age women entering the labor force in recent decades will continue to be reflected in further increases in labor force participation as the more recent generations move into older ages.

The Panel also believes that improvements in longevity, along with potentially dramatic changes in labor supply and demand in the near future, could have significant effects on the participation rate of all older workers, even under current law. Many proposals for reforming Social Security, moreover, require the Office of the Chief Actuary to project the impact of changing participation rates on benefits and the actuarial balance. ***SSA needs to undertake or sponsor research that better accounts for the potential effects on labor force participation of changes in retirement ages, changes in the value of Social Security and Medicare benefits, trends in the availability of private pension income, and other variables.*** The Panel recommends that increased resources be devoted to this area of research but, beyond adjustment for labor force participation of older women relative to men already noted, holds in abeyance any recommended changes to the projections until some of that research is undertaken.

Finally, given the uncertainty over labor force participation and its importance to the actuarial projections—both under current law and under many proposals to change the law—the Panel recommends that variations in participation rates be incorporated into the alternative assumptions for the high and low projections. At present, many of the parameters underlying labor force projections are not varied among high-, intermediate-, and low-cost scenarios.

b. Marital Status and Benefits for Low-Income Survivors and Spouses

The Panel recommends that SSA revise and extend the methodology for estimating the marital status of future beneficiaries. Because of budgetary pressures, about a decade ago the Department of Health and Human Services ceased gathering data that enable the actuaries to adjust the projections to changes in the relative levels of marriage rates by age. Surveys by the Census Bureau, although they must be interpreted with caution, show that age-specific marital patterns continue to change. One reason that this issue has become so important—both for the projection of actuarial cost and for estimates of the distribution of that cost—is that ***under some reasonable assumptions about continuation of current patterns, the number of poor and near-poor older women could increase substantially in the future.***

The patterns of increasing poverty among older women reflect a much higher incidence of never-married individuals and divorced individuals with less than 10 years of marriage to the same spouse. Social Security law targets much of its relief against low income in retirement through its spousal and survivor provisions. That relief, however, is proportional to the Social Security benefit attributable to the other spouse's earnings and it applies in the case of divorced individuals only to those with prior marriages of 10 years or more. Those conditions are not necessarily related to need. One study by the Office of Policy within SSA (Iams and Butrica 1999) indicated that the increase in individuals not qualifying for spousal or survivors benefits might be so large that it could have a significant impact on poverty rates. More specifically, despite significant real growth in benefits per worker and in benefits for married couples, poverty rates among retired women might not fall at all by 2020. In effect, ***the growing group of never married and divorced women after short marriages—a group with higher-than-average vulnerability—could occupy a larger percentage of the elderly population.***

The future marital status of women has a significant effect on projections of OASDI actuarial balance and Supplemental Security Income (SSI) costs—not just under current law, but even more so under some types of reform proposals that the Office of the Chief Actuary has been estimating. The Panel therefore recommends that OCACT begin by investigating under current law the sensitivity of the financial projections to future marital status. Further, OCACT should adapt or at least supplement its current methods with alternative methods and data sources. A particular requirement is a set of data that will produce projections that are representative across states and regions as well as across demographic groups.

At the same time, it is crucial for the Office of Policy or other offices within SSA to study the distributional implications and make them available through public reports. We believe that these types of calculations cannot be done well without some sort of microsimulation modeling. While efforts have

begun within SSA, they must be advanced much further. ***Even beyond SSA, we hope the suggestions will be considered by other parts of the statistical establishment and that they pay attention to the data requirements necessary to monitor the trends.***

c. Disability

The Office of the Chief Actuary within SSA makes projections of "incidence rates" for the Disability Insurance (DI) program as one piece of their projection of future costs of the DI program. Those incidence rates show the number of newly entitled DI beneficiaries during a year as a percentage of the "exposed population," or the number of U.S. citizens who are insured under DI less the number who are currently entitled to receive benefits. A second piece of the forecast of future costs comes from projections of death rates, recovery rates, and conversion rates—the fraction of DI beneficiaries reaching the normal retirement age. Combining the two pieces leads to a projection of costs of the DI program as well as measures of "prevalence," or the ratio of the total number of DI beneficiaries to the size of the insured population. While the Office of the Chief Actuary does not forecast prevalence rates directly, they can be derived from the two pieces described above.

The Panel reviewed the projections of incidence and prevalence rates and found them to be reasonable, even though most epidemiological studies forecast continued improvements in objective measures of the health and disability status of Americans. ***The projected increase in the fraction of the U.S. population entitled to DI benefits is a result of demographic, economic, and programmatic factors that outweigh the impact of technological improvements in health care and health status.*** Perhaps the single most important factor is the increasing average age of the DI insured population and the fact that older individuals are more likely to apply for and be awarded DI benefits than younger individuals.

However, the Panel questions OCACT's forecast of a large, abrupt reduction in the rate of improvement in mortality of DI beneficiaries after 1999. The Panel recommends further studies of the determinants of the rapid improvement in those mortality rates in recent years to provide better guidance on whether such rapid rates of improvement will continue in the future.

The Panel reviewed the general methodology that OCACT uses to forecast inflows and outflows to the DI roles and concluded that the approach, which can be approximately described as a "judgmentally-adjusted extrapolation of historical trends," appears to be a fast, simple, and cost-effective method. It is not obvious that substantial investments in more detailed behavioral models of the DI application and awards process would necessarily result in more accurate long-term forecasts.

Nevertheless, the Panel believes that there could be substantial payoffs to new investments in research and data gathering that would enable SSA to develop more detailed dynamic behavioral models of the DI application, appeals, and awards process. Such models are likely to yield more accurate forecasts of the behavioral and distributional effects of policy changes and are also likely to improve our understanding of the relative importance of the various factors that have led to large swings in DI incidence rates in the past. ***Unfortunately, few existing models are adequate for predicting the behavioral and welfare impacts of currently contemplated changes to the DI program and awards process, including the Disability Process Redesign initiative.***

2. Investment Issues

a. Equity Premium

For many reform proposals, SSA is called on to make a projection of the average real rate of return on stocks. Historically, the average real rate on stocks has been significantly higher than on bonds. Nevertheless, ***the Panel recommends that when examining reform proposals that involve alternative investments, results should first be presented reflecting a government bond rate of return on those investments.*** By doing so, it will not lead readers or reviewers of its estimates to assume that an equity premium comes with no corresponding increase or shift in risk or other cost for society. Then it can present a second set of estimates indicating some median state of the world that assumes that the Trust Funds or individual accounts are able to earn a risk premium. At the same time, it needs to formally note that this is not "free" money, but comes at the cost of increased risk to the system. Those nontraditional investments involve a shifting of risk in society and an increase in risk for those who must bear it by covering any shortfall or accepting any windfall.

Historically, before the recent period of very high valuation of stock, the equity premium, which is the excess of the rate of return on stocks over the rate of return on short-term riskless bonds, has averaged between 6 percent and 7 percent per year. Looking forward requires an estimate of the ex ante, or expected, equity premium, and we recommend use of a conservative forecast of an ex ante equity premium of 4 percent per year over the short-term riskless rate. However, the Office of the Chief Actuary actually uses a benchmark based on a long-term bond return, and the long-term bond return in the last 5 years has averaged approximately 1 percent above the short-term government rate. Hence, recommending a 4 percent per year equity premium over the riskless rate is equivalent to recommending a 3 percent premium over the benchmark real rate on special issue bonds held by the Trust Funds.

The recommendation of a lower-than-historical premium reflects consideration of the high price-to-earnings and earnings-to-dividend ratios at the time that this Report was written. Indeed, the Panel received some recommendations that at current price-to-earnings ratios the equity premium may be close to zero, at least temporarily. (Right now, given the difficult nature of forecasting the premium, OCACT does not distinguish between short-term and longer-term expected rates of return on stock investment.) We further recommend that OCACT track academic progress on understanding the equity premium and be prepared to modify the equity premium assumption accordingly.

The Panel recognizes the tenuous nature of any assumption, as well as the danger that under current methods of presentation, it appears to suggest that the government can make money simply by borrowing more and investing the proceeds (on behalf of itself or individuals) in the stock market. Nonetheless, inasmuch as some assumption must be made, Panel members believed they were compelled to provide an estimate of the average expected premium. ***We strongly recommend that SSA and the Advisory Board conduct further review than could be accomplished by this Panel with its relatively broad mandate and short time to report.*** This type of review should not await the appointment of some future panel that will review methods and assumptions more broadly.

b. Presentation of Results with "Additional" Returns Resulting from the Equity Premium

One of the more difficult issues dealt with by the Panel was how risk associated with returns on equity should be valued. Currently, when called upon to evaluate proposals that involve equity investments, OCACT assumes that realized returns will equal its government bond rate plus the expected equity premium. At the same time, calculations of quantities such as the actuarial balance involve discounting all cash flows at its bond rate. ***All else equal, these assumptions have the effect of making proposals that include equity investments appear advantageous even when there is no additional saving or income being generated in the economy.*** As discussed in the section on the equity premium, this result derives in part from neglecting the cost of risk.

Using the expected return on equity is superficially consistent with the rest of the methodology used by SSA, which bases calculations on expected values of uncertain quantities such as rates of mortality decline and productivity growth. It ignores the distribution of possible outcomes around that expected return. Equity is fundamentally different in two respects, however. The first is that the variance of equity returns, even on an annual basis, is quite substantial. Unlike other adverse outcomes, low equity returns affect the value of Trust Fund assets immediately. The omission of uncertainty

due to equity investments can be particularly misleading. The second difference is that the risk of investing in equity can be avoided, with a corresponding reduction in the expected return, by investing in less risky assets. Thus, the nature of the risk is fundamentally different in that it can be priced. This second difference is reflected in standard actuarial practice, which requires that defined-benefit pension funds discount stock investments at a higher rate to reflect the risk.

The Panel recognizes the need for a relatively simple way to adjust for risk of equity investments, at least until more accurate methods can be developed and implemented. ***A rough adjustment for the (negative) value of risk can be accomplished simply by assuming that the cost of risk equals the risk premium.*** That is, the differential between the return on government bonds and the return on equity is reflected at the margin by the premium in the market. Hence, if reform implies some movement toward equity purchases, either by individuals or by the government, then the return from those purchases equals the return on government bonds, plus the equity premium, less some valuation of additional risk which at the margin is approximated by the equity premium. ***In short, the benefit of any higher average return on equity is offset in this measure by the cost of the associated additional risk.*** This in part motivates the recommendation that equity investments first be evaluated as if they are expected to return the rate on the special-issue bonds held by the Trust Funds.

More formal modeling of the risks also can be obtained through the examination of options. The purchase of an appropriate put option combined with the sale of an appropriate call option can guarantee that some value will be available in the future, not unlike the implicit promise of Social Security to provide at least a minimum level of benefits that are capped at some level. Option pricing techniques, then, determine the "cost" of risk by the prices that are placed at the margin in the market for those risks. Options pricing techniques are based on strong assumptions that have the benefit of making many options-pricing formulas attractively simple. However, to the extent that the assumptions abstract from reality, the application of the formulas may not correctly price the risk. Nonetheless, ***we recommend that the techniques be adapted to try to address questions related to risk borne by individuals and the Social Security system in the face of equity investment.*** Such techniques could be supplemented via stochastic simulations using a microsimulation model to show the downside risk to an individual.

Finally, we must note that the "loss" people associate with risk may far exceed the expected or average loss measured in dollar terms. To take an extreme example, suppose that an individual has 1/100 chances of starving and 99/100 of eating $500 of food for a month. The expected (average) amount of food consumption equals $495, but the individual may be willing to accept the surety of $250 of food consumption every month over the more risky

alternative. In effect, the individual is willing to pay an average of $245 per period to avoid an average or expected loss of $5 of food consumption. Measured in terms of the probability of starvation—1 percent in this example—the risk may appear to be small. However, measured (more appropriately) in terms of how much the person would pay to avoid this risk, almost 50 percent of average consumption, the risk appears large. Thus, when evaluating the risks associated with stock market investment, simply reporting the probability of unfavorable events does not adequately reflect the degree of risk. Some measure of the amount people would pay to avoid the risk is a more appropriate—though more difficult to compute—measure.

c. Consistency of Asset Returns with Other Variables

We have already emphasized the importance of ensuring that the projected real interest rate be consistent with the term structure of interest rates and the projected rate of inflation. ***The need for consistency extends to other variables as well.*** For instance, the returns to corporate debt and equity represent the return to the total corporate capital stock. Thus, the appropriately weighted average of the rate of return on corporate debt and equity should equal the rate of return on the corporate capital stock. Meanwhile, estimates of the rate of return on corporate capital exist in the economics literature and should be incorporated into forecasting of rates of return by SSA.

3. Presentation Issues

a. Format of Trustees Report

The Panel commends SSA and the Trustees for the high quality of reporting that they already undertake and their attempt to improve that reporting from year to year. Nonetheless, we believe that further improvements are possible, some simply because of technological advances. ***The format of the Trustees Report, we believe, could be simplified and made more user-friendly.*** The Panel struggled with an issue familiar to the Trustees and the Office of the Chief Actuary: how to provide as much information as possible without overwhelming the reader. One strong recommendation from the Panel is to accommodate three types of readers. The first would benefit most from the type of summary already provided in the publication, "Status of Social Security and Medicare Programs: A Summary of the … Annual Reports." The second type makes use of the more extensive Trustees Report. Here, too, choices must constantly be made about what to present and what not to present, and how far to go in providing fuller descriptions and presentations of assumptions and potential outcomes under those assumptions. (Recommendations on items to include or change in the complete annual report follow.) The third type needs even further detail, more than can be provided in a single document. That information is often contained in studies

produced by various parts of SSA. The third type of reader is much more likely to access the Report or the Summary via the Internet and thus to take advantage of the features that such a presentation mode can achieve.

We recommend that the Trustees Reports contain a continually updated crosswalk that allows readers, as easily as possible, to move back and forth at the three different levels. Thus, the Summary and the Trustees Report would include footnotes and listings of sources of further information. An electronic version of the Summary Report and the Trustees Reports would then contain Website references, ideally with point-and-click capability that would allow a reader, say, reviewing labor force participation, to move to available reports on that specific subject.

Similarly, the front section of the Trustees Report could be made to look more like the Summary Report to Congress. Quick references and hot buttons to specific later chapters, sections, and related reports would allow the user to explore the features of the Report to the greatest extent possible. Such references also would allow SSA to show the depth and sophistication with which it has investigated each set of assumptions and made its decisions.

We recognize that these types of reference and library functions require a significant amount of effort and judgment. But we believe this would be a worthwhile investment of energy and time by SSA and would enhance significantly its ability to convey to the public and to policy makers the information at its disposal. It would also demonstrate the depth to which the actuaries and other offices within SSA have explored various issues.

b. Illustrating Uncertainty

The Panel, like panels before it, has struggled also with the issue of how better to present the uncertainty that surrounds forecasts. Two different types of issues arise: 1) how that uncertainty is interpreted; and, 2) how variation around some median forecast is demonstrated, including how the range of uncertainty usually increases as one moves toward the far future.

The current system of presenting low- and high-cost alternatives to the intermediate assumptions is inadequate. The alternatives are useful in demonstrating the sensitivity of the forecast to the underlying parameters (section II.G of the Trustees Report). However, without any model of the probabilities of the underlying parameters taking on the alternative values, there is no way to use the alternatives to form a distribution of possible outcomes. ***It is inadequate to show any forecast without an indication of the uncertainty that surrounds it.*** We follow previous panels in strongly recommending efforts toward stochastic modeling or similar techniques that are better able to capture the interrelationship among assumptions. We are not dogmatic in the recommendation, as we recognize that even stochastic modeling requires some set of assumptions about the variance in future

outcomes—for example in fertility rates—that are hard to estimate. However, the assumptions are in some way embedded in current methods of projection in any case.

Some modeling techniques allow for graphical presentations that are better at displaying the range of uncertainty. What we seek is a method of displaying to policy makers and the public just how uncertain is some average cost outcome or date of exhaustion of the Trust Funds, and what are the probabilities that events will be close to or far from that result. That the system might have a very high probability of being out of balance by 2 or more percent of taxable payroll, for instance, may be worth knowing regardless of whether it has attained actuarial balance under some set of intermediate assumptions.

The current presentation of uncertainty—as reflected in low-, average- and high-cost assumptions—is also presented in a way that emphasizes the fragility of the estimating process, but not the malleability of the law. That is, displaying uncertainty is not performed solely to indicate that the future is unknown but also to alert policy makers how that uncertainty and risk to the system vary with policy choices. Current law, for instance, has partially eliminated most (but not all) of the risks to the Trust Funds that might be associated with changes in inflation. It has achieved this goal, among other means, by indexing benefits after age 60 roughly to the change in prices, so that lower inflation means lower increases in benefits. But the law has not similarly reduced the risk to the system associated with the personal benefit of living longer. Indeed, most of the projected imbalance in the system at the current tax rate would not be there if the expected number of years in retirement had been kept constant over time by indexing it for life expectancy. (Nor would our suggested changes in life expectancy projections make much difference for actuarial balance in such an indexed system.) Similarly, the law can be adjusted to reflect changes in workers-to-retirees over time due to fertility or immigration patterns—changes that must have an impact on all government programs, not just Social Security, because of the effect on the number of taxpayers. Or the law can be made less sensitive to the differential indexing of initial benefits eventually available to those not yet retired vis-a-vis the benefits to those already retired.

Thus, it is possible under different techniques—none of which is perfect, but many of which are useful—to show how different reforms can reduce significantly the probability of shortfalls in the future. ***It is our view that the Social Security Administration must develop different techniques for measuring uncertainty—not merely to refine predictions but to allow policy makers to consider reforms to Social Security that would lessen its sensitivity to adverse economic and demographic trends.***

c. Cohort Versus Period Life Expectancy

It is traditional for actuaries to present data on life expectancy (and other projections) in "period" tables. Period tables indicate patterns for particular individuals if they were to follow the same pattern in future years as do people in the current period. In the case of life tables, Social Security typically presents in the Trustees Report the expected life span of someone age 65, if that person were to have the same probability of death in years after age 65 as is projected for all persons *in that year.* Period tables are useful mainly as an intermediate step for actuaries and others who are projecting out matrices of future outcomes based upon a matrix of recent outcomes.

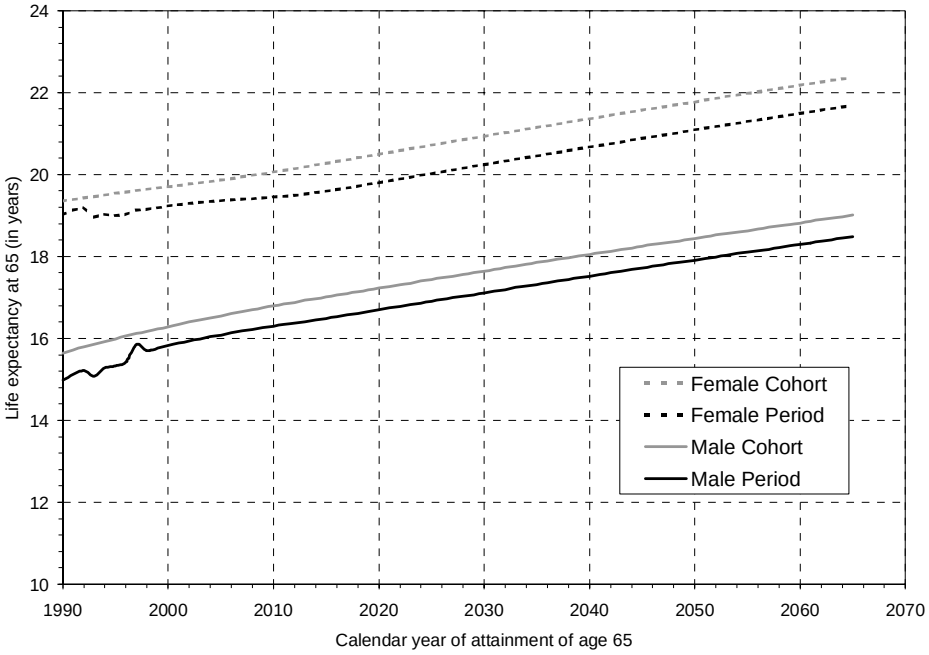
Many readers who are not actuaries, however, cannot understand the period life tables, and they misuse them when reporting on life expectancies. When people discuss projections of life expectancies, they usually have in mind the actual number of years individuals are expected to live. This number is not shown in the period tables because they do not take into account the expected improvements *after a given age.* For someone turning 65 in 2020, for example, the period table for 2020 gives their expected remaining years of life under the mortality conditions projected for all ages in the year 2020 only. In fact, the true life expectancy for this person will be greater since mortality is projected to continue to decline after 2020. When that person turns 70 in 2025, a 2020 cohort table reflects the life expectancy of someone age 70 in 2025, whereas the period table uses the life expectancy for someone age 70 in 2020. Thus, a cohort life table takes into account the full range of projected future mortality rates rather than only those occurring up to some given calendar year.

The use of period versus cohort life expectancy, therefore, has led to confusion among some policy makers who look to the Trustees Report for information. When discussing retirement age, they think they can turn to the period table to estimate number of years of expected retirement support, and they cannot. To know that number they must use cohort tables. Use of period tables tends to bias downward their perceptions of the number of years of retirement support promised by Social Security (and Medicare).

The Panel recommends that cohort life expectancy be published in the Trustees Report in addition to the period life expectancy. The cohort life expectancy provides the information that most readers of the Report would like to see and would find most useful in thinking about the system.

As an example of the difference in expected lifetimes conveyed by cohort life expectancy and period life expectancy, consider a 65-year-old female born in 1955. According to the period life expectancy now published in the Trustees Report, her life expectancy in 2020 at age 65 will be 19.8 years (see Figure III.1). But taking into account expected improvements in life expectancy after 2020 as reflected in cohort life expectancy raises her life expectancy to 20.5 years.

Figure III.1.—Cohort and Period Life Expectancies for Males and Females at Age 65 for Years 1990-2065



Source: Office of the Chief Actuary, Social Security Administration.

d. Lifetime Value of Benefits

The Trustees Reports have traditionally shown the value of annual benefits in Social Security and the ways they are changing over time. However, a large share of the growth of Social Security costs over the years has been the expansion in the number of years of support provided. The growth in annual benefits provided, therefore, is significantly smaller than the growth of lifetime benefits. The expected lifetime value of benefits conveys more about the value of the insurance package that people receive than does the annual figure.

The Panel recommends that the Trustees Report contain at least one simple presentation of the lifetime value of retiree and spousal benefits expected by individuals who live to retirement age and then have retired in the past or will retire in the future under current law.[1] This could be done for some typical low-, average-, and high-wage persons. We believe that such a

[1] A separate calculation could also be made for the value of insurance arising from premature death or disability. Survivor's benefits and Disability Insurance benefits play an important role for those who die before retirement age or who are disabled during their working years. For the Trustees Report, the Panel suggests a more simplified analysis of retiree benefits to illustrate the lifetime value of retiree and spousal benefits for those who live to retirement age.

presentation would be extremely informative concerning the benefits of the system (note that the item is also one that is recommended for inclusion in comparisons of proposals, as well).

Some members also believe that it would be useful to show lifetime value of taxes paid by the same cohorts in order to facilitate a comparison of Social Security taxes paid with Social Security benefits provided. A proper comparison of taxes and benefits, however, is further complicated by the necessity of correctly valuing the disability and death insurance provided prior to retirement age. A fair comparison of taxes and benefits would require a separate type of benefit calculation than that suggested in the previous paragraph which only looks at persons surviving to retirement age. If there is not space in the Trustees Report for this separate calculation, it could be made available through electronic means.

e. Alternative Projections of Benefits Under Current Law

Under current law, once the Trust Funds are exhausted they are limited in their ability to make payments of moneys not available to them. What would actually happen as a legal matter at the time of exhaustion in an actuarially imbalanced system is still unclear. Accordingly, offices such as the Congressional Research Service have made projections of promised benefits under different scenarios. One would be that tax rates are increased on future generations of workers somehow to provide the level of benefits promised under current formulas for benefit growth. Another is that benefits (or benefit growth rates) are reduced proportionately to be payable under existing tax rates. Although neither of these scenarios is likely to define precisely what would result from reform—or what the government would do when writing checks to beneficiaries at times when revenues and Trust Funds were inadequate—each helps to set bounds on what the current system promises and what current law allows. Table III.B5 of the Trustees Report, on the other hand, only shows the first type of scenario and, therefore, is misleading when presented by itself. ***The Panel recommends that at least these two types of scenarios be presented when describing current law in an actuarially imbalanced system.***

f. Typical Workers

In several of its reports and tables (including table III.B5 in the 1999 Trustees Report), Social Security reports on benefits received by those with "low earnings," "average earnings," "high earnings" and "maximum earnings." Recent research commissioned by SSA itself, however, now reveals that the typical or average retiree falls closer to the low-earnings than the average-earnings category. There is at least one obvious reason for this. The Social Security assumption about average earnings is that the person receives the average earnings of all workers for each year. But the assumption fails to

take into account the significant number of zero-earning years of many individuals, particularly women and those who spend part of their lives in noncovered activities. Whatever the reason, a majority of women and a significant proportion of men fall closer to the low-earnings category than the average-earnings category.

As a result, individuals analyzing the program or changes to the program are liable to be misled when looking at what is now called the average earner and low earner. For the true average person (male and female alike), the annual benefit is lower and the rate of return on contributions is higher than for Social Security's projected "average earner." When reform is being considered, changes to features like minimum benefits are liable not to affect SSA's "average earner" as much as they will affect the true average earner, and they likely would help a true low earner but would not show up as helping SSA's low earner. We recommend that SSA realign its presentation of typical workers as well as display complete distributional tables. Right now, SSA presents a series on low, average, high, and maximum earners that essentially starts in the middle of the earnings distribution (for men and women together, and, even then, not fully representing men with fairly low lifetime earnings) and moves upward from there. A new series should include a more typical low earner and a more typical average earner as well as a typical high earner.

The Panel recognizes that although the previous choice of typical workers may have been misleading when examining the impact of Social Security on the individual, it was a bit more on target in a period when policy makers talked mainly about male workers. SSA did make adjustments to combine an average- with a low-earnings spouse when presenting data on couples, so that an average-low combination for a couple would be closer to the situation of an average working couple. Nonetheless, the combination is still inexact and misrepresents what are average and low.

SSA is uniquely able to examine earnings and, to some extent, marital status over long periods of time. ***Given the importance of women's labor force participation and the changing nature of marital status, we suggest that SSA present a new set of typical workers and couples that would more "typically" represent the actual population of men and women both now and in the near future.***

g. Sustainability of the Trust Funds

The Panel would like to reinforce concerns about the overemphasis on 75-year actuarial balance raised by previous panels and addressed in part by the procedures adopted by the 1994-96 Advisory Council on Social Security. Currently the first year in the 75-year projection period has a positive cash flow (with contributions exceeding benefit payments), whereas the 75th year

has a negative cash flow. With each new projection in recent history, a year with negative cash flow is added, and the system is shown as more out of balance.

When reformers aim only for 75-year balance, therefore, they usually end up in a situation where their reforms only last a year before being shown out of 75-year balance again. The 1994-96 Advisory Council wisely tried to accept only reforms that produced *sustainability* over the longer term—sustainability defined in a way that would ensure that taxes and benefits were more or less in line after the 75th year.

Although there is no perfect way to demonstrate long-term patterns of sustainability, the members of this Panel remain concerned that many designers of reform try to reach balance simply by targeting their plans only at the 75-year actuarial deficit. Often they do not recognize that reaching balance over the 75-year horizon is not adequate if it is long-term balance they really want to achieve. Accordingly, they need summary statistics up front to help them visualize the broader situation and permit examination of the balance over different time horizons.

We suggest that some simple alternatives would go a long way toward solving this problem. The income rate, cost rate, and actuarial imbalance for the last few years (or even the last, 75th year) can always be shown side by side with the imbalance over 75 years. That can be done in tables such as I.G2 in the 1999 Trustees Report, so that readers do not misinterpret or use data out of its broader context. The advantage of that method is that it requires no additional calculations on the part of the actuaries. At the same time, it offers the reader a chance to investigate the fiscal health of the system over a different time horizon.

h. Unfunded Obligations

The members of the Panel also believe that alternative estimates of costs and taxes for the combined OASDI system under current law over all future periods would be worth incorporating more fully into the Trustees Report. The Office of the Chief Actuary calculates three measures of unfunded obligations of the OASDI Trust Funds as of a given valuation date. First, the "open-group surplus or deficiency" is based on the assets and liabilities for all current workers and beneficiaries as well as future new entrants to the system over the next 75-year period, measured from the valuation date.[1] Second, the "closed-group transition gain or cost" is similar to the open-group measure with the following exceptions. No new entrants to the system after the

[1] It represents the difference between a) the assets at the beginning of the period plus the present value of tax income over the next 75 years, and b) the present value of the projected cost of the program over the next 75 years.

valuation date are assumed[1], and the 75-year period is extended to 100 years to capture the lifetimes of all persons included in the valuation. Finally, the "maximum transition cost" represents the transition cost for continuing the Social Security program in a completely different form.[2] The approach is similar to the one developed for past service credits under the Personal Security Account (PSA) plan for the 1994-96 Advisory Council.

Although the numbers are subject to a variety of interpretations and are sensitive to assumptions, private plans are currently required to report similar calculations. We are not suggesting that the numbers be unduly emphasized or displace current presentations, but the Panel believes that they are important enough to incorporate in the Trustees Report, both as raw numbers and as a proportion of gross domestic product.

Perhaps such alternate estimates could be summarized in a section of the Trustees Report and mentioned briefly in the front of the Trustees Report and in the Summary Report with a reference to the larger examination of the issues later in the Report or in an on-line appendix.

i. Reporting on the Distribution of Benefits

The Social Security Administration has recently developed the capability to forecast not only the aggregate Trust Fund balance and the "typical worker" scenario, but also the future poverty status and other related issues concerning the distribution of benefits. Although the methodologies require additional testing and review, they signify a new era for SSA forecasts. ***SSA and other government agencies should find a way to bring the new studies into public view as soon as possible.*** One way to do that is to mention the new methodology in the Trustees Report and to refer the interested reader to the Website of the Office of Policy and to related reports such as those on the modeling income in the near term (MINT) model. (See the upcoming section on microsimulation for more on the point.)

j. Disability Insurance Projections of Incidence and Prevalence

In our suggestions for estimating the actuarial costs of disability insurance, we noted that there is a need to understand the actual prevalence of disability as well as the incidence of *new* net awards coming into the system. Here we raise a parallel concern with presentation of data even in the absence

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[1] Specifically, only persons in the system who are 15 years or older as of the valuation date are included in the calculations.

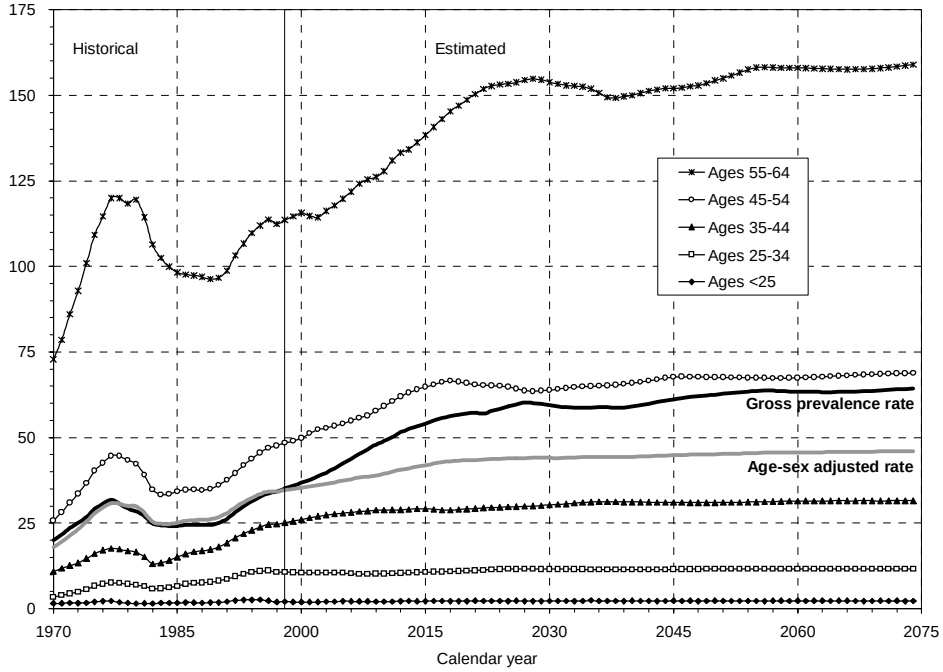
[2] It is computed as the difference between a) the value of the assets on the valuation date plus the present value of revenue from taxation of future benefits payable on the old form (under the old system), and b) the present value of all future benefits payable after the valuation date based on earnings before the valuation date (earnings credited under the old form). Future benefits payable on the old form for workers who have not reached benefit eligibility age (62) are calculated on a proportional past-service-credit basis.

of changes in the models. When Social Security reports a relatively constant incidence rate by age, it could easily imply to the reader that the percentage of people in each age category projected to receive disability benefits will be level, but that interpretation would be incorrect. What constant incidence means roughly is that net newcomers into the system are coming on board at about the same rate over time. ***But the prevalence of disability is projected, at least at the time of this report, to go up significantly by age, and as a proportion of the population to go up even faster because of the aging of the population.*** That increase has significant and important implications for actuarial cost, as the age-specific increases imply one or more changes ahead. Those changes could include increases in causes of disability, changes in the definitions of disability as interpreted administratively, or lesser ability of society to find work opportunities for those eligible for disability insurance under current law but currently working nonetheless.

We believe that very few are aware of the Social Security projections or their implications. Therefore, we recommend that the Trustees Report itself contain one simple graph and a table of prevalence rates of disability insurance by age, by all ages, and by an age-adjusted calculation (see Figure III.2). This last set of numbers reflects what would be happening on average to prevalence because of changing numbers receiving disability insurance even if there were no change in the age distribution. For example, the gross prevalence rate increases from about 35 per thousand disability insured to about 54 per thousand disability insured between 1998 and 2015, while the age-sex adjusted rate rises from about 35 per thousand to about 42 per thousand.

Figure III.2.—DI Disabled Workers Prevalence Rates, by Select Age Groups, at end of Calendar Years 1970-2074

(Per thousand disability insured)



Source: Office of the Chief Actuary, Social Security Administration.

4. Methodology and Models

a. Comparing Current Law and Reform Proposals Within a Consistent Framework

SSA has always been in a world in which it must constantly analyze reform proposals and indicate the impact of those proposals on actuarial balance. Recent years, however, have brought new demands. Estimates for three alternative reform plans were published by the 1994-96 Advisory Council on Social Security, but many other estimates have since been provided formally and informally to members of Congress or other commissions suggesting reform. Most of these plans have included investment in stocks along with more traditional provisions. Informed public debate and, ultimately, intelligent public policy would be greatly facilitated if all policy options and current law were evaluated and presented in a consistent framework and manner. ***As a step toward a consistent framework for evaluation, we suggest the development of a common set of features or parameters and outcomes that must be specified by each reform proposal to project the effects of those proposals and to ensure that they are compared on an equal basis.***

We include below a specific set of recommended features that could serve as a template for consistent evaluation of proposals and presentation of results. The first section of the checklist outlines the characteristics of Social Security policy that must be fully specified by a proposal to evaluate various effects of the proposal. The second section briefly lists the sorts of assumptions that must be made to calculate the effects of a proposal. That list puts some focus on assumptions related to investment issues associated with equity because equity investment of retirement accounts and/or Social Security is a relatively new consideration for SSA. Other economic and demographic assumptions have been covered elsewhere in this report. The third section of the checklist outlines some of the economic effects and implications of proposals that should be analyzed. Of course, the checklist is not definitive; it is a starting point that should be refined.

A Checklist for Comparisons of Reform Plans and Current Law

(The default value for parameters is current law, where appropriate.)

Plan Characteristics

Funding sources
- Contributions (tax policy)
  - Payroll tax rate
    - Employee
    - Employer
    - Self-employed
  - Cap
  - Tax treatment of contributions
- Transfers from general revenues
- Sensitivity to investment returns

Benefits
- Retirement age
  - Full benefit eligibility
  - Earliest eligibility
- Benefit calculation
  - Benefit formula
    - AIME
    - Adjustment for retirement at other than normal retirement age
    - Earnings test
    - Benefits related to life expectancy
  - Taxation of benefits
  - Treatment of COLA
  - Minimum benefit
  - Disability benefits
  - Survivor benefits
  - Dependent benefits
  - Sensitivity to investment returns
    - Guarantees (floor, ceiling, etc.)
    - Taxation of investment returns

Investment
- Inside Trust Funds
  - Fraction invested in private securities
    - Menu of securities
    - Who manages investments?
      - At what cost?
  - Effect of fluctuations in investment returns
    - Adjust benefits, taxes, or size of trust fund?
- Private accounts
  - What asset allocations are permitted?
    - Default allocation?
    - Guaranteed floor on benefits?
  - Administrative costs
  - Taxation of investment returns
  - Transferability of accounts to survivors, ex-spouses
  - Annuitization rules
    - Early withdrawal
    - Loan provisions

Treatment of transition
- Paying for benefits of current retirees
- Transfers from general revenues

SSA Valuation Assumptions[1]

Investment return statistics
- Means, variances, covariances, serial correlation

Discounting assumptions

Economic Implications

Exploration of key sensitivities
- Rates of return on government bonds and equity
- Labor supply response rates

Projections of revenues, costs, and Trust Fund balances of Social Security system
- Implications for unified budget

Net taxes and benefits
- Distributional considerations
  - Intergenerational
  - Intragenerational
    - Prevalence of poverty
    - Marital status

Cost of guarantees

Macroeconomic implications
- Asset prices, interest rates
- National saving and investment

Incentive effects
- Labor supply effects
- Risk-taking in individual accounts

[1] In addition to the current set of assumptions, evaluation of plans with either private or public investment accounts will need the following assumptions. It is important to use a common set of assumptions to evaluate different proposals.

In some cases, our concern is that proposals be more completely specified, for example, with respect to rules for disability payments or the income taxation of benefits. In other cases, our concern is with a consistent presentation of outcomes. Not all the outcome estimates are under the control of SSA. For example, two proposals may restore the same amount of actuarial balance to the OASDI Trust Funds but have very different effects on general revenues or on the budget as a whole. For the latter estimates, the Treasury and Office of Management and Budget, or the Joint Committee on Taxation and the Congressional Budget Office, may need to be involved. Another worrisome comparison would occur when two proposals involve different amounts of equity investment. A potential problem arises when SSA projects its costs under some bond interest rate, but then attributes a stock market return to individual accounts or to the trust fund investment. If two plans differ only in the amount of equity investment, and SSA assumes that equity returns always dominate bond returns, then the plan with the greater amount of equity investment will always tend to look better if the additional risk of equity returns is not accounted for.

Some outcomes cannot be derived from figures on actuarial balance—for example, projected impact on poverty among the elderly. Certainly the actuarial balance alone does not capture the risks involved in reform proposals or the possible range of impacts on individuals. Many of the items may require analysis that may take awhile to perform and require the participation of offices within SSA other than the Office of the Chief Actuary. We recognize that in cases like these—as opposed, say, to the specification of plan parameters—it often will not be possible to present all or even most needed information up front. Nonetheless, it should be an expectation of those who propose plans that SSA will attempt to undertake such analyses.

We recognize that the legislative process proceeds at a pace not under the control of SSA or other agencies. Moreover, SSA has not been built up over the years to be able to handle the recent level of demand for reform analyses that has been coming its way. We suggest most strongly, nonetheless, that a standard set of plan specifications and outputs eventually should be expected, even if some of the output analysis can be released only over time. In addition, every effort should be made to ensure that policy makers are not misled in picking among proposals by an inconsistent way of presenting results.

Finally, where a reform proposal does not specify changes, and OCACT makes an assumption for the proposal or assumes that no change is being proposed, that assumption should be formally stated. It would be possible, for instance, for SSA to develop a checklist of plan features similar to the one we suggest here. When SSA provides information on particular plans, it can then indicate precisely which items have not yet been specified in the

plan or not yet estimated. Such a standard presentation would better alert policy makers and the public to what they do not know, which is often as crucial to decision-making as what is known.

b. Macro Effects of Alternative Policies

OCACT provides actuarial estimates of program changes for a significant number of requesters, including members of the Executive Branch and Congress. The full impact of reform, however, cannot be determined well only through actuarial calculations of impacts on Trust Fund balances, but needs to be investigated using one or more broader frameworks. Ideally that would involve some amount of detailed modeling, but at a minimum it means that a more elaborate economy-wide and government-wide balance sheet is needed. Often the other government and economic effects feed back into Social Security actuarial calculations—as when effects on labor supply change the amount of Social Security tax collected. Therefore, although the advances we suggest here may require other offices of government to participate and go beyond issues of actuarial balance, they often are required as well to perform a thorough job of actuarial balance estimation.

In evaluating the revenue and cost projections for Social Security, one of the first required steps is to consider the budgetary impact on the rest of the government expenditures and revenues, rather than to focus exclusively on the impact on the financial position of Social Security. For example, if Social Security taxes are raised, some of those additional taxes will effectively reduce the amount of earnings subject to income tax (and Social Security tax), thereby reducing general revenues along with any net changes in Social Security tax revenue. If Social Security retirement ages are changed, labor supply will also be altered, which will lead to changes in collections of income taxes as well as Social Security taxes. Internal to SSA itself, changes in benefit levels in Social Security will affect the numbers of individuals receiving Supplemental Security Income (SSI) and vice-versa. While some government-wide effects—for example, a change in food stamp benefits—would be difficult to calculate every time a proposal or amendment to a proposal was put forward, others are simply too large to ignore. SSA must collaborate with the rest of government to begin to deal with these vital issues—even if, strictly speaking, it is not solely or even primarily the "job" of the Office of the Chief Actuary. It is someone's job, and other offices within SSA and the budget offices in the Executive Branch and in Congress have an obligation to make sure that the broader budgetary perspective is provided.

Social Security policies also affect the consumption and saving of individuals, as well as the incentives to supply labor. Those behavioral responses, in turn, feed back into the costs of Social Security and the taxes that it and the rest of government are able to collect. A great degree of uncertainty surrounds the quantitative importance of the feedback effects. But rather than

assume that these feedback effects are zero (as is current practice in many, but not all, cases), it would be valuable to develop models that would incorporate the behavioral adjustments into the projections. Where the uncertainty is large, as it often is, it is often better to provide alternative estimates under different assumptions, thereby providing information in the form of some sensitivity analysis.

One of the key macroeconomic variables that may be affected by Social Security policy is national saving, which determines how much wealth the United States accumulates over time. Although it might be tempting to assume that any additional saving within the Social Security system (or within individual accounts associated with Social Security reform) leads to an equal increase in national saving, such an assumption might not be realistic. The additional saving could be offset, in part or in whole, by decreased saving elsewhere in the government's budget or by decreased private saving. Again, models would be extremely valuable in assessing and taking account of the potential offsets to increased saving in the Social Security system. Once again, sensitivity analysis is needed given the range of uncertainty.

SSA already indirectly incorporates some behavioral responses some of the time. For instance, it usually makes some assumption about changes in retirement patterns when the early or normal retirement age is increased. For changes in the normal retirement age by itself, it suggests close to a zero response. Right now, however, the procedure is ad hoc, leading to the danger of inconsistency later when other proposals are examined. For example, simultaneous changes that increase the retirement age, require deposits to individual accounts, and reduce the value of annual benefits made available under Social Security have all sorts of interactive effects. Increasing the retirement age may induce work and increase or reduce saving. Mandatory individual accounts may lead to a build up of savings in individual accounts, which would be partially offset by some decline in other forms of private saving and induce less work if the increase in net saving is positive. And any reduction in annual benefits may induce both more work and saving (absent the other changes). Such changes are simply difficult to handle in the absence of a more complete model that consistently takes some account of behavior.

c. Micro Models

The Panel strongly endorses efforts to use and integrate microsimulation-based forecasts of the distribution of future incomes and Social Security outcomes. The Office of the Chief Actuary should work closely with the Office of Policy and other government agencies to encourage, foster, and nurture the growth and use of the models. Moreover, the inner workings of the models should be examined and recalibrated routinely after review by outside experts on the structure and capabilities of the models.

The value of microsimulation models is often misunderstood. For projections of single variables, such as mortality rates or economic growth or future participation in private pension plans, they often add little value. Generally, the models make projections on the basis of assumptions derived from other estimation procedures. Accuracy in the projection of a single variable usually requires an understanding of broad social and economic trends but is often less dependent upon interactions with other variables or with the detailed ways that changes might play out among households of different types. ***On the other hand, if there are important interactions that need to be modeled, then microsimulation becomes a valuable tool.*** For example, if there was strong evidence that mortality rates varied by economic and social status, and birth rates also varied by status of adults, then it would be hard to project those interactions over time without some sort of microsimulation model. Microsimulation modeling is most helpful for examining distributional issues and for analyzing situations in which cross-sectional correlations in the population are important. In other words, microsimulation models are particularly useful for longitudinal projections tracing the behavior of individuals and families over time under varying and complex economic conditions. Such behavior cannot be captured by the current Social Security projection model, which takes cross-sectional snapshots of the behavior of the entire population at each point in time.

The advantage to microsimulation models stands out when estimators have to deal with what might be called "either-or" cases in which the choice varies widely among households of different characteristics. For example, with the growth in two-earner couples, many more now receive benefits on the basis of their own earnings records rather than as spouses of partners. Trends over time in the claiming of worker benefits in lieu of spousal benefits are not linear and cannot be projected simply by extrapolating from the past. Instead, one must project the data for households of different types and with different earnings splits among couples, as well as take into account the impact of divorce and similar "family" situations on the numbers of individuals who will qualify for spousal benefits (another either-or condition).

Another example of either-or modeling involves multiple options in the benefit formula. For example, some proposals would provide for benefits under a traditional benefit formula or a minimum, whichever is greater (along with a third option, a spousal or survivors benefit). One cannot accurately project the cost and distributional effect of options such as these without a microsimulation model.

Still another example of where microsimulation helps is when policy makers want to constrain the impact of a policy change on particular individuals. Suppose, for example, that future shortfalls were to lead policy makers to reduce benefits, but they did not want to reduce those benefits for the

poorer third of beneficiaries. With microsimulation, it would be possible to develop a formula that would meet that objective; it would be difficult and less accurate under other techniques.

Finally, at least some reform efforts (e.g., the National Commission on Retirement Policy) wished to examine options for earnings sharing and other possible designs for spousal/survivors benefits. To be estimated, however, earnings sharing and other spousal/survivors benefit formulas require a good deal of information on the income patterns among spouses over time. Because SSA did not have adequate microsimulation models at the time, it could not provide cost estimates on options, much less the distributional impact and potential reduction in poverty levels of different alternatives. Because options could not be estimated, they were excluded from the proposals. ***Here, therefore, is a primary case where the lack of microsimulation capability is literally shaping policy that will affect tens of millions of individuals.***

d. Public Access and Future Advisory Efforts

The Panel recommends to SSA, to its Trustees, and to those in charge of the SSA budget that adequate resources be provided to help document the current system. Although the suggestion is not new, extraordinary demands placed on the Office of the Chief Actuary in recent years for analysis of legislative proposals and development of assumptions and projection methods have stretched existing resources. As a result, it has been extremely difficult to adequately address the need for thorough public documentation of all areas involved in making financial projections. To try to assist in this development, a prototype summary document was prepared by the Panel under the direction of Edward W. (Jed) Frees and will be published separately by the Advisory Board and made available on its Website. The Office of the Chief Actuary will make cross-references to the study on its Website. In addition, OCACT has indicated its intention to increase the level of detail and comprehensiveness of documentation available to the public and to update this documentation more frequently. The content of the Frees paper is expected to provide considerable help in this effort. The Panel recommends that the more complete documentation should contain links and references to existing studies and that such links (in an electronic version) be accessible, when possible, through point-and-click techniques on a Website.

By documenting more of their work—it is, of course, impossible to document everything—SSA would open itself to outside academia in ways that would go beyond what a technical panel can do on occasion. Effectively, SSA would avail itself of many more intellectual resources to improve its projections. At the same time, the work of future advisory panels would be expedited if a summary were available.

The 1995 Technical Panel recommended that there be an ongoing advisory Technical Panel. The 1999 Panel, in turn, has recommended that further advice be sought in a number of areas, such as how to treat returns from the types of investment options put forward in a number of reform proposals. ***We believe that the Advisory Board and SSA together should consider what types of advisory processes might best achieve the objective sought by both technical panels: an ongoing review in a way that allows SSA to achieve its mission in the most efficient way possible.***

e. Evaluating the Precision of Projections

Like the 1995 Panel, we recommend development of models that would represent a stochastic counterpart to the methods currently used to forecast financial solvency of the OASDI system. As a first step, we propose a cohort model to deal with the interactions among variables affecting the population generally, such as mortality and fertility. At the same time, we recognize that a model based on individuals might be better to deal with risks inherent in some proposals.

With a stochastic projection system, one computes an entire distribution of projected future outcomes. We suggest that initially a model might be constructed using mean projected assumptions corresponding to those of the current deterministic system under the intermediate assumptions. At the same time, the model could mimic the organizational structure of the long-range deterministic model without getting too involved in the short-range model.

To repeat comments made in a slightly different context, stochastic modeling has two primary roles to play in the Trustees Report. First, it is far superior to the current presentation of Alternatives I and III in displaying the range of uncertainty in the actuaries' forecasts. The alternatives are useful only in establishing the sensitivity of the forecast to changes in parameters, whether individually or in groups. Second, it is a useful tool to understand the interaction among variables. In particular, it can help policy makers understand that much of the uncertainty in forecasts is due not to future unknown economic and demographic forces but rather to the lack of built-in flexibility in the program itself and its lack of adaptability to changes in those economic and demographic forces. The models can help policy makers target a reduction in this sensitivity along with, say, any reduction in actuarial imbalance under some intermediate assumption.

f. Consistency Among Variables

The Office of the Chief Actuary uses a complex model of the U.S. economy that depends upon many inputs. As we have stressed elsewhere in this report, it is critical to model the relationship among the inputs so that

sensible projections result from the model. As a technique to understand the relationship among variables, OCACT uses regression in several areas of the projections. In the absence of other information about economic or demographic structural relations, regression methods have enjoyed substantial popularity in the applied sciences as a tool that is useful for understanding empirical relationships.

When SSA analysts estimate their models, they fit relationships among variables with data observed over time. Because data are typically available on an annual basis, most regression estimations use only a small number of data points, thus causing estimators to be more unreliable than they might be with a longer series of information. Further, several relationships are estimated individually by each age and sex cohort, so that many regression equations are estimated. When SSA fits the many regression equations, it sometimes finds that the estimated relationships are not economically, demographically, or actuarially plausible and that ad hoc adjustments are required.

We recommend that SSA sponsor research, either internally or externally, that investigates the use of modern statistical and econometric techniques as an alternative to their current procedures. Modern techniques, such as seemingly unrelated regressions or shrinkage estimation, take advantage of information in neighboring cohorts, such as when estimating relationships by each age-sex cohorts. These techniques not only produce more efficient estimators but also mitigate the need for ad hoc adjustments.

Summary of Data and Modeling Needs

- ***Real Wages.***—Measuring "true" productivity in an economy that places increasing emphasis on services and information, rather than goods, is difficult. The Federal statistical system should receive support for long-proposed initiatives to measure service production as well as it currently measures production in manufacturing and other traditional sectors.
- ***Marital Status.***—Up-to-date surveys of marital status have not received priority within the government as a whole. SSA should either receive support to collect such data or adopt alternative methods to exploit existing data sources that are both geographically and demographically representative of the marital and family status of future beneficiaries.
- ***Labor Force Participation.***—Further model development is needed to examine the labor force participation of older individuals and deal explicitly and consistently with many types of reforms, such as further changes in the retirement age or changes in levels of benefits. Such reforms could affect projected labor force participation rates of both older men and older women.
- ***Microsimulation Modeling.***—The Panel feels strongly that evaluation of economic and demographic changes, and of reform proposals, should include an analysis of distributional effects. The Panel recommends continued use and integration of microsimulation-based forecasts of the distribution of future incomes and Social Security outcomes throughout the various government agencies. Within SSA, the Panel recommends continued support for ongoing modeling efforts such as CORSIM, MINT, and the Projected Cohorts Model (PCM).
- ***Evaluation of Uncertainty.***—SSA should develop a model that is a stochastic extension of the model currently used to forecast financial solvency. The model should be used to provide some quantitative assessment to policy makers of the extent to which different policy designs reduce or increase the probability of being out of actuarial balance. It should also be used to understand the extent to which different policy designs reduce or increase the sensitivity of Social Security to economic and demographic changes that cannot be well predicted under any model.
- ***Linking Surveys with Administrative Records.***—SSA should increase its support for and use of individual-level survey data for studying retirement and disability that contain links to its administrative records. Prominent examples include the Health and Retirement Survey (HRS) and the Survey of Income and Program Participation (SIPP).
- ***Employer-Based Data.***—SSA should increase its support for collection of firm-level information on pensions, health insurance, and fringe benefit packages. Additional information is also needed to improve understanding of the factors affecting productivity, working conditions, compensation packages, and the overall demand for older workers.
- ***Disability***.—SSA should devote more resources to developing explanatory models that help to understand and forecast incidence rates of Disability Insurance, both under current law and under various changes in policy. In addition, SSA should explore the causes of the recent rapid improvements in mortality among the DI population.

IV. EXPLANATORY MATERIAL ON SELECTED TOPICS

The Panel believes that several topics deserve a more lengthy explanation than could be provided in the recommendations themselves. Some discussions are also fairly technical in nature. This part of the report covers those issues.

A. ECONOMIC ISSUES

The Panel examined several economic issues at length: the procedures for projecting real earnings growth, the implications of recent methodological changes in the Consumer Price Index, and future trends in rates of labor force participation. In addition, the Panel discussed various ways to make consistent projections of real interest rates and the equity premium.

1. Real Wage Differential

Recommendation: See Executive Summary.

Explanation: The rate of growth of real earnings, known as the real wage differential, has a moderate effect on the estimate of actuarial balance in the OASDI program. Although it increases tax revenues and initial benefit payments (or primary insurance amounts) by about the same percentage, retirement benefits for those already retired grow only with a cost-of-living adjustment that reflects inflation. The lag between earnings growth and benefit growth implies that higher rates of real earnings growth improve the actuarial balance of the Trust Funds. Although the growth of real earnings can be projected directly as the difference between the growth of annual earnings per worker in covered employment and the rate of CPI inflation, it is useful to link it to projections of future growth in labor productivity. The linkage between productivity and real earnings has four major components: 1) the share of labor compensation in total GDP, 2) earnings as a share of total compensation, 3) hours per worker, and 4) the ratio of the GDP price deflator to the CPI:

$$\frac{\text{earnings}}{\text{worker}} = \frac{\text{output}}{\text{hours}} \times \frac{\text{compensation}}{\text{output}} \times \frac{\text{earnings}}{\text{compensation}} \times \frac{\text{hours}}{\text{worker}} \times \frac{\text{PGDP}}{\text{CPI}}$$

Thus, for example, the intermediate projections of the 1999 Trustees Report are based on an assumed long-term rate of real earnings growth of 0.9 percent. That rate is the result of annual growth in labor productivity of 1.25 percent and a net decline in the linkages of 0.35 percentage points per year.

The projections are heavily influenced by past rates of change in productivity and the linkages, but they are ultimately based on subjective judgments about future trends. Those historical trends in productivity growth and the linkages to real earnings growth are shown in Table IV.1. The historical data

have been adjusted by the Social Security Administration to be consistent with current concepts. Thus, for example, historical data of the Consumer Price Index have been adjusted to be consistent with current concepts.[1] The table provides measures of the average rate of change over various periods extending back to 1951.

Table IV.1.—Historical Trends in Productivity and Real Wage Components, 1951-97, With and Without CPI Adjustment

(Annual rates of change)

			Component linkages to average real earnings					
Period	Nonfarm business productivity	Total economy productivity	Compensation divided by GDP	Earnings divided by compensation	Hours per week	Price ratio	Average real earnings	CPI-W
			Unadjusted data					
1951-97	1.85	1.81	-0.06	-0.26	-0.26	-0.13	1.09	3.99
1973-97	1.10	1.00	-0.17	-0.19	-0.11	-0.45	0.07	5.39
1987-97	1.05	0.91	-0.11	0.08	0.28	-0.42	0.75	3.43
1992-97	0.96	0.78	-0.18	0.34	0.57	-0.44	1.08	2.66
Geometric weights	1.47	1.36	-0.06	-0.13	-0.08	-0.28	0.81	4.25
			1999 Trustees Report					
Alt. I	—	1.56	0.00	-0.09	0.00	-0.10	1.37	2.30
Alt. II	—	1.26	0.00	-0.17	-0.10	-0.10	0.89	3.30
Alt.III	—	0.97	0.00	-0.26	-0.20	-0.10	0.41	4.30
			Adjusted for CPI methodological changes					
1951-97	—	1.90	-0.06	-0.26	-0.26	0.16	1.47	3.59
1973-97	—	1.09	-0.17	-0.19	-0.11	-0.09	0.52	4.92
1987-97	—	0.98	-0.11	0.08	0.28	-0.14	1.09	3.07
1992-97	—	0.82	-0.18	0.34	0.57	-0.23	1.33	2.41
Geometric weights	—	1.44	-0.06	-0.13	-0.08	0.01	1.18	3.86

Because of the difficulty of making projections over long periods, the Panel believes that adopting a common historical period as a basis for the assumed future growth rates would have significant value. The Trustees should deviate from the standard framework only when they are relatively confident in a specific alternative. It also seems reasonable to place greater reliance on the recent relative to the distant past. Thus, the Panel concurs with prior suggestions that consideration should be given to weighted averages of the historical data over a standard period. An example of geometric-weighted averages for productivity and the linkages is shown in the table, extending over the full period for which program

[1] Kenneth J. Stewart and Stephen B. Reed, "Consumer Price Index Research Series Using Current Methods, 1978-98," *Monthly Labor Review* (June 1999): 29-38.

data are available. The geometric weights decline at an annual rate of 0.95. While such a projection strategy may seem unduly mechanical, it may provide a more disciplined and readily acceptable basis for the projections.

a. Labor Productivity

The current intermediate assumption calls for a growth rate in long-term productivity of 1.25 percent. A sharp break in U.S. productivity growth occurred in the early 1970s. Over the full period of 1951-97, growth averaged 1.9 percent per year, but only 1.1 percent since 1973. The current assumption lies between these two numbers, and it is slightly below the geometric-weighted average. Since 1995, U.S. productivity growth has accelerated, but it is too early to determine if those improvements are more than cyclical. They were, for example, preceded by several years of very poor performance even in the early 1990s—part of the period some believe to be part of a new period of greater productivity growth. The gains are heavily concentrated in durable manufacturing, and there is little evidence of significant gains in industries that are heavy users of the new information technologies. However, it is difficult to measure the output of some of these service industries, and the productivity gains may be held back by transitory problems of adjusting to the new technologies. On balance, the Panel concluded that it would be reasonable to increase the current assumptions slightly, and the Trustees should be prepared to make large adjustments if the recent gains in actual productivity are sustained.

The measurement of labor productivity is also affected by the recent methodological changes in the CPI because some of those changes will lead to revisions in the national accounts. Preliminary estimates of those revisions are incorporated in the historical data of Table IV.1; but the publication of the new national accounts will alter both the estimate of productivity growth and the rate of change in the price ratio. For the Trustees' ultimate focus on real earnings growth, however, it makes little difference if the methodological reforms are allocated to changes in productivity or the relative price ratio or some combination.

b. Linkages Between Productivity and Real Wage Growth

Historical rates of change in the four components of the linkages are shown in Table IV.1. The Panel believes that the net effect of the intermediate assumption is to provide an overly pessimistic view of future growth in real wages relative to productivity growth. Much of the past decline in the ratio of earnings to labor compensation can be traced to the growth in employer contributions to social insurance and private health insurance. Future increases in contributions for social insurance are explicitly not to be incorporated in the projections, and projections of health insurance costs are extremely

problematic. On the other hand, the recent sharp rise in the ratio is partly due to an unsustainable decline in employer contributions for private pensions, induced by large capital gains in existing retirement accounts. Questions were also raised by the Panel about the assumption of continued declines in hours worked. Hours worked have actually increased over the last decade. Accordingly, the Panel recommends a smaller rate of deterioration (by 0.05 percent) in both the ratio of earnings to labor compensation and in hours per week.

The greatest uncertainty is associated with projections in the ratio of output prices (those that apply to GDP) to the Consumer Price Index for urban wage earners. In the past, the CPI tended to rise much more rapidly than the GDP price deflator, but the recent revisions in the methodology for computing the CPI should eliminate most of the difference. The current assumption of a 0.1 annual percentage rate of decline in the price ratio has been justified by the expected difference between price changes measured with a Laspeyres index, as used in the CPI, compared to the chained price index of the national accounts. But that expected difference may decline in importance when the CPI weights are updated more frequently. Large differences also arise in the composition of the goods and services that are included in the two indices that create greater uncertainty about relative rates of change. In particular, major sectors of the economy, such as government and nonprofit institutions, are assumed to have no significant productivity growth, and the price indices simply parallel the growth in wages. Many of these sectors are excluded from the CPI. Prices of imported products are also fully reflected in the CPI, but have no direct impact on the GDP price deflator. Recent differences are strongly influenced by the falling prices for computers which are more important in GDP than in consumption. On balance, the Panel concludes that the current assumption of a small annual decline in the price ratio over a long period of time is reasonable.

2. Consumer Price Index

Recommendation: See Executive Summary.

Explanation: Changes in the economy-wide rate of inflation have only modest effects on the financial balance of the fund, because the system is largely indexed against variations in the price level. However, while the methodological changes in the computation of the CPI will have no effect on the future path of nominal wages, initial benefits, or interest rates, they will reduce the annual cost-of-living adjustments. Reductions in the cost-of-living adjustments have a cumulative effect on individual beneficiaries that increases with the number of years that they live after age 62. The changes in the CPI since 1995 are estimated to have reduced the annual rate of increase in the CPI by about 0.5 percentage points per year. That is, the reforms will reduce a typical retiree's benefit at age 72

by about 5 percent relative to the situation under the 1995 concepts. That translates into an improvement in the actuarial balance of about 0.75 percentage points over the period of 1999-2073.

The Trustees' projections incorporated the bulk of these CPI changes by creating a historical series that was designed to be consistent with the current methodology. The Panel recommends that the Trustees now incorporate improved estimates of a consistent CPI, such as recently published by the Bureau of Labor Statistics (BLS). The BLS incorporated a larger number of the changes and had greater information on which to base its judgments about the effects on the historical data.

As shown in Table IV.1, the current assumptions of the long-term rate of change in the CPI seem consistent with the historical experience, although they are higher than the experience over the past decade. The Panel recommends no change in the assumed rates of change for each of the three alternatives.

3. Rates of Labor Force Participation

Recommendation: See Executive Summary.

Explanation: The Trustees' projections assume that the age-specific rates of labor force participation for both men and women will be relatively constant in the future. The aggregate participation rate declines slightly in the projections because of a gradual aging of the workforce. The Panel believes that the projections are consistent with developments during the 1990s in which the prior patterns of a declining rate of participation for older males and a rising rate for females appear to have come to an end. However, the projections assume a continued large difference between the participation rates of men and women—about 15 percent on average—that struck some members of the Panel as too large. The participation rates of women should be reexamined on a cohort basis to assure that current high rates of participation by younger age groups are carried forward in future years. That is, for older individuals, female labor force participation rates relative to male participation rates look too low.

Much additional research is also needed to determine the influence of increases in the Social Security retirement age on the labor force participation of older workers. Here we believe that a much greater turnaround is possible and that, moreover, the model needs to account consistently for the influences of such policy changes as increases in retirement age, changes in annual and lifetime value of benefits, and labor force demand, among others.

The Panel also believes that variations in the participation rates should be incorporated as part of the alternative high- and low-cost projections.

4. Return on Government Bonds

Recommendation: See Executive Summary.

Explanation: The Trustees Report shows the nominal interest rate on special public-debt obligations issued to the Trust Funds as one of the economic assumptions. In fact, that nominal interest rate is directly related to the assumed real rate of interest and the assumed rate of inflation. Hence the Panel discussed the importance of making consistent projections of interest rates in the future. Consistency requires recognizing the linkages among real and nominal interest rates and the rate of inflation.

For low rates of inflation and low nominal interest rates, the real interest rate is well approximated by the nominal interest rate minus the rate of inflation. Nominal interest rates on government bonds of various maturities are readily observable in financial markets, and the long-term rate of inflation suggested by the Technical Panel elsewhere in this report is 3.3 percent per year. Therefore, in order for the real interest rate to be consistent with the projected rate of inflation, the (long-term) real interest rate should be approximately equal to the long-term nominal interest rate minus 3.3 percent.

An alternative source of information about the real interest rate is potentially available from the prices of Treasury Inflation-Indexed Securities (TIIS, formerly called TIPS), though the market in these securities is still relatively new and perhaps not as liquid as the market for conventional Treasury securities. However, as this market matures, it may prove to be a useful guide to future inflation and the real interest rate.

Until then, we recommend that in choosing nominal interest rates and inflation rates—and, implicitly, a real interest rate—SSA use information available in other financial market prices, moderated by consideration of historical trends, that is reflected in "the term structure of interest rates." The term structure of interest rates is the relationship between the maturity of government securities and their yield. Embedded in the term structure is an implicit estimate of future short-term interest rates. According to the "expectations hypothesis," the long-term rates reflect the market's expectations about what rates of return will be in the future. The logic underlying the expectations hypothesis is that (risk-neutral) investors with long horizons, say 30 years, could invest in 30-year bonds or in a sequence of 30 1-year bonds. If the expected final return over 30 years from investing in the 30-year bonds were significantly higher than the expected return over 30 years from investing in a sequence of 1-year bonds, investors would rush to invest in 30-year bonds. Such behavior would drive up the price and drive down the expected rate of return on the bonds. Thus, the expected return on a 30-year bond cannot significantly exceed the expected return on a sequence of 30 1-year bonds. A similar argument implies that the expected return on a 30-year bond cannot be significantly lower than the expected return on a sequence of 30 1-year bonds (because investors would sell 30-year bonds, thus driving down the price and

driving up the expected return on the bonds). Therefore, the expected returns on a 30-year bond and on a sequence of 30 1-year bonds are approximately equal. Hence the annualized expected rate of return on a 30-year bond is approximately equal to the average of the expected rates of return on 1-year bonds over the next 30 years. Thus, it is common to use the term structure to try to infer expectations of future interest rates.

Using the term structure to predict real rates is complicated by the fact that we can only observe the nominal term structure. To infer expectations about future real rates, we must subtract expected inflation, an unobservable quantity, from the observed nominal rates. Since SSA must forecast inflation for other calculations, it makes sense to use this inflation forecast as the basis for determining the real interest rate from nominal interest rates. Hence, we recommend subtracting the SSA inflation estimate from the long-term (i.e., over 10-year) nominal rate in the term structure to approximate the long-term real interest rate. Consistent with the Technical Panel's recommendation of 3.3 percent per year for the rate of inflation, the long-term real interest rate should be about 3.3 percent less than the long-term nominal interest rate. The current term structure is fairly flat in the long end, with long-term interest rates close to 6 percent at the time the Panel met. This leads us to recommend a real rate assumption of 2.7 percent. To bracket the range of likely deviations from this value, we further recommend that the rate be set to 2 percent in the high-cost scenario and 3.5 percent in the low-cost scenario.

Basing the real interest rate entirely on the term structure of interest rates without considering other evidence, however, would be unwise for three reasons. First, factors other than expectations of future real rates can temporarily influence the term structure. Second, there is considerable uncertainty about expected inflation. And third, the expectations hypothesis has not performed well historically. We therefore recommend also considering historical experience in determining rate estimates.

Among the many interest rates available, the first item to determine is the appropriate reference rate. During the 1990s, the rate on new issues to the Trust Funds has averaged about 20 basis points above the 10-Year Treasury Constant Maturity Rate and about 20 basis points below the 30-Year Treasury Constant Maturity Rate. (A basis point is 1/100th of a percentage point.) Because SSA is required to credit itself with a weighted average of bond rates, either one, adjusted by the corresponding average basis point differential, would seem to be a reasonable benchmark.

Based on standard data from Ibbotson, over the period 1926 to 1997 the realized real return on long-term government investments has averaged approximately 2.4 percent, which is below the 2.7 percent that we recommend as a median value. The series on long-term government bonds goes back further than that for Constant Maturity Treasury securities, so the exact maturity of the

underlying bonds cannot be determined. Table IV.2 shows the average Constant Maturity Treasury Rates over the last 5 years, based on data available from the Federal Reserve.

Table IV.2.—Average Real Rate on Constant Maturity Treasury Securities (CMT's), January 1994 to August 1999

	10 year CMT	30 year CMT
Minimum nominal rate	**4.28**	**4.81**
Maximum nominal rate	**8.00**	**8.13**
Average nominal rate	**6.24**	**6.52**
Average special issue differential	**0.21**	**-0.07**
Average CPI inflation	**2.47**	**2.47**
Average adjusted real rate	**3.98**	**3.98**

Source: Federal Reserve Bank of Chicago.

The table reveals that realized real rates in the 1990s have been much higher than those earlier in the 20th century. In fact, they exceed the recommended low-cost scenario. We recommend a lower rate than has been the case in recent historical experience partly because the high realized rates in recent years are often attributed to lower than anticipated inflation rates. However, it may become necessary to adjust the assumed rate upward if the recent higher real rates persist.

5. The Equity Premium

Recommendation: See Executive Summary.

Explanation: For many reform proposals, the Office of the Chief Actuary is called upon to make a projection of the average real rate of return on stocks. The stocks may be held inside the Trust Fund or in individual accounts overseen by SSA. Much of the Panel's discussion focused on how the risk and returns associated with these investments should be reflected both in calculations such as the actuarial balance, and in any summary comparison of proposals.

Here we elaborate on what is known about the equity premium and on the reasons for our recommendations. The recommendations can be summarized as follows:

- The Panel recommends that the average equity premium be set to a constant 3 percent over the assumed real rate of interest on government bonds used in other SSA calculations.

- SSA should be prepared to modify the assumed average equity premium as new insights on the size and determinants of the equity premium become available.
- When examining reform proposals that involve alternative investments, results should *first* be presented reflecting a government bond rate of return on those investments. This will avoid the false inference that the equity premium comes with no corresponding increase in risk or other cost for society.
- Calculations that explicitly incorporate the equity premium should also include a price of risk. This can be accomplished by adjusting the discount rate used for investment cash flows or by option pricing methods. SSA should study these alternatives and further develop and standardize the methodology used to evaluate risky investments.

Traditionally, the equity premium refers to the difference between the expected return on a diversified stock portfolio and the expected return on short-term government securities (for example, 6-month Treasury bills). Since expectations cannot be directly measured, discussions of the premium generally focus on the historical realized equity premium, or ex post premium. The ex post equity premium has averaged between 6 percent and 7 percent per year this century. Looking forward, however, requires an estimate of the ex ante equity premium.

In recent years, the premium on stocks has significantly exceeded the historical average. For example, since 1990 the average premium on stocks has been approximately 13 percent per year. Since most of these returns were in the form of capital gains rather than dividend increases, price-dividend ratios are now at record levels. At the same time, price-earnings ratios, which some consider more stable indicators of firm valuation, are near record levels. Both these measures suggest that for equity returns to equal what they have been historically, extraordinarily high levels of earnings growth must be sustained in the future. The reason is as follows. If prices are high relative to current dividends, it must be that investors anticipate very high future dividends to compensate. Consistent with this, substantial empirical evidence shows that a large value of the price-dividend ratio predicts lower stock returns in the future (for example, Campbell and Shiller 1998).

Several qualitative explanations have been suggested for the price run-up and for lower expected returns in the future. “Rational” explanations include the fact that the baby boom is entering peak saving years, that productivity has escalated due to technological improvements, and that there have been major political changes around the world. Rates of participation in the stock market are increasing, in part because the growth of mutual funds has lowered the cost of investing and made diversification feasible. On the other hand, “irrational exuberance” could be fueling the price rise. If so, the bubble could eventually

burst, or prices could stagnate for years. For all of those reasons, many observers believe that expected returns looking forward are lower than they have been in the past.

In considering a recommendation for the ex ante equity premium, the Panel restricted its attention to choosing a constant value for the equity premium over the entire 75-year projection period. A reasonable alternative is based on the notion that the current price-dividend and price-earnings ratios are very high. This alternative would project stock prices to fall in the near term or medium term (thus earning a very low, or even negative, equity premium in the near term or medium term). After the fall in stock prices, stocks would earn an equity premium closer to the historical average of 6 percent or 7 percent per year. We chose not to follow this alternative strategy because any prediction of the size and timing of a fall in stock prices is necessarily highly speculative.

The recommendation of the Panel was clearly influenced by the high level of stock prices at the time of its report. The Panel recognizes, therefore, that the Trustees or any other group attempting to make its own projection would need to take into account any significant change in stock prices between the time that this report is issued and the time it makes its own assumption. In effect, the Panel believes that the higher such measures as the price-earnings ratio and the price-dividend ratio, the lower should be the equity return attributed to stock investments either by the Trust Funds or in individual accounts.

a. The Equity Premium and SSA Projections

The Panel therefore recommends that SSA use a conservative forecast of an ex ante equity premium of 4 percent per year over the short-term riskless rate. However, SSA actually uses a benchmark based on a long-term bond return, and the long-term bond return in the last 5 years has averaged approximately 1 percent above the short-term government rate. For instance, the average annual return since January 1994 on 6-month Treasury securities is 5.21 percent, versus 6.23 percent on the 10-year constant maturity Treasury. Hence, recommending a 4 percent per year equity premium over the risk-free rate is equivalent to recommending a 3 percent premium over SSA's benchmark real rate.

To think about how the equity premium should be treated in SSA projections, it is important to understand why the premium exists in the first place. The equity premium is understood by economists to be compensation for the risk of investing in stocks rather than in safe government securities—it is the "price of risk." For the same expected rate of return, investors would prefer to put their money in safe bonds rather than risky stocks. To induce them to hold stocks instead, the expected return on the stocks must be higher than on bonds. If Trust Fund assets are invested in the stock market, the rules for how shortfalls are covered will determine whether taxpayers or beneficiaries bear

the market risk. As a first approximation, it is reasonable to assume that the higher expected returns on the stock investments are offset by the cost of the increased risk to taxpayers and beneficiaries. Equivalently, if 1 dollar of investment is transferred from bonds to stocks, there is no net benefit to the system.

Under OCACT's current method of evaluating proposals featuring investments in stocks, however, a dollar of stock investment will appear to be worth more than a dollar in present value terms. Why this occurs is easiest to understand in a simple numerical example. Imagine that a plan calls for investing $1 million in the stock market for 1 year. Using the recommended expected equity premium of 3 percent over the recommended government bond rate of 2.7 percent implies a return of 5.7 percent, and an expected cash flow of $1,057,000. The cash flow later feeds into calculations, as perhaps best demonstrated by an actuarial balance, that require taking a present value. Since all expected cash flows are discounted at the government bond rate, the present value of the investment would be calculated as $1,057,000/1.027 = $1,029,211. It appears that the plan has improved the financial status of the system by $29,211, just by moving $1 million into equities for a year. If the investment is held for more years, the distortion is magnified by the effect of compounding.

There are several ways to avoid the bias. The simplest is to adjust the discount rate used to discount cash flows from stocks. The standard textbook approach (and the one used by private pension funds) is to use a risk-adjusted rate. In the context of the above example, the cash flow at the end of the year should be discounted at 5.7 percent rather than at 2.7 percent. The higher discount rate reflects the higher return required as compensation for risk. Discounting $1,057,000 at 5.7 percent results in a present value of $1,000,000, and hence no distortion. Note that this is equivalent, in present value terms, to assuming that the stock investment only returns the government bond rate and then discounting by the government bond rate. We recommend the latter approach because it represents the smallest deviation from SSA's current methodology that does not introduce a bias in favor of stock market investments.

We also recommend that SSA explore more sophisticated approaches to quantifying the risk and return from stock market investments. Options pricing theory allows us to calculate how much the capital markets would charge for certain types of return guarantees. For instance, a put option guarantees that the return on a stock will be no less than a pre-specified floor level, since it gives the owner of the option the right to sell the stock on a pre-specified future date at a pre-specified price. If Social Security recipients gain when the stock market appreciates, but are protected from large falls in stock prices, it is as if they own a put option, given to them by future generations of taxpayers. In general, the cost of reducing risk can be equated to the price of the options purchased. There are two advantages to using the options pricing

approach. First, the method quite reliably explains market prices of options, eliminating the need for complicated and potentially controversial modeling assumptions. Second, the formula for pricing options is easy to implement and familiar to the financial community.

b. Contributions from Academic Research

Both the equity premium and the prospect of investing Trust Fund or individual account assets in the stock market have spurred a large volume of academic research and debate. It is worthwhile to briefly summarize the major issues here. We recommend that SSA follow the research and consider its merits in developing a policy on evaluating stock market investments.

The "equity premium puzzle" refers to the finding that the observed historical equity premium is higher than can be easily explained in a standard utility-based economic model. If people are only moderately risk-averse, it is surprising in the context of the model that they require a 7 percent premium for stock investments. Such a large premium is especially surprising considering that market downturns have been relatively infrequent and, with the dramatic exception of the Great Depression, not too severe. Economists have varied reactions to the puzzle. Some conclude that the models are inadequate and that the premium is fair, others conclude that the high returns were a historical accident that was not entirely anticipated. Still others view the high premium as a near arbitrage opportunity and counsel people to invest more in the market to take advantage of the high return relative to risk. The debate pertains to SSA primarily because the lack of consensus on how to explain historical returns underscores the difficulty of predicting a forward-looking equity premium.

Investment of Trust Fund or individual account assets in the stock market has potential implications for general equilibrium and distributional considerations. Some researchers suggest that if SSA transfers large sums of money from government securities into stocks, the forces of supply and demand will increase the cost of borrowing to the government and lower the return on stocks. Reliable estimates of the size of these effects, and further exploration of the factors that might mitigate them, await further research. A number of researchers have pointed out that investing Trust Fund assets in the market on behalf of low-income beneficiaries may improve welfare. If that group is unable to save on their own but would like to invest in the market if they had the money, then SSA can make them better off by investing on their behalf. Trust Fund investments also help that group avoid the potentially high transactions costs involved with small individual investments. Of course, other beneficiaries may oppose exposing their retirement income to stock market risk. Until there is some consensus on how to quantify those benefits, it seems prudent to abstract from the effects as recommended above.

B. DEMOGRAPHIC ISSUES

The Panel examined the projections of marital status and mortality at some length. It also looked at the process of projecting levels of immigration.

1. Marital Status

Recommendation: See Executive Summary.

Explanation: The Trustees' current methodology for estimating the marital status of future beneficiaries has lacked key data for a decade. Specifically, the method requires annual rates of new marriage and divorce by age of husband crossed with age of wife. Data for age-specific marriages and divorces were reported for a substantial subset of states by the National Center for Health Statistics through 1988, when budget shortfalls caused the center to eliminate them. No other statistical agency has filled the breach, since Social Security is almost unique among government programs in needing information about an individual's marital rather than household status. Consequently the actuaries have had to project the relative levels of marriage rates by age based in large part on survey data from the 1980s. Marital patterns have been changing throughout the 1990s, as suggested by data for total marriages that continue to be available.

Given the continued absence of up-to-date age-specific data, as well as the questionable quality of other data currently available, the Panel recommends that SSA and the Trustees investigate alternative methods and data sources. In doing so, it will be important to pay particular attention to data that will produce projections that are both representative across states and regions as well as across demographic groups. SSA could, for instance, consider modeling data from marital histories gathered by the Census Bureau via regularly conducted national surveys together with Social Security records, and check the results by gathering data from those states that supply current data (adjusting for any bias resulting from incomplete coverage).

The Social Security Administration's Office of Research, Evaluation, and Statistics has developed a shorter-term model (MINT) that includes demographic estimates for the baby boom cohort. This model includes more recent information about age-specific marriage and divorce patterns based on data from the Survey of Income and Program Participation, combined with Social Security records. Its results confirm independent projections, such as Goldstein's (*Demography*, August 1999). In particular, the MINT model suggests that the Trustees may be underestimating the never-married and divorced proportion of the future elderly. Close attention needs to be paid to projections of these groups.

This raises two concerns, one regarding eventual costs to the system and one regarding the system's goal of providing income security for the elderly. First, married people, widows and widowers, and divorced people whose marriage lasted

for at least 10 years can claim benefits as spouses or survivors if such a benefit exceeds the benefit they would receive based on their own earnings. Generally lower lifetime earnings of women, relative to men, cause the majority of women to take this option. While the proportion of married women who will benefit by claiming benefits on their own earnings is increasing, the MINT model estimates that the majority of baby boom women will still do better to claim a spouse or survivor benefit. At the same time, an increase in the proportion of female benefit claimants who have never married, or who divorced before 10 years of marriage, will reduce costs to the Trust Fund, since fewer women than projected will have the option of claiming a higher spousal or survivor benefit.

Second, the MINT projections of never-married baby boom women suggest that the increase is particularly pronounced among the African American population. Elderly African American women already have relatively high poverty rates, as do never-married and divorced black women in general. It is important that those who are assessing Social Security reform proposals be able to assess their likely impact on those who are particularly vulnerable.

Thus, the Panel urges the Trustees to refine both short-term and long-term capabilities to estimate the effects on the Trust Fund of various reform proposals given the treatment of spouses and survivors, divorced persons, and never-married persons, and the likely number of people in each group. It also urges other parts of the government to be responsive to the important need of Social Security for improved survey data in this area.

2. Immigration

Recommendation: See Executive Summary.

Explanation: The Panel notes that of the three components of net immigration, only one is well documented. The accuracy of the number of legal immigrants is likely to be quite high, but neither the number of emigrants nor the number of illegal immigrants is known with precision.

Partly because of the limited data on current emigration and illegal immigration, the Panel feels that the range of uncertainty expressed in the Trustees' low and high assumptions is too narrow. Moreover, there have been periods in the past when legal immigration fell well below that allowed by statute. On the other hand, there is some doubt as to whether recent attempts to curb illegal immigration are effective. Some writers have suggested that the combination of projected future labor shortages in the United States and rapid population growth in developing countries will lead to higher immigration, legal or otherwise.

The Trustees' low assumption of 750,000 is well above the lower bound of 300,000 net immigrants in a recent forecast by the Bureau of the Census. The Trustees' high assumption of 1,150,000 is below that of the Census Bureau's high forecast of 1,370,000. Therefore the Panel recommends that the Trustees allow for

a significantly broader range of possibilities in the alternative population projections, perhaps on the order of plus or minus 50 percent of the central assumption.

3. Mortality

Recommendation: See Executive Summary.

Explanation: A workshop on mortality projection convened by the Institute of Medicine and the National Research Council, while recognizing the great uncertainty in long-term mortality forecasts, generally supported forecasts of mortality decline at average historical rates. Those average historical rates imply more rapid decline than that projected by SSA in its intermediate projections (Stoto and Durch 1993: 558, 571-72. The Lee-Carter 1992 forecasts were viewed favorably, at least for the short and medium term; they predict mortality decline that are, overall, more consistent with the SSA rapid decline scenario.). These historical rates of decline are in line with the summary recommendation of this Panel. A recent review (Wilmoth 1998) also takes this position. Some well-informed articles also argue that future mortality declines will be more rapid, or less rapid, than the historical averages (Olshansky et al. 1990; Manton et al. 1991). The Panel believes, however, that these historical rates provide a prudent *intermediate* forecast, although they currently correspond more closely—at least in life expectancy at birth after a few decades—to the SSA *high*-cost assumption for mortality. Some evidence in support of that view is reviewed below.

a. The Forecasts in International Context

According to the SSA intermediate assumption, life expectancy at birth for U.S. females will not reach the level currently enjoyed by French women in 1995 until 2033; by Swedish women, until 2026; and by Japanese women, until 2049. For U.S. males, the corresponding dates are 2002, 2026, and 2029. It is difficult to understand why the United States should lag so far behind other countries. Indeed, the SSA assumptions for females imply that it will take more than three times as long to achieve gains in life expectancy as it took France and Japan, and twice as long as it took Sweden, with differences for males somewhat less dramatic.

Because such a high proportion of people in the United States now survive into old age, mortality trends at older ages have a very important influence on life expectancy at birth. A careful and highly regarded study of trends in mortality for those above age 80 in nine countries with good data shows that mortality decline at these ages accelerated steadily from the 1950s to the 1980s (Kannisto et al. 1994:802). The average annual rate of decline for women ages 80 to 89 rose from just under 1 percent in the 1950s to over 2 percent in the 1980s, with the corresponding figures for men going from just over 0.6 percent to just over 1.4 percent. Rates of decline at ages 90 to 99 were

similar to those just described for males, but a bit less dramatic. During the 1980s, the average annual rate of decline in 19 countries with good data was 1.8 percent for women in their 80s, and 1.2 percent for women in their 90s. For males, the corresponding figures were 1.2 percent and 1.0 percent. The rates of decline projected for the United States by SSA are one-half to one-third of those rates, at 0.6 percent for females in both age groups, and about 0.5 percent for males in both age groups (SSA Actuarial Study No. 112). A study by Horiuchi and Wilmoth (1995) assesses international data showing similar though less dramatic contrasts with the SSA assumptions for mortality for ages 60 to 64 and 75 to 79 in five countries with low mortality.

It is possible, of course, that the United States is simply different from these other countries. However, it easier to see why this might be so for *levels* of mortality than it is *for rates of decline*. At the least, the experience of other nations demonstrates conclusively that U.S. mortality can fall a long way without encountering biomedical limits. Indeed, mortality in Japan has already achieved more than 75 percent of the gains foreseen for the United States in 2070, according to the SSA intermediate projection.

b. Long-Term Trends in U.S. Mortality

Between 1900 and 1996, the age-adjusted death rate for U.S. males declined at the rate of 0.94 percent per year, and for females at 1.30 percent. SSA assumes that over the next 75 years, the rates of decline will average 0.58 percent for males, and 0.51 percent for females, substantially slower than the historical averages (based on tables presented to the Technical Advisory Panel in March). It is arguable that trends back to the beginning of the century are less relevant than the experience in its second half, say since 1954 (date chosen to coincide with the period divisions in the tables provided). From 1954 to 1996, the average rate of decline for males was 0.80 percent, including a period from 1954 to 1968 when mortality of males was actually increasing. That rate is still substantially higher than the assumed future rate of decline of 0.58 percent up to 2073. For females from 1954 to 1996, the rate of decline was 1.13 percent, more than twice as great as the assumed future rate of 0.51 percent. The rates of decline assumed by SSA imply that the age-adjusted death rate in 2073 would be 18 percent greater for males than the level reached by extrapolating the average rate since 1954, and for females the SSA assumption would be 60 percent higher than the extrapolated historical level. If we focus on the more relevant death rates above age 65, the same kind of calculation shows that SSA assumptions would be 13 percent higher for males in 2073 and 56 percent higher for females.

The main divergence from historical trends occurs for females. Some justification can be found in the slow rate of decline (0.47 percent per year overall, and only 0.33 percent above age 65) observed during the most recent period, 1982-1996. It is important that the slowdown be understood, and this is

a prime research need. One possibility is that the slowdown reflects the delayed effects of an increase in smoking by women. In our view, however, it is prudent to assume that the slowdown is temporary, based on the continuing rapid and accelerating rates of decline observed for females in other countries. The rate of decline since 1982 is by far the slowest reported for any of the periods in the table presented to the Panel.

The high-cost assumption in the 1999 Trustees Report is that the death rates adjusted for age and sex decline by 1 percent per year over the next 75 years, about 0.5 percent faster than the intermediate assumption. This is a bit slower than the average female experience since 1954, and a bit faster than the average male experience. We believe that it would be prudent to adopt the type of life expectancy expected by 2074 in the current high-cost assumption in deriving a new intermediate assumption.

Although SSA has been criticized for assuming that mortality declines at younger ages will be far slower than the historical average experience, we believe that their assumption is well-founded and should be maintained. Examination of the age pattern of mortality decline in the United States over the past 50 years, and in other countries with low mortality (such as Japan, Sweden, and France), indicates that there has been a shift in this pattern. The age pattern of mortality decline has moved away from more rapid declines at younger ages, and toward more equal rates of decline or even more rapid ones at older ages.

c. Biomedical Considerations and Causes of Death

The discussion has focused on historical and international trends in mortality, with no reference to causes of death, biology, or medicine. Some analysts argue that biological limits to mortality will make it increasingly difficult to achieve gains in the future, as deaths from infectious disease have largely been overcome and the remaining causes of death have more to do with degenerative processes. Other analysts, however, interpret the biological evidence to suggest that dramatic gains may be imminent. Although the demographic approach may seem to ignore a large body of knowledge, it is not clear that forecasts could be improved or would be altered by introducing insights from other fields. Over the past century, there has been a major change in the structure of deaths by cause in the United States, yet the rate of mortality decline has been remarkably steady, for example as summarized by the Lee-Carter (1992) k-index. Experts in some causes of death need not be particularly successful at forecasting its overall future progress over the next 75 years.

Health research is directed sometimes at one cause of death, sometimes at others. As we look to the future through a biomedical lens, it is easy to focus on the potential for dramatic progress (genome project, specific medical procedures, the mortality of population subgroups with healthy life styles).

However, it is also easy to focus on the potential for stagnation or deterioration (AIDS, drug resistant strains of old diseases, trends in Eastern Europe and sub-Saharan Africa). We suggest that given our current state of knowledge, the best guides we have to the future are past trends and international experience. Trends have been surprisingly regular over the past century, and international experience suggests at least a continuation and perhaps an acceleration of long-term trends in the United States, at least at older ages. There is no suggestion in the international mortality trends that an upper biomedical limit to life expectancy is being reached. On the contrary, mortality decline at older ages is accelerating.

d. References

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C. METHODOLOGY AND MODELS

1. Micro Models

Recommendation: See Executive Summary.

Explanation: The Technical Panel was impressed with the presentations made by the Office of Policy and its MINT (Modeling Income in the Near Term) and cohort projection models. These models are showing that, under some reasonable projections, the demographic and distributional characteristics of the baby boom generation in retirement are likely to be quite different than those of the current generation. In particular, according to these models, women's odds of being divorced and never married will rise, as will the probability that future cohorts of women will have their own private pensions and entitlements to old-age and survivors retirement benefits based on work, not marriage. Without having time to fully assess these models, the Panel nonetheless felt that this type of development was absolutely crucial. And it is extremely timely since these are the types of outcomes that need to be examined under alternative reform scenarios. Steve McKay and others within OCACT have been working on developing a microsimulation model using SSA's Continuous Work History Sample, Master Beneficiary Record, and NUMIDENT files. More recently, they have done work with the Office of Research, Evaluation, and Statistics based on the CORSIM model. Over time, the capabilities of SSA and other governmental agencies in distributional forecasting should grow to the same level of expertise and accuracy as the macroeconomic forecasts by OCACT.

As noted in the recommendations, it is impossible to know the potential impacts of a variety of reforms—both actuarial cost and distributional impact—without such models. We note, in particular, the inability of reform commissions and members of Congress to put various reforms of spousal and survivors benefits in their proposals because they could receive no assessment from SSA of their costs and distributional impacts. In this particular case, the goal of any reform is generally to reach some distributional objective—e.g., lower poverty rates for the very old—and that goal must be assessed against cost and impact on who would pay to achieve the aim. But the issue goes beyond the inability to assess options offered by others in a timely manner. Neither SSA nor other government agencies can provide information on some types of reform options to policy makers—either formally in the form of studies or informally in the form of policy advice. Although SSA has developed some capabilities in these areas in recent years, the Panel hopes that SSA as well as other government agencies will continue to increase their investment in these capabilities. Within SSA, the Office of the Chief Actuary and the Office of Policy, among others, need to work closely together to develop this capability, as the issue goes beyond any particular office.

2. Public Access

Recommendation: See Executive Summary.

Explanation: The projection model of the OASDI system is complex and understood by few. Serious policy discussions are hampered by the fact that so few people understand the methodology. Because other agencies or groups do not understand SSA methods, those groups try to develop alternative models without the benefit of SSA's 65 years of experience. Both SSA and these other groups spend substantial amounts of time comparing and contrasting these competing models. In addition, even well-informed consumers do not understand SSA methods. Thus, SSA upper management spends substantial amounts of time defending their projections.

The model's complexity leads to perceived and real problems as well. In many places, the development of the system appears to be uneven. And the fact that the current system is developed and managed by different people implies that the parts sometimes do not fit together smoothly. This, of course, is only a natural development from improvements made over time and the level of demand on the Office of the Chief Actuary. Nonetheless, one consequence is that the methodology is frequently difficult to explain and cumbersome to use. A way to better tap both outside and inside resources, we believe, would be to provide an overview of the entire methodology. An overview would help both the SSA actuaries and other professionals in understanding the working of the various components.

We recommend that adequate resources be provided to better document the current system. Although this point has been made repeatedly (see the 1958 quotation below), documentation still has not happened. We recognize that not everything can easily be documented and cross-referenced, but the perfect need not be the enemy of the good. To help initiate such an effort, a prototype summary document titled, "Summary of Social Security Administration Projections of the OASDI System," was prepared under the direction of Panel member Edward W. (Jed) Frees and will be forthcoming from the Advisory Board.

The more that SSA can document its current work, the more it would open itself to outside academia and thus be able to take advantage of many more intellectual resources to improve the projections. In particular, the availability of a summary would make the work of future advisory panels more useful. A supplemental approach suggested by the 1995 Technical Panel, would be to create an ongoing advisory Technical Panel. We have suggested either that an ongoing Panel be established or that SSA obtain sets of advisors on topics of particular importance. The idea may be particularly fruitful given the ongoing nature of the Social Security Advisory Board.

A quotation from the Subcommittee for Actuarial Cost Estimates of the 1958 Advisory Council is still apt today. The quotation appears in Actuarial Study 49, "Methodology Involved in Developing Long-Range Cost Estimates for the OASDI System," by R.J. Myers. "We also recommend that the Actuary adopt the practice of assembling in a single report a detailed description of the technique used in making cost estimates, the actuarial formulas and factors used and their bases or derivation and the actual calculations. Such report would be a public document available to any one for reference or study purposes. It would simplify the work of future Advisory Councils."

3. The Uncertainty of Long-Term Forecasts

a. Introduction

Forecasts of the financial status of the system 75 years in the future will obviously be quite uncertain and must rest on many assumptions that will not in fact be satisfied in the future. It is important that decision makers have a guide to the uncertainty of the forecasts on which they base their plans. Forecasters typically assess and describe this uncertainty by preparing a range of forecasts based on different sets of assumptions, or scenarios. A scenario consists of a set of assumptions about the future trajectories of the key variables, such as fertility, mortality, the growth rate of wages, interest rates, inflation, disability and so on. These assumed trajectories are then bundled together into the scenarios. The range of the forecasts of financial status across these high-cost and low-cost scenarios is intended to give a sense of the uncertainty associated with the intermediate forecast.

Unfortunately, there are serious problems with this scenario method. It assumes that trajectories are always high or always low, thereby ruling out the possibility of events such as the baby boom and bust. It combines trajectories in rigid ways, such as high fertility always going with high mortality in the SSA projections, thereby ruling out the possibility that in some year fertility might be unusually high at the same time that mortality was unusually low. These two difficulties are instances of the extremely strong assumptions that are made about the correlation of forecast errors over time and across variables. They lead to a third problem—the different aspects of the high and low scenarios will have different amounts of uncertainty associated with them. For example, the likelihood that fertility will fall within the high-low range in some given year may be much less than the likelihood that the summary actuarial balance will fall within the high-low range. A fourth problem is that no probabilities are associated with the forecast ranges, so that a user has only a vague sense that the forecaster believes it likely that the outcomes will fall within the range. The lack of probabilities makes it almost impossible to compare the sensitivity of different policy regimes to changes in demographic

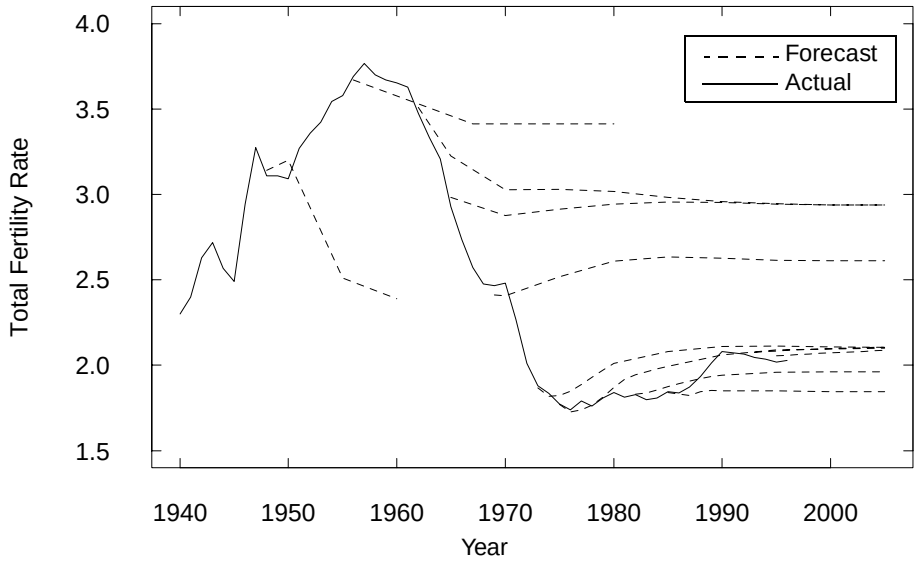
and economic conditions. Policy makers therefore target some measure of sustainability under some intermediate conditions rather than try to ensure that what they promise will be unsustainable with only a small probability.

The problem of inconsistency is readily illustrated from OCACT's population forecasts. In the projection for 2070, the high-low range for the population age 0 to 19 is plus or minus 34 percent. The range for the working ages (20-64) is plus or minus 20 percent, and the range for the elderly (65+) is plus or minus 9 percent. The total dependency ratio is the ratio of youth and elderly to the working-age population, and we would expect it to be highly uncertain, as it is a ratio of highly uncertain quantities, as we have just seen. However, it has a range of only plus or minus 5 percent. This cannot be right, but the strong assumptions underlying the scenario method force a high number of children always to coincide with a low number of elderly, and conversely, so that much of the uncertainty in this variable is assumed away. In the case of Social Security finance, the total dependency ratio is irrelevant; it is only the old-age dependency ratio that matters. However, the kind of inconsistency just illustrated permeates the entire structure of uncertainty, although most instances are less dramatic.

b. Uncertainty of Input Variables and Uncertainty in Outcomes

One way to form an impression of the uncertainty of population forecasts is to look at the record. Figure IV.1 plots the central fertility forecast by the Bureau of the Census, published in various years back to the mid-1940s. We see that it was not unusual for the forecasts to be wrong by as much as 1.0 or 1.5 births within 10 or 15 years of publication. Attempts to forecast fertility during the baby boom and baby bust years fared particularly badly. Only in the past 20 years, when fertility has been more stable, has the forecast record improved. The challenge to the forecaster is to incorporate a realistic amount of uncertainty into the forecast. The Office of the Chief Actuary now forecasts a long-run level of fertility (the Total Fertility Ratio) of 1.9 children per woman, with a high-low range of 2.2 to 1.6 children (see Chapter III. Recommendations for a discussion of this assumption). The high-low range of 0.6 children is reasonable given the current methodology, but seems narrow when set against the experience of the past half century, during which period fertility had a range about three times this wide. Would it be possible, then to incorporate a more realistic measure of uncertainty in the Actuarial forecast?

Figure IV.1.—Total Fertility Rate: Actual and Middle Series Projections, 1940-2005

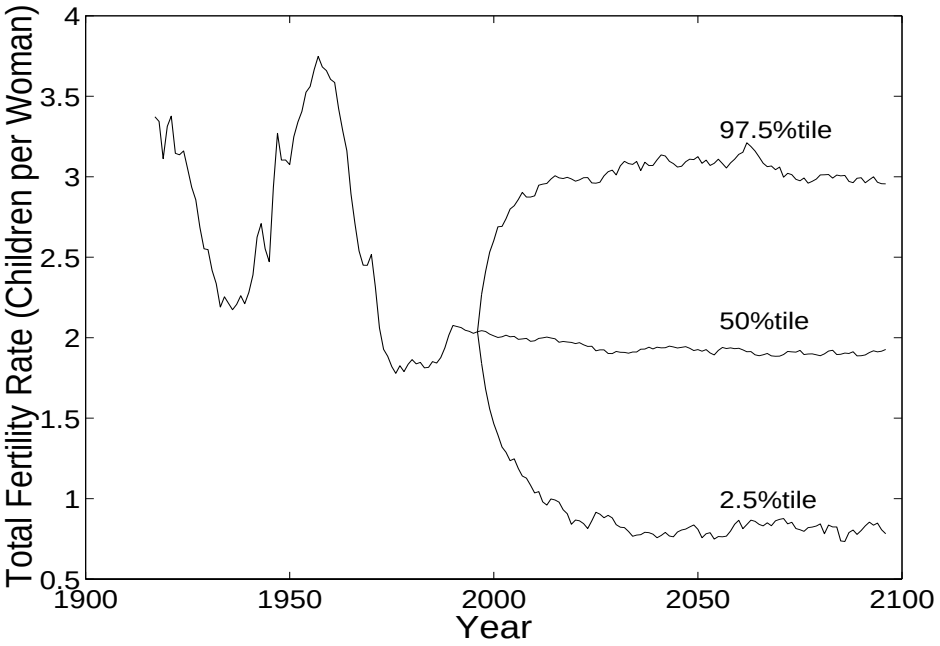


Note: Middle Series is calculated as the simple average of moderate high and moderate low series, when no middle series is forecast.

Source: U.S. Census Bureau, Current Population Reports, Series P-25 and Lee 1999.

A starting point is to develop a probabilistic forecast of some input to the actuarial forecast, let us say fertility. It could be based on a time series model of fertility, fitted to historical data. Figure IV.2 plots such a forecast, showing the mean forecast, and 95 percent probability intervals. These intervals should contain the future level of fertility in any particular year 95 percent of the time. Note that these bounds are very wide, at 0.8 to 3.1 children per woman, and although for this reason they seem unlikely to be too narrow, they also seem to contain little useful information.

Figure IV.2.—Total Fertility Rate, Historical (1917-1996) and Forecasted (1997-2096), with 95% Probability Intervals for Annual Values



Source: Lee and Tuljapurkar, forthcoming.

One's first thought is simply to take the bounds (or the bounds for some other probability) to be the high and low bounds on the trajectory range for the high and low scenarios of OCACT's forecasts of the system's finances. That would be a mistake, however. What matters for the long-term finances of the system is not the level of fertility in any particular year but, roughly speaking, the long-term average level of fertility, which is a different matter. The bounds on the long-term average can be calculated from the fitted time-series model of fertility, and will depend very sensitively on the degree of autocorrelation of errors in the fertility forecast. If there is no autocorrelation, then if fertility is higher than the forecast in one year, that tells us nothing about what it will be in the next year. In this case, there will be tendency for errors to cancel out over the long term, and the 95 percent interval for the long-term average of fertility over a 75-year horizon will be only one-ninth as wide as the interval for a single year. More realistically, however, errors are likely to be persistent. If the forecast is too high in one year, it is likely to be too high in the next year as well, because the social or economic conditions that caused the error are likely to change fairly slowly over time. At the extreme, errors will be perfectly correlated, in which case the 95 percent probability interval for the forecast in a single year would be no wider than the interval for the forecast of the long-run average level of fertility. Clearly it is critically important to know the degree of autocorrelation of forecast errors for the input, and to take it into account.

In the case of fertility, the autocorrelation of errors in a fitted model is quite high at about 0.96, so there is some cancellation of errors over time, but not a great deal. When we calculate the probability interval for the average level of fertility over a 75-year horizon, the interval is about 60 percent as wide as for a single year. For some other inputs, the autocorrelation of errors is less, and the reduction in interval width is therefore more dramatic. For example, for the real interest rate, the interval for the 75-year average is only about one-third as wide as for an annual value, and the reduction for the rate of real wage growth is similar.

Could OCACT calculate the probability bounds for these long-run average values of the inputs, and use them to define the high-low ranges? On reflection, there is a further problem with this step. If we use a 95 percent interval for fertility, and for mortality, and for all the six additional inputs for which OCACT assumes a range, then the probability of all of these inputs simultaneously exceeding or falling short of these bounds would be far, far less than 5 percent. If fertility and mortality vary independently, for example, the chance that both would be outside their 95 percent ranges at the same time would be only 0.05 squared, or 0.0025. In other words, the right ranges for all the inputs considered together would have to be much narrower, with less probability coverage, in order for their joint range to have 95 percent probability coverage. With eight uncertain inputs, each should have a probability range of only about 33 percent rather than 95 percent, if they are independent.

Even after all these adjustments, it would still not be possible to derive appropriate bounds for OCACT to use. First, the variables enter into the calculations of actuarial balance in a highly nonlinear way, with lags and repeatedly cumulated functions of inputs. Second, there would remain the problem that the extreme bounds for the inputs are bundled together in an arbitrary way to form the scenarios. There is no reason why positive errors in forecasting fertility should invariably be associated with positive errors in forecasting mortality, as assumed by OCACT in using the scenario-based method. Third, there would remain the problem that the consequences of inputs fluctuating over time are not assessed in the scenario method, even for fluctuations within the high-low range.

We must conclude that there is no good way to combine statistical estimates of the uncertainties of forecasts of the input variables with the scenario method to form improved estimates of the forecasts of the system's finances. Instead, it is necessary to take a different approach if we want to improve on the evaluation of the uncertainty of the forecasts.

c. Alternative Approaches

One possible approach is what might be called the "random scenario" method. In the random scenario method, the assumed trajectories of each uncertain variable in each scenario are multiplied by a random variable. The distribution of that random variable is chosen so that there is a given probability, for example two-thirds, that the trajectory lies within the specified high-low range for that input variable (see Lee 1999). Through Monte Carlo simulation, hundreds or thousands of different trajectories are estimated. The high-low ranges themselves could be selected in any way, but would typically be chosen subjectively by experts. This approach has been used in population forecasting, for example by Lutz and Scherbov (1998). It may solve the two problems of arbitrary bundling of trajectories into scenarios and lack of cancellation of forecast errors across different input variables. But it retains the seriously problematic assumption that errors in forecasting any input are perfectly correlated over time, ruling out fluctuations in inputs and preventing any cancellation of errors over time. Furthermore, whether experts can successfully attach probability interpretations to their assumed high-low is not clear.

Another approach to assessing uncertainty is to analyze the past performance of forecasts that have been done using a similar method. This method has been applied to population forecasts (Keyfitz 1981; Stoto 1983; all recent projection publications by the U.S. Bureau of the Census; Keilman 1999). It is not clear whether it could be usefully applied to OCACT's forecasts of the system's finances, but it would be worth doing some further research on this possibility. Analyses of this sort include Myers (1981), Bayo (1990), and Lee and Tuljapurkar (in press).

A third approach is to develop statistical time-series models of the key inputs using historical data, and then to use stochastic simulation to produce stochastic forecasts for the finances of the system. This approach has been taken by Lee and Tuljapurkar (1998, and references therein, and in press). This method will be described briefly below as an illustration of the possibilities.

d. Illustrating Approaches to Stochastic Projection

SSA should begin serious efforts to develop a stochastic forecasting system to model uncertainty. Although there are many ways of modeling uncertainty, we have the most experience with probabilistic methods. This section reviews several different currently available stochastic projection methods and outlines the development of a new stochastic projection model that would meet the needs of SSA and its customers.

Several important efforts have already been made at developing a stochastic forecasting system. To illustrate, the 1994-96 Technical Panel described two stochastic forecasting methods. The Employee Benefits Research Institute (EBRI) subsequently considerably enhanced one of these models. Another example is the work by Frees et al. (1997) that extends the SSA work of Foster (1994). In Frees et al., the authors provide a fully endogenous model of wage, unemployment, inflation and investment returns using multivariate time series methods. Another important example is the Mountain View Research—University of California at Berkeley (MVR-UCB) approach, described as follows.

The MVR-UCB Stochastic Projection Approach. In the basic model, four input variables are treated as stochastic: fertility, mortality, real wage growth, and real interest rates. In some runs involving investment of the Trust Funds in equities, the rate of return on the S&P 500 is also treated as stochastic. All other input variables are set to the intermediate values used by OCACT. Fertility and mortality are both age-distributed variables, not single rates. Special models are used to express the variation over time in these distributions of rates using a single parameter (see Lee and Tuljapurkar 1994). In the case of fertility, that single parameter is the total fertility rate (TFR). For mortality, that parameter is an index, k_t, which drives the level of the logs of the age-specific rates. These parameters are then modeled as time-series processes (for example, k_t is modeled as a random walk with drift) that form the basis for the forecasts.

Demographic accounting identities link fertility, mortality and net immigration to the evolution of the size and age distribution of the population. Given the stochastic models for fertility and mortality, and the assumptions made about net immigration, it is possible to calculate one future stochastic "sample path" for the population through Monte Carlo simulation. Random variables are drawn from the specified distributions and are used to fix fertility and mortality at each step, from the present to whatever forecast horizon is selected, say 75 years. The result is a single projection of the population, reflecting the random draws. This process can be repeated to get a second random projection, and then repeated over and over again until we have, say, 1,000 different random population trajectories. For any desired quantity, say the old-age dependency ratio in 2055, we can plot the frequency distribution of ratios that is an estimate of the probability distribution.

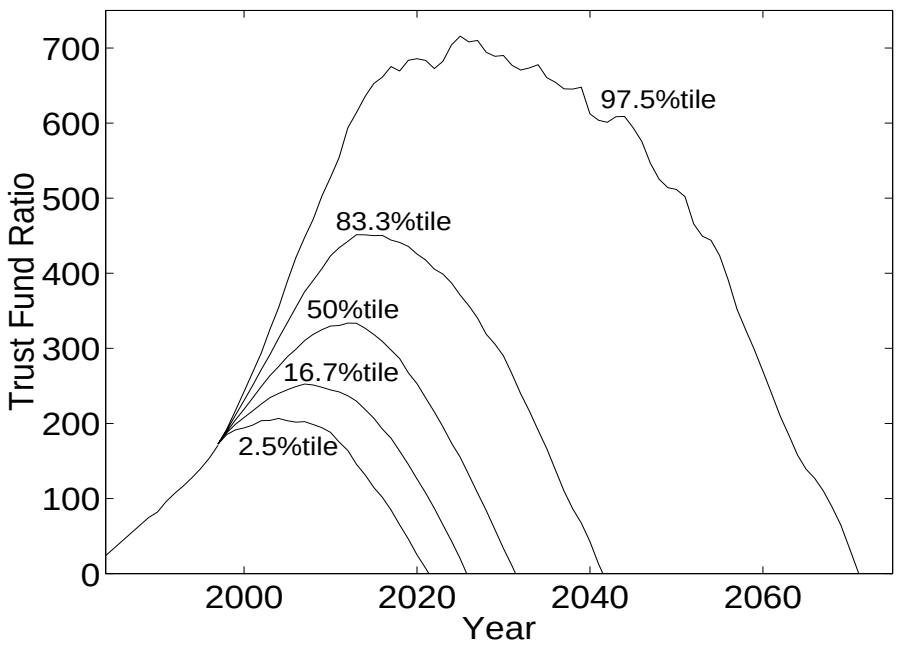
The method also draws on estimated cross-sectional age profiles of payroll tax payments and of benefits received. They are then projected over time by the stochastic productivity growth rate—multiplicatively for taxes, and in a more complicated manner for benefits. When the age-specific tax payments and benefits are multiplied times the stochastic population age distribution, they generate stochastic forecasts of payroll tax revenues and expenditures on benefits. Once again accounting identities link these quantities

to the evolution of the Trust Fund balance and to other quantities of interest for Social Security finances. The stochastic interest rate determines the rate of return earned by the Trust Funds or the cost of borrowing if the fund becomes negative. It is a feature of the model that there is no economic feedback. For example, there is no effect of the level of the Trust Funds on the rate of interest or on the productivity of labor.

As an example of the output of this approach, Figure IV.3 plots the median Trust Fund balance together with probability bounds for intervals of 67 percent and 95 percent probability.

Figure IV.3.—Trust Fund Ratios for OASDI

(Assets as percent of annual expenditures)



Source: MVR-UCB stochastic projections.

e. Stochastic Projection Principles

The MVR-UCB model is based on fitted cross-sectional age profiles for taxes and benefits, which are then driven by stochastic productivity growth. In this approach, many of the details of interest to SSA are implicit in the cross-sectional age profile, such as marital status and changing labor force participation rates. For SSA purposes, it is important to make those and other elements explicit and perhaps stochastic in their own right. Therefore, a strong argument exists for developing a stochastic projection method that is linked more directly to the structure and content of the current deterministic projection model used by the actuaries. The following discussion suggests how this might be done.

We recommend the development of a model that is a stochastic extension of the model currently used by OCACT to forecast financial solvency. Initially, we propose a cohort model, not a model that follows individuals over time. Although models following individuals over time are useful for assessing the adequacy of Social Security benefits, they require a further stage of development. Of course, many Social Security proposals introduce elements of individual accounts. To analyze the adequacy of Social Security benefits under such proposals, effort should be devoted to modeling individuals over time as well.

With a stochastic projection system, one computes an entire distribution of projected future outcomes. We propose that an immediate goal is to construct a system in which the mean projection assumptions correspond to those of the current deterministic system under the intermediate assumptions. To accomplish this, we further recommend that the model development mimic the organizational structure of the long-range deterministic model. The long-range deterministic model is simpler than the deterministic short-range version.

The techniques recommended to model uncertainty involve time-series analysis of data and simulation of future paths of the system. Following the structure of the current long-range model, the projection system could be decomposed into several components:

- Demographic and population projections
- U.S. economy employment
- OASDI economy employment
- U.S. economy projections
- OASDI economy earnings
- Beneficiary population projections
- Benefit awards
- Model of investment returns (new)

Initially, each component of the projection would forecast the future using simple data-driven models, where the choice of the model is influenced by theory. For components that are difficult to implement, the current SSA deterministic methods can be used initially. The goal is to evolve to a full structural model of the OASDI economy, with behavioral models to anticipate future paths.

f. Stochastic Projection Flowchart

To be specific, here is one outline of a flowchart to provide stochastic projections of the OASDI system. The Technical Panel is not wedded to this proposed flowchart. The purpose is to provide a concrete suggestion. Presumably, criticisms and counterproposals will provide better flowcharts in subsequent iterations.

(1) Demographic and population projections

Stochastic projections of the mortality and fertility components have been well documented by Ron Lee and other members of the Technical Panel. SSA could use its existing deterministic filters for deaths of spouses, marriages, divorces, and immigrants, if necessary.

(2) U.S. economy employment

The projection of the labor force participation rate developed by OCACT is well suited to stochastic projections. It would require the ratio of real GDP to potential GDP and disability prevalence rates as inputs.

For unemployment rates, one could initially use the long-range constants that are currently used by OCACT. Alternatively, the unemployment rate could be part of the U.S. economy projections.

(3) OASDI economy employment

Initially, OCACT could use its existing deterministic filters. The filters would take stochastic U.S. economy employment as input and yield stochastic OASDI economy employment as output. Additional research is required to assess the degree of estimation error on the forecasting error.

(4) U.S. economy projections

Initially, OCACT could develop stochastic components in separate modules, as under the current projection system. Simple models such as univariate time series models could be used initially. Over time, more complete models could evolve, including vector autoregressive models, multivariate time series models, conditionally heteroscedastic models, and error correction models.

A number of separate modules would have to be developed. The separate modules include models to forecast full-employment labor force participation rates and unemployment rates as well as labor productivity. Those forecasts would be used to forecast GDP, potential GDP, and the ratio of real to potential GDP. In addition, models are needed to forecast the

components of earnings per worker. The components include earnings per dollar of compensation, compensation per dollar of production, labor productivity, and hours worked. Forecasts of the components are then used to forecast earnings per worker. Finally, OCACT would need to develop models to forecast unemployment, inflation, and the GDP price deflator.

The long-run goal would be to integrate the separate models into one cohesive model of the U.S. economy.

(5) OASDI economy earnings

Initially OCACT could use its existing deterministic filters. The filters would take stochastic U.S. economy earnings (from step 4) as input and yield stochastic OASDI economy earnings as output. Additional research is required to assess the degree of estimation error on the forecasting error.

(6) Beneficiary population projections

Initially OCACT could use its existing deterministic filters. These filters would take the stochastic population as input and yield a stochastic beneficiary population as output. Again, additional research is required to assess the degree of estimation error on the forecasting error. In particular, analysis should be performed to ensure that the beneficiary filters are not affected by the size and characteristics of the simulated stochastic population.

(7) Benefit awards

Initially OCACT could use its existing deterministic filters. Additional research is required to assess the degree of estimation error on the forecasting error. Attempts should be made to integrate a model such as the CORSIM model into the stochastic projection model. In addition, effort should also be made to introduce stochastic simulation of the payout patterns.

(8) Investment return models

There are many privately developed models on investment returns, such as the one developed by the Employee Benefits Research Institute (EBRI). Some of that existing methodology can be applied in the SSA model.

g. References

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4. Projections of Disability Insurance

The Panel evaluated the procedures the Office of the Chief Actuary uses to forecast the costs and Trust Fund balances of the Disability Insurance (DI) program. Particular attention was devoted to one of the most uncertain aspects of these forecasts, future inflows into the DI roles. The Panel concluded that the OCACT's overall forecasting procedure and the particular forecasts it produced for the 1999 Trustees Report are reasonable, with the exception of its projections of mortality rates of DI beneficiaries. These conclusions will be explained in more detail below. We begin with a brief description of the method OCACT uses to make its projections, followed by an analysis of particular aspects of its 1999 forecasts. We conclude with a discussion of the pros and cons of using more detailed behavioral models of the disability application, appeals, and awards process for long-term forecasting and policy evaluation.

a. Description of OCACT's Forecasting Procedure

OCACT forecasts inflows of new DI beneficiaries using projected incidence rates that equal the ratio of newly entitled DI beneficiaries during a year to the exposed population. The latter quantity equals the total number of U.S. citizens who are insured under the DI program less the number who are currently entitled to receive benefits. OCACT forecasts outflows using projected death and recovery rates, including conversions—that is, the number of DI worker beneficiaries reaching the normal retirement age. The total population of DI beneficiaries is then forecasted recursively, beginning with a current population and adding projected inflows and subtracting projected outflows. The forecasting procedure produces implied forecasts of prevalence rates, defined as the ratio of the total number of currently entitled DI beneficiaries to the size of the insured population. Note that OCACT does not forecast prevalence rates directly. Instead, prevalence rates are derived from separate projections of incidence, death, and recovery rates, and the total number of conversions.

Given forecasts of the number of DI beneficiaries for separate age-sex cells, OCACT forecasts total costs of the DI program using projections of age-sex adjusted average annual benefits per DI beneficiary under current law, and its forecasts of administrative expenses. This procedure yields total projected outflows. Projected inflows are the sum of forecasted DI tax contributions, income from taxation of benefits, and Trust Fund earnings. Given a starting balance for the DI Trust Fund, future Trust Fund balances are forecasted recursively, adding total inflows and subtracting total outflows.

The Office of the Chief Actuary continuously monitors and studies the factors affecting inflows and outflows to the DI rolls. Based on these analyses, OCACT produces projections of incidence, death, and recovery rates that could be described as "judgmentally-adjusted extrapolations" of historical trends and

the average levels in these rates. Thus, recent trends toward increasing or decreasing incidence, recovery or death rates are generally not projected to continue forever. Instead, most forecasts exhibit some degree of "mean reversion," meaning that the long-run forecasts of these rates tend to move back towards the long-run average incidence rates that have been observed in the past. The reversion implies that OCACT's forecasts will generally lie within a "confidence band" formed by extrapolating the high and low values of incidence rates experienced in the past.

b. Analysis of OCACT's 1999 Intermediate Projections

OCACT's 1999 intermediate projections predict that the ratio of DI Trust Fund balances to annual expenditures will increase from 153 percent at the beginning of 1999 to 213 percent in 2004, and will decline thereafter until the projected exhaustion date of 2020. A few simple graphs may help to provide a better sense of the assumptions underlying OCACT's projections. Figure IV.4 summarizes the historical and projected trends in the cost of the DI program, measured by the ratio of DI expenditures to GDP. The figure shows a rapid rise in the cost of the DI program since its inception in 1956 until the mid-1970s, followed by two relatively short downturns. The cost of the program declined from 1977 to 1990 during a period of tightened award standards initiated under the Carter Administration and continued under the Reagan and Bush Administrations, and a decline occurred during the good economic times of recent years. OCACT projects continued growth in the program over the next 75 years, peaking at 0.946 percent of GDP in 2027. After that point, the ratio of DI expenditures to GDP is projected to fall until 2040, a delayed consequence of low fertility during 1975-1980. [Note that the intervening rise (2040-55) results from the "echo" of the baby boomers.] The projection calls for a second drop in the ratio after 2055, a result of forecasts of average benefit levels that do not increase as rapidly as GDP during this period.

Figure IV.4.—Trend in DI Expenditures Relative to GDP

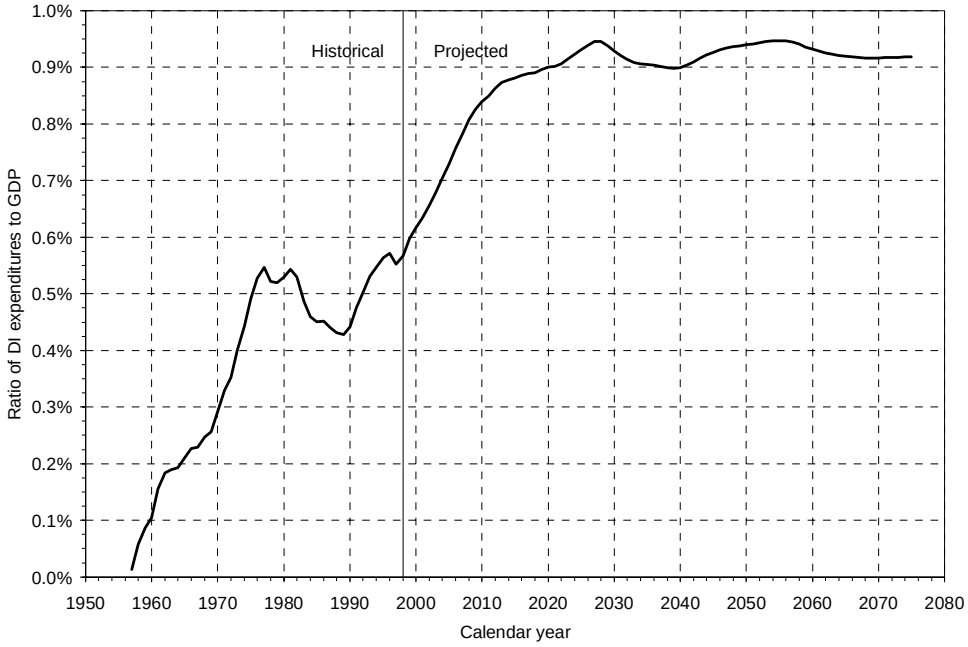
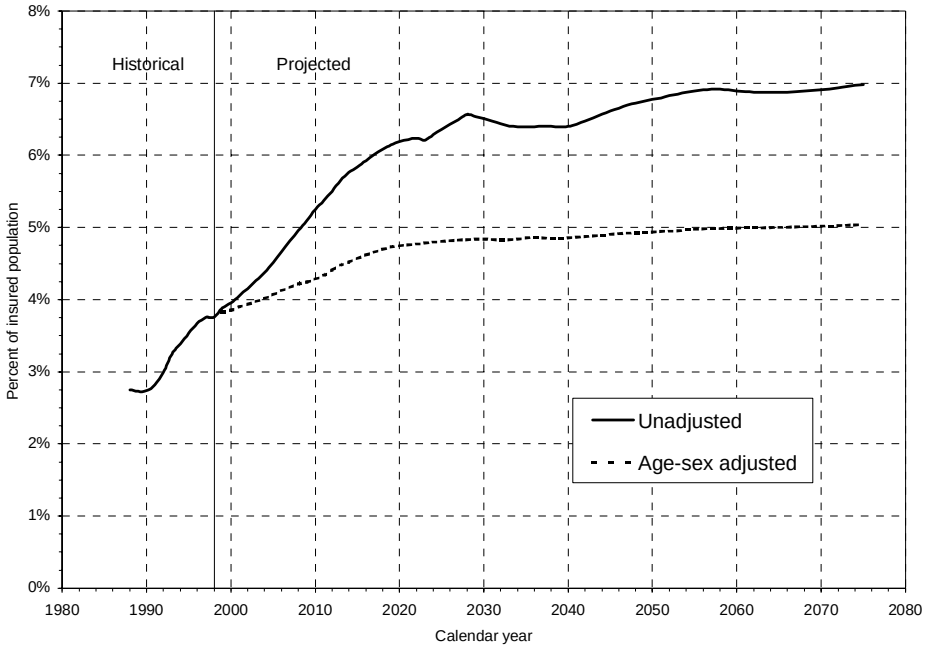


Figure IV.5 plots historical and projected DI prevalence rates over the period 1988 to 2075. These rates have increased steadily over the period 1988 to 1996, pausing briefly in 1997 and 1998. OCACT projects a particularly rapid increase in DI prevalence until 2030, by which time most of the baby boom generation will have reached normal retirement age. Thereafter prevalence continues to grow at a more moderate rate, reaching 7 percent of the insured population by 2075. The projected increases in DI prevalence rates stand in marked contrast to numerous epidemiological studies that have found consistent trends of improvement in most "objective" measures of health status, and corresponding reductions in the frequency of disabling impairments and incidence of chronic disabilities. (See, e.g., Freedman and Soldo, 1994, Lee and Skinner, 1999, Manton, Corder and Stallard, 1997, and Singer and Manton, 1999.) The improvements in health and reductions in chronic disability rates parallel the steady reduction in overall mortality rates among Americans. Is it reasonable to forecast continued growth in the fraction of the U.S. population receiving DI benefits even though epidemiological studies forecast that Americans are getting healthier?

Figure IV.5.—Historical and Projected DI Prevalence Rates

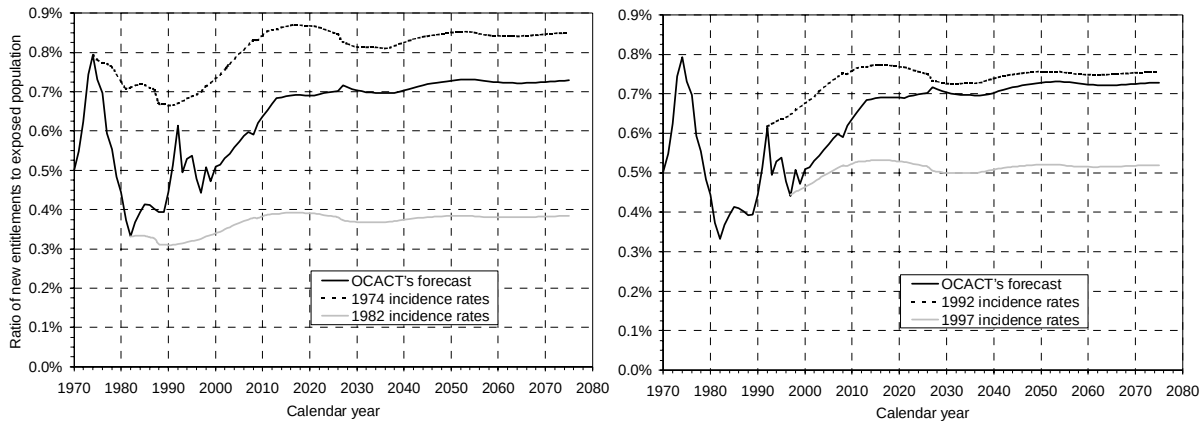


To provide some insight into this question, Figure IV.5 also presents an "adjusted" forecast of prevalence rates based on the counterfactual assumption that the age distribution of the U.S. will remain at its 1998 values. Adjusted prevalence rates increase by a much smaller amount, from about 4 percent in 1998 to 5 percent by 2075. The smaller increase indicates that only about 40 percent of the total projected increase in prevalence rates of 3.2 percentage points can be attributed to forecasts of increased DI incidence rates and reduced termination rates. The bulk of the increased prevalence rates is due to the projected aging of the U.S. population and the fact that, at least up to ages near early retirement age, older individuals are more likely to apply for and be awarded DI benefits than younger individuals.

While population aging explains the bulk of the increase in prevalence of DI receipt, we still face the question of whether OCACT's projection of steady increases in incidence rates is reasonable, given that it appears inconsistent with the trend towards improved health discussed above. Many empirical studies have shown that both self-reported and "objective" measures of health and disability status are strong predictors of which individuals decide to apply for DI benefits. (See, e.g. Benítez-Silva et al. 1999a; Bound 1991; Bound and Burkhauser 1998; Halpern, J. and J. A. Hausman 1986; Hu, J., K. Lahiri, D. R. Vaughan, and B. Wixon 1997; Kreider, 1999; and Lahiri, K., D. R. Vaughan, and B. Wixon 1995.) However, the strong explanatory power of health status at the individual level gets "averaged away" at the aggregate level. At that level, the effect of the steadily improving trends in

epidemiological measures of health and disability status appears to be overwhelmed by changes in other factors that appear to have been responsible for the large swings in incidence rates in the past. We can see this clearly in Figure IV.6, which presents historical and projected trends in the aggregate incidence rates.

Figure IV.6.—Alternative Projections of DI Incidence



Incidence rates are defined as the ratio of the number of newly entitled DI beneficiaries to the exposed population (the total number of people insured for DI benefits less those who are entitled to receive such benefits). The graphs plot incidence rates derived from historical data on new entitlements and the exposed population from 1970 to present and from OCACT's intermediate case projections from 1999 to 2075. Since the data on new entitlements and the exposed population start in 1988, the graph plots approximations to aggregate incidence rates over the period 1970 to 1987 calculated from weighted averages of annual age/sex incidence rates during this period using weights equal to the fraction of the DI insured population in each age/sex group in each year. These differ slightly from the exact aggregate incidence rates which should be calculated from weights derived from the exposed population instead of the DI insured population.

Historically, incidence rates varied from a high of 0.79 percent in 1974 to a low of 0.33 percent in 1982, followed by another rapid increase in the early 1990s, and peaking at 0.61 percent in 1992. The large fluctuations in incidence rates appear to be far too large and rapid to be explained by corresponding changes in the underlying health and disability status of Americans over this period.

A number of recent studies have shown that demographic, social, political, and economic variables are much stronger predictors of changes in aggregate DI incidence and prevalence rates than changes in underlying health

status of the U.S. population. For example, Stapleton et al. (1994) and Rupp and Stapleton (1995) analyzed aggregate application and awards data and concluded that the most important factors affecting incidence rates include: 1) benefit levels, 2) program leniency as measured by award probabilities and audit rates, 3) strength of the demand for labor (as measured by unemployment rates), 4) the availability (or lack thereof) of alternative sources of support, and 5) social attitudes, particularly those affecting any possible stigma associated with receiving DI benefits. They noted that, "Long term trends in the prevalence of disabling conditions may be influencing long-term growth in applications and awards (in some cases negatively), but with one exception (AIDS/HIV), we did not find convincing evidence of health trends explaining the recent acceleration of applicant and award growth. … However, expansion of the population with qualifying disabilities due to legislative and regulatory changes and increased awareness of disabling conditions might have substantially contributed to application and award growth."[1]

Previous empirical work suggests an explanation for the "paradox" that DI prevalence and incidence rates have generally increased over time while the prevalence of chronic disability has decreased. The key is to recognize that the determination of whether a person is "disabled" according to SSA's definition (i.e., "the inability to engage in any substantial gainful activity by reason of any medically determinable physical or mental impairment which can be expected to result in death or which has lasted or can be expected to last for a continuous period of at least 12 months") is not a clear-cut decision based entirely on objectively determinable measures of physical and mental impairments. Instead, disability determinations involve subjective decisions and relative evaluations that may change over time with changes in the political, social, and technological environment. Clearly, the nature of physical/mental conditions that are regarded as disabling is very different in today's "information economy" than they were in an industrial/agrarian economy in the 1800s. It is not surprising therefore that Actuarial Study 114 (1999) documents significant changes in the distribution of impairments that are listed as the primary reasons for being awarded DI benefits. In particular, in recent years mental conditions account for a much bigger share of disabilities, accounting for over 20 percent of all awards, compared to only 11 percent of all awards in 1982. Political changes in the definitions of "disability" are also evident in the 1996 Social Security amendments, which disallowed alcoholism and drug abuse as impairments that qualify an individual for DI or SSI benefits. State-level variations in political philosophies may also account for the otherwise large unexplained state-to-state variations in DDS award rates (see Gruber and Kubik 1997 and Social Security Advisory Board 1997).

[1] Rupp and Stapleton (1995): 49-50.

To the extent that "disability" is partly a socially determined concept, it may share many characteristics with other socially determined concepts such as "poverty". Just as poverty rates may not necessarily decrease as the nation gets richer, DI prevalence rates may not decrease as the nation gets healthier. That could happen, for example, if society defines the "poor" as the x percent of our society who have the lowest income. Similarly there might be a tendency for society to define disability as the y percent of our society who have the poorest health. Indeed, the prevalence of DI receipt could grow over time as our society gets healthier and wealthier, since a wealthier society may be more willing and able to support an increasingly larger share of its least healthy citizens on the DI roles.

The Panel believes that OCACT's forecast of a steady but moderate increase in incidence rates represents an appropriate degree of caution given the large swings in incidence rates that have occurred in the past. This conclusion is supported in part by the "confidence bands" presented in Figure IV.6. Those bands were formed by assuming that the historical high and low age-sex specific incidence rates that occurred in 1974 and 1982 would persist into the future.[1] The left-hand panel of Figure IV.6 shows that OCACT's projection lies between these bands, which represent extreme high and low rates that seem unlikely to occur again in the future. The right-hand panel of Figure IV.6 shows OCACT's projection also lies within a narrower set of confidence bands formed by assuming that the high and low incidence rates observed in the more recent past (i.e., those achieved in 1992 and 1997, respectively) will continue to hold in the future.

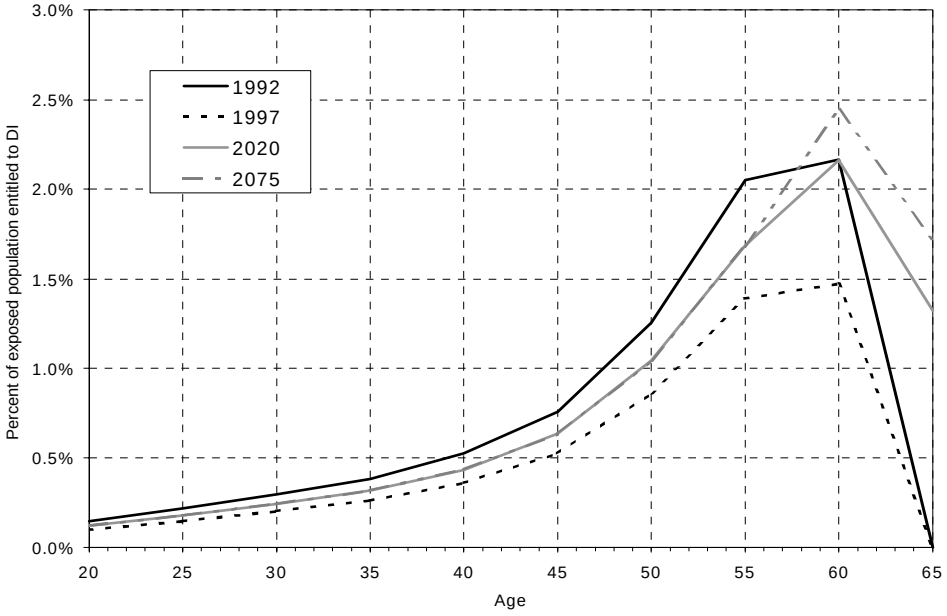
Note that the bands in the left hand panel of figure IV.6 imply that aggregate incidence rates would have decreased between 1975 and 1990 even though age/sex incidence rates are assumed to remain fixed at their 1974 or 1982 values by construction. This is another illustration of the importance of "compositional effects" due to changing demographics. The wave of baby boomers (who were still relatively young between 1975 and 1990) caused the mean age of the U.S. population to decrease, whereas after 1990 the aging of the baby boomers combined with the effects of increasing lifespans and decreased fertility rates in the 1970s and 1980s caused the mean age of the U.S. population to increase. Since DI incidence rates increase with age, the decrease in the mean age of the U.S. population between 1975 and 1990 is

[1] The bands presented in figure IV.6 are population average incidence rates formed by taking weighted averages of the age/sex incidence rates experienced in the years 1974, 1982, 1992 and 1997, where the weights are the projected fractions of the exposed population in each age/sex category and were calculated using OCACT's projection of the exposed population under the intermediate assumptions. However changes in the assumption about the future path of age/sex incidence rates will produce corresponding changes in the exposed population, and to be fully consistent the weights used to compute the bands presented in figure IV.6 should be recomputed to reflect this. However it is unlikely that such an adjustment would have a major impact on the bands, which in any case are only presented for illustrative purposes.

responsible for part of the decrease in aggregate DI incidence rates. Conversely the increase in the mean age of the U.S. population after 1990 has the opposite effect. Thus, the bands provide another way of illustrating the importance of demographic shifts as one of the factors behind changes in aggregate incidence rates for DI.

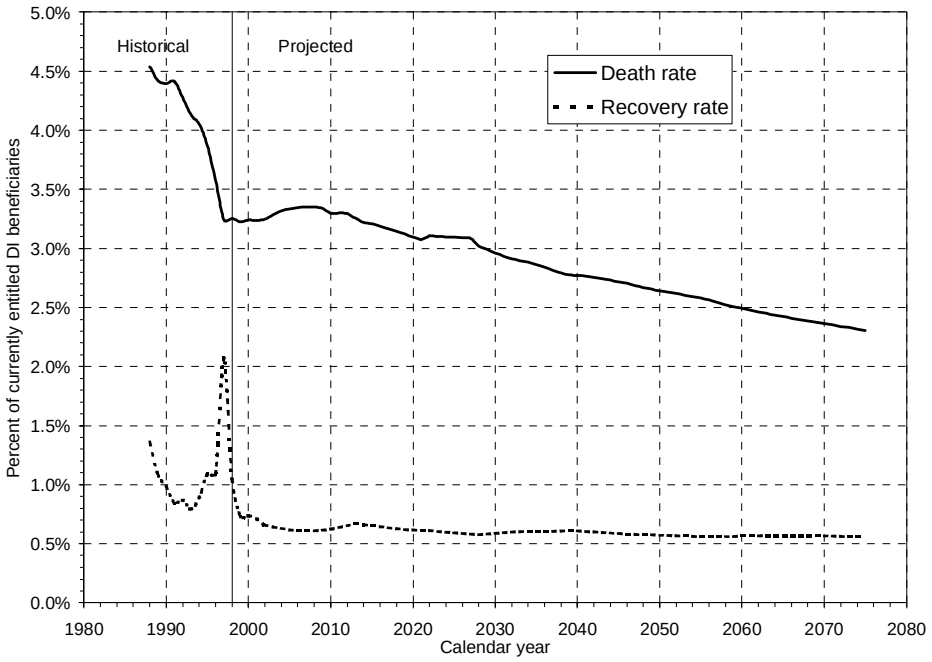
Figure IV.7 presents OCACT's projections of age-sex specific incidence rates for 2020 and 2075 respectively. Except for ages 65 and 66, their projections lie entirely within the bands formed by the high and low age-sex specific incidence rates experienced in 1992 and 1997, respectively. The higher projected incidence rates for those over 65 is due to the impact of the increase in the normal retirement age (NRA) from 65 to 67. For someone who is older than the NRA, DI and old-age (OA) retirement benefits are perfect substitutes. SSA's procedure is to automatically convert DI beneficiaries to OA beneficiaries at this age. However, there may be a small incentive to apply for DI benefits prior to the NRA, and this is reflected in OCACT's projections. Those at ages 65 and 66 do not have much incentive to apply for DI benefits if the Medicare eligibility age remains at 65, suggesting that OCACT's projections of incidence rates for these ages might be a bit too high. But the relatively small number of people in this age range implies that changes in the incidence rate assumptions for this group are unlikely to have a major impact on OCACT's forecasts. Overall, the Panel felt that OCACT's projection of a gradual increase in incidence rates to levels that are somewhat higher than the low values experienced in the current strong economic environment was appropriate.

Figure IV.7.—DI Incidence Rates by Age for 1992, 1997, 2020, and 2075



The only aspect of OCACT's DI forecasts that the Panel did not think was reasonable is their projection of a sudden reduction in the rate of mortality improvement beginning after 1999. Figure IV.8 presents OCACT's projections of mortality and recovery rates for DI beneficiaries along with historical values over the period 1988 to 1998. Notice the large increase in "recovery rates" following the 1996 amendments which disallowed disability-qualifying impairments in the areas of alcoholism and drug addiction. Although significant increases in expenditures for Continuing Disability Reviews are likely to result in a higher recovery rate in future years, the total number of recoveries is relatively small. Reasonable variations in the projected recovery rate are unlikely to have an important impact on OCACT's projections of DI roles and expenditures.

Figure IV.8.—Actual and Projected Recovery and Death Rates



However, OCACT's mortality assumptions can have a much bigger impact on its projections of DI roles and expenditures. Over the period 1988 to 1998, mortality rates declined at a rate of 2.8 percent per year, whereas after 1999 OCACT projects that this rate of improvement will decrease to only 0.5 percent. Such a sudden break does not seem reasonable. The Panel feels that more research should be devoted to understanding the causes of the seemingly abnormally high historical rate of decline in mortality rates of DI beneficiaries in recent years. In addition, research should examine whether this group is somehow special and is likely to experience continued high rates of mortality improvement in the future. In the meantime, it may be a good idea to gradually

reduce the projected rate of decline in mortality rates from the high 2.8 percent historical rates towards the rate of approximately 1 percent recommended by the Panel to be the new overall intermediate projection for mortality. Otherwise, OCACT's intermediate forecast is likely to be too optimistic, somewhat underestimating the size of the long-term actuarial deficit of the DI program and overestimating the projected date of exhaustion of the DI Trust Fund.

c. Analysis of OCACT's Forecasting Procedure

The Panel evaluated the adequacy of OCACT's methodology of using judgmentally adjusted extrapolations of historical trends in incidence, death, and recovery rates to project the evolution of the DI program. The question is whether more formal econometric models of incidence, death, and recovery rates might be used to improve their projections. More formal modeling might involve including covariates that could account for the impact of changes in programmatic and economic factors, and epidemiological measures of health and disability status of the U.S. population. In particular, incidence into the DI program can be modeled at a greater level of detail as it depends upon individuals' propensities to apply for DI benefits and the leniency of the "gatekeepers." Those gatekeepers are the 54 state Disability Determination Services that process initial applications and reconsiderations, and the Administrative Law Judges and Appeals Council that process appeals. OCACT does not produce explicit projections of the probability that an individual will apply for benefits or appeal a denial, or the probability that an application or appeal will be awarded. Instead, its projections are based on incidence rates that represent the net effect of a series of application, appeals, and awards decisions.

The DI application, awards, and appeals process has been modeled econometrically using individual panel data at a much finer level of detail by Hu et al. (1997), Lahiri et al. (1995) and Benítez-Silva et al. (1999a). The third paper estimated in a detailed reduced-form model an individual's decision to apply for DI and SSI benefits, the DDS "first stage" award decision, the decision by rejected applicants to appeal an initial rejection, and the "second stage" decision by SSA's Administrative Law Judges and Appeals Council whether to award or deny an appeal.

The studies suggest that there could be important payoffs to modeling the awards and appeals process in greater detail, since such efforts could lead to improved understanding of the factors affecting DI incidence rates. For example, the Benítez-Silva et al. (1999a) paper found that there is a large apparent return to appealing an initial rejection by the DDS. Those who appeal have a significantly higher chance of being awarded benefits, raising the probability of award from 54 percent at the first-stage decision made by the DDS to a 70 percent "ultimate award rate" when the option to appeal was

considered. However, the increased award rate comes at the cost of substantial delays. The mean time between application and award at the first stage is 5 months compared to a mean time between application and award of 15 months for those who received benefits after one or more stages of appeal. Although the long delays are certainly an unintended consequence of backlogs in the appeals process resulting from the rapid growth in applications in the early 1990s, the Benítez-Silva et al. (1999a) paper suggests that delays appear to function as an implicit type-dependent "application fee" that dissuades opportunistic behavior. That is, individuals who do not regard themselves as being disabled are far less likely to apply or appeal than individuals who do regard themselves as being disabled.

Research is also being done on the role SSA may play in affecting individuals' self-perceptions of disability status. Recent work by Benítez-Silva et al. (1999b) shows that among DI applicants, self-reported disability status is an unbiased indicator of SSA's ultimate award decision (i.e., accounting for the possibility of a successful appeal of an initial denial). This finding suggests that the way SSA administers its DI awards process might have an important bearing on the "social standard" that the public perceives about what impairments constitute "disability." Further empirical work based on psychological and economic models may give us deeper insights into the factors influencing individuals' self-perceived disability status, and how those factors could affect their decisions about whether or not to work and whether or not apply for DI benefits.

However, most existing micro studies are based on reduced-form econometric models that are not appropriate for forecasting the effects of policy changes, such as changes in award rates, audit rates, or benefit levels. For these sorts of forecasts, a structural econometric approach is required, such as the existing static structural models of the DI application process by Halpern and Hausman (1978) and Krieder (1999). However, those models cannot capture the dynamics of the appeals process. Given the large number of DI entitlements that come via successful appeals, it is essential to model the dynamics of the entire DI awards and appeals process if we are going to be able to make accurate policy forecasts. One way to do this is by modeling the sequential decision process of whether or not to apply for DI benefits via dynamic programming (DP) methods. The DP framework is rich enough to explicitly account for the potential returns, uncertainties, and "hassle costs" associated with submitting an initial application for benefits, and deciding whether to appeal or re-apply if denied. Work along those lines is currently in progress as part of an integrated model of social insurance that is being developed by Buchinsky and Rust (1999). The DP approach has been very successful in modeling and predicting retirement behavior (see, e.g. Rust and Phelan 1997). But it remains to be seen whether the DI application decision can be successfully integrated into these models to produce accurate forecasts of changes in various aspects of the DI program and awards process.

Furthermore, it is unclear whether a "rational" DP model can accurately capture all the psychological factors affecting application and appeals decisions.

Reduced-form econometric models can be useful for forecasting provided there is no change in the existing "policy regime." As OCACT is charged with making projections under current law, reduced-form econometric models may be adequate for its purposes. However, our ability to predict behavior at the individual level requires a large number of covariates, so an econometric approach to forecasting would require auxiliary forecasts for all of the model's covariates, substantially complicating OCACT's forecasting problem. Furthermore, economists currently have only a rudimentary understanding of all the factors affecting applications and awards, and relatively little is known about the role of psychological, social, and political factors. Panel members are aware of no other forecasting models that are capable of taking into account most of the key determinants of application and appeals decisions.

Given our limited knowledge about the determinants of applications, appeals, and awards, it is not clear that a more detailed econometric model would necessarily generate more accurate aggregate forecasts than the less formal and explicit judgmental forecasting procedure used by OCACT. For the limited purpose of forecasting DI Trust Fund balances, the Panel concluded OCACT's existing "judgmental forecasting" procedure appears to be a fast, simple, and cost-effective method.

Nevertheless, the Panel believes that a substantial investment in developing improved dynamic models of the disability application and awards process is justified if SSA is interested in policy evaluation—that is, the evaluation of the behavioral, distributional, and welfare impacts of alternative policies. This capability is especially important in view of the "Disability Process Redesign" effort that SSA has been considering over the last 5 years. Some of the proposed changes that are under consideration include improving the standardizations of the awards process via functional impairment indices to reduce some of the large state-to-state variation in award decisions, and procedures designed to reduce the delays involved in submitting applications and appeals. Improved models could be used to predict whether substantial reductions in delays could significantly increase individuals' incentives to apply or appeal, and to provide better insight into whether standardized functional impairment indices could reduce the magnitude of the "Type 1 and 2" classification errors in the DI awards process.

There are encouraging signs that SSA is investing resources necessary to develop such models, including their funding of the Disability Evaluation Survey (DES) (a public release version of which will be available after 2002), and their funding of an academic "Disability Institute" to study these issues in

more detail. Although more detailed econometric models may not have a huge payoff in terms of improved accuracy of long term forecasts, these models could have a huge payoff in another area. They could lead to an improved understanding of the disability awards process, the factors leading to continued growth in the program, and the impact of new policies designed to improve the targeting of scarce tax dollars to the individuals who need them the most.

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V. APPENDIX

A. GLOSSARY

Actuarial balance. The difference between the summarized income rate and the summarized cost rate over a given valuation period.

Actuarial deficit. A negative actuarial balance.

Alternatives I, II, or III. See "Assumptions."

Annual balance. The difference between the income rate and the cost rate in a given year.

Assets. Treasury notes and bonds, other securities guaranteed by the Federal Government, certain Federally sponsored agency obligations, and cash, held by the trust funds for investment purposes.

Assumptions. Values relating to future trends in certain key factors which affect the balance in the trust funds. Demographic assumptions include fertility, mortality, net immigration, marriage, divorce, retirement patterns, disability incidence and termination rates, and changes in the labor force. Economic assumptions include unemployment, average earnings, inflation, interest rates, and productivity. Three sets of economic assumptions are discussed in this report—

- Alternative I is characterized as a "low cost" set—it assumes relatively rapid economic growth, low inflation, and favorable (from the standpoint of program financing) demographic conditions.
- Alternative II is the "intermediate" set of assumptions, and represents the Trustees' "best estimates" of likely future economic and demographic conditions.
- Alternative III, characterized as a "high cost" set, assumes slow economic growth, more rapid inflation, and financially disadvantageous demographic conditions.

Average wage index. The average amount of total wages for each year after 1950, including wages in noncovered employment and wages in covered employment in excess of the OASDI contribution and benefit base. These amounts are used to index the earnings of most workers first becoming eligible for benefits in 1979 or later, and for automatic adjustments in the contribution and benefit base, bend points, earnings test exempt amounts, and other wage-indexed amounts.

Award. An administrative determination that an individual is entitled to receive a specified type of OASDI benefit. Awards can represent not only new entrants to the benefit rolls but also persons already on the rolls who become entitled to a different type of benefit. Awards usually result in the immediate payment of benefits, although payments may be deferred or withheld depending on the individual's particular circumstances.

BLS. Bureau of Labor Statistics.

Baby boom. The period from the end of World War II through the mid-1960s marked by unusually high birth rates.

Bend points. The dollar amounts defining the AIME or PIA brackets in the benefit formulas.

Beneficiary. A person who has been awarded benefits on the basis of his or her own or another's earnings record. The benefits may be either in current-payment status or withheld.

Board of Trustees. A Board established by the Social Security Act to oversee the financial operations of the Federal Old-Age and Survivors Insurance Trust Fund and the Federal Disability Insurance Trust Fund. The Board is composed of six members, four of whom serve automatically by virtue of their positions in the Federal Government: the Secretary of the Treasury, who is the Managing Trustee, the Secretary of Labor, the Secretary of Health and Human Services, and the Commissioner of Social Security. The other two members are appointed by the President and confirmed by the Senate to serve as public representatives. Stephen G. Kellison and Marilyn Moon began serving 4-year terms on July 20, 1995.

CMT. Constant Maturity Treasury (securities).

COLA. Cost-of-living adjustment.

CORSIM. OCACT and ORES are developing a microsimulation model to evaluate the cost and/or distributional effects of alternative Social Security policies. The model is derived from the CORSIM microsimulation model developed at Cornell University.

Consumer Price Index—CPI. Relative measure of inflation. In this report, all references to the CPI relate to the Consumer Price Index for Urban Wage Earners and Clerical Workers (CPI-W).

Cost rate. The cost rate for a year is the ratio of the cost (also called outgo, expenditures, or disbursements) of the program to the taxable payroll for the year. In this context, the outgo is defined to include benefit payments, special monthly payments to certain uninsured persons who have 3 or more quarters of coverage (and whose payments are therefore not reimbursable from the general fund of the Treasury), administrative expenses, net transfers from the trust funds to the Railroad Retirement program under the financial-interchange provisions, and payments for vocational rehabilitation services for disabled beneficiaries; it excludes special monthly payments to certain uninsured persons whose payments are reimbursable from the general fund of the Treasury (as described above), and transfers under the interfund borrowing provisions.

Covered employment. All employment and self-employment creditable for Social Security purposes. Almost every kind of employment and self-employment is covered under the program. In a few employment situations, for example, religious orders under a vow of poverty, foreign affiliates of American employers, or State and local governments, coverage must be elected by the employer. However, effective July 1991, coverage is

mandatory for State and local employees who are not participating in a public employee retirement system. In a few situations, for example, ministers or self-employed members of certain religious groups, workers can opt out of coverage.

Covered worker. A person who has earnings creditable for Social Security purposes on the basis of services for wages in covered employment and/or on the basis of income from covered self-employment.

Disability. For Social Security purposes, the inability to engage in substantial gainful activity (see "Substantial gainful activity—SGA") by reason of any medically determinable physical or mental impairment that can be expected to result in death or to last for a continuous period of not less than 12 months. Special rules apply for workers age 55 or older whose disability is based on blindness.

The law generally requires that a person be disabled continuously for 5 months before he or she can qualify for a disabled-worker benefit.

Disability incidence rate. The proportion of workers in a given year, insured for but not receiving disability benefits, who apply for and are awarded disability benefits.

Disability Insurance (DI) Trust Fund. See "Trust fund."

Disability termination rate. The proportion of disabled-worker beneficiaries in a given year whose disability benefits terminate as a result of the individual's recovery, death, or attainment of normal retirement age.

Disabled-worker benefit. A monthly benefit payable to a disabled worker under normal retirement age and insured for disability. Before November 1960, disability benefits were limited to disabled workers aged 50-64.

Earnings. Unless otherwise qualified, all wages from employment and net earnings from self-employment, whether or not taxable or covered.

Gross Domestic Product—GDP. The total dollar value of all goods and services produced by labor and property located in the United States, regardless of who supplies the labor or property.

HRS. Health and Retirement Survey.

Income rate. Ratio of income from tax revenues on a liability basis (payroll-tax contributions and income from the taxation of benefits) to the OASDI taxable payroll for the year.

Inflation. An increase in the volume of money and credit relative to available goods, resulting in an increase in the general price level.

Insured status. The state or condition of having sufficient quarters of coverage to meet the eligibility requirements for retired-worker or disabled-worker benefits, or to permit the worker's spouse and children or survivors to establish eligibility for benefits in the event of his or her disability, retirement, or death. See "Quarters of coverage."

Interest. A payment in exchange for the use of money during a specified period.

Interest rate. Interest rates on new public-debt obligations issuable to Federal trust funds (see "Special public-debt obligation") are determined monthly. Such rates are set equal to the average market yield on all outstanding marketable U.S. securities not due to mature for at least 4 years from the date of the determination. The "effective" interest rate for a trust fund is the ratio of the interest earned by the fund over a given period of time to the average level of assets held by the fund during the period. The effective rate of interest thus represents a measure of the overall average interest earnings on the fund's portfolio of assets.

Long range. The next 75 years. Long-range actuarial estimates are made for this period because it is approximately the maximum remaining lifetime of current Social Security participants.

MINT. Model of income in the near term.

Normal retirement age. The age at which a person may first become entitled to unreduced retirement benefits. Currently age 65, but scheduled under present law to increase gradually to 67 for persons reaching that age in 2027 or later, beginning with an increase to 65 years and 2 months for persons reaching age 65 in 2003.

OASDI. Old-Age and Survivors Insurance and Disability Insurance.

PCM. Projected cohorts model.

PSA. Personal security account.

Pay-as-you-go financing. A financing scheme where taxes are scheduled to produce just as much income as required to pay current benefits, with trust fund assets built up only to the extent needed to prevent exhaustion of the fund by random economic fluctuations.

Payroll taxes. A tax levied on the gross wages of workers.

Present value. The equivalent value, at the present time, of a future stream of payments (either income or expenditures). The present value of a future stream of payments may be thought of as the lump-sum amount that, if invested today, together with interest earnings would be just enough to meet each of the payments as they fell due. At the time of the last payment, the invested fund would be exactly zero. For example, a home mortgage of $100,000 represents the present value at 8 percent interest of future monthly payments of $714.40 for the next 30 years. Present values are widely used in calculations involving financial transactions over long periods of time to account for the time value of money (interest) and the changing value of the dollar (inflation).

Quarters of coverage. Basic unit of measurement for determining insured status. In 1999, a worker receives one quarter of coverage (up to a total of four) for each $740 of annual covered earnings. The amount of earnings required for a quarter of coverage is subject to annual automatic increases in proportion to increases in average wages.

Real-wage differential. The difference between the percentage increases in 1) the average annual wage in covered employment and 2) the average annual Consumer Price Index.

SIPP. Survey of Income and Program Participation.

SSI. Supplemental Security Income.

Social Security Act. Provisions of the law governing most operations of the Social Security program. Original Social Security Act is Public Law 74-271, enacted August 14, 1935. With subsequent amendments, the Social Security Act consists of 20 titles, of which four have been repealed. The Old-Age, Survivors, and Disability Insurance program is authorized by title II of the Social Security Act.

Special public-debt obligation. Securities of the United States Government issued exclusively to the OASI, DI, HI, and SMI Trust Funds and other Federal trust funds. Section 201(d) of the Social Security Act provides that the public-debt obligations issued for purchase by the OASI and DI Trust Funds shall have maturities fixed with due regard for the needs of the funds. The usual practice in the past has been to spread the holdings of special issues, as of each June 30, so that the amounts maturing in each of the next 15 years are approximately equal. Special public-debt obligations are redeemable at par value at any time and carry interest rates determined by law (see "Interest rate").

Statutory blindness. Central visual acuity of 20/200 or less in the better eye with the use of a correcting lens or tunnel vision of 20° or less.

Substantial gainful activity—SGA. The level of work activity used to establish disability. A finding of disability requires that a person be unable to engage in substantial gainful activity. Under current regulations, a person who is not statutorily blind and is actually earning more than $700 a month (net of impairment-related work expenses) is ordinarily considered to be engaging in substantial gainful activity. A person who is statutorily blind (see "Statutory blindness") is not considered to be engaging in substantial gainful activity, for the purpose of determining a condition of disability, unless the person's earnings are more than $1,110 a month in 1999 (net of impairment-related work expenses). This amount for the blind is subject to adjustment each year to reflect increases in average wage levels.

TFR. Total fertility rate.

TIIS. Treasury Inflation-Indexed Securities (formerly called TIPS).

Taxable earnings. Wages and/or self-employment income, in employment covered by the OASDI and/or HI programs, that is under the applicable annual maximum taxable limit. For 1994 and later, no maximum taxable limit applies to the HI program.

Taxable payroll. A weighted average of taxable wages and taxable self-employment income. When multiplied by the combined employee-employer tax rate, it yields the total amount of taxes incurred by employees, employers, and the self-employed for work during the period.

Termination. Cessation of payment of a specific type of benefit because the beneficiary is no longer entitled to receive it. For example, benefits might terminate as a result of the death of the beneficiary, the recovery of a disabled beneficiary, or the attainment of age 18 by a child beneficiary. In some cases, the individual may become immediately entitled to another type of benefit (such as the conversion of a disabled-worker beneficiary at normal retirement age to a retired-worker beneficiary).

Total fertility rate. The average number of children who would be born to a woman in her lifetime if she were to experience the birth rates by age observed in, or assumed for, a specified year, and if she were to survive the entire childbearing period.

Trust fund. Separate accounts in the United States Treasury in which are deposited the taxes received under the Federal Insurance Contributions Act, the Self-Employment Contributions Act, contributions resulting from coverage of State and local government employees; any sums received under the financial interchange with the railroad retirement account; voluntary hospital and medical insurance premiums; and transfers of Federal general revenues. Funds not withdrawn for current monthly or service benefits, the financial interchange, and administrative expenses are invested in interest-bearing Federal securities, as required by law; the interest earned is also deposited in the trust funds.

- **Old-Age and Survivors Insurance (OASI).** The trust fund used for paying monthly benefits to retired-worker (old-age) beneficiaries and their spouses and children and to survivors of deceased insured workers.
- **Disability Insurance (DI).** The trust fund used for paying monthly benefits to disabled-worker beneficiaries and their spouses and children and for providing rehabilitation services to the disabled.
- **Hospital Insurance (HI).** The trust fund used for paying part of the costs of inpatient hospital services and related care for aged and disabled individuals who meet the eligibility requirements.
- **Supplementary Medical Insurance (SMI).** The trust fund used for paying part of the costs of physician's services, outpatient hospital services, and other related medical and health services for voluntarily enrolled aged and disabled individuals.

Year of exhaustion. The year in which a trust fund would become unable to pay benefits when due because the assets of the fund were exhausted.

B. HISTORY OF TECHNICAL PANELS

1. Establishment of Technical Panels

In 1968, the Social Security Act was amended to provide for the appointment of an Advisory Council every 4 years beginning in 1969. The purpose of the Councils was to review the status of the Social Security and Medicare Trust Funds as well as the scope of coverage and adequacy of benefits under the Social Security and Medicare programs. The statute specifically authorized the Councils to engage the technical assistance necessary to carry out their functions.

Five quadrennial Advisory Councils (1971, 1975, 1979, 1991, 1994-96) convened panels of experts to assist them in their deliberations. Those panels, generally consisting of economists and actuaries, were charged primarily with reviewing the economic and demographic assumptions and the methodology underlying the cost projections included in the most recent OASDI Trustees Report. Only the 1991 Council appointed a technical panel to look solely at the Medicare projections, and it met in the same year as the OASDI technical panel appointed by the Council. The 1984 Advisory Council, which focused almost exclusively on Medicare, and the 1988 Council, which looked at the DI program, did not convene technical panels.

2. 1991 Panels

In appointing the 1991 Advisory Council, then-Secretary of Health and Human Services Louis Sullivan directed the Council's attention to a broader agenda than called for by the statute governing establishment of Advisory Councils. He asked that the Council look at ways of providing more stable financing for health care (including long-term care) for the aged, the disabled, the poor and the uninsured. To assist it in accomplishing such a broad mandate, the Council convened three groups of experts and assigned a distinct task to each.

- The Council appointed two separate technical panels to look at the assumptions and methodology used in the Trustees Reports on OASDI and the Medicare programs, with only one expert (actuary and current Public Trustee Steve Kellison) serving on both panels.
  - The OASDI panel (which met from May through June of 1990) limited its review to key economic and demographic projections.
  - The second panel (which met from June through December 1990) was the first and only panel ever convened by an Advisory Council to focus on the Medicare projections. While it consisted primarily of experts in health economics and devoted most of its attention to health cost issues, the panel also commented on certain of the trustees' broader assumptions. In brief, the

Medicare panel supported all of the conclusions and recommendations of the OASDI panel except the recommendation concerning the best estimate of real wage growth over the long run. The Medicare panel recommended that the ultimate 1.3 percent growth rate included in the 1990 Trustees Report be lowered to 0.7 percent, rather than to 1.0 percent as the OASDI panel had recommended.

- In January 1991, following completion of the work of both technical panels and based on the blending of their projections, the Council convened a third panel, the Expert Panel on the Future of Income Security and Health Care.
  - The panel consisted of all of the members of the technical panels plus two experts on long-term care. Its job was to project the health care financing and income security environment of the early 1990s forward to 2020 and to assess what implications the projections might have for policy makers.
  - The panel's fundamental conclusion was that, in the absence of major change, projected future gains in income and wealth would be significantly eroded by the resources required to support the health care sector.

3. 1994-95 Panels

The 1994-96 Advisory Council (which submitted its report in January 1997) looked only at the OASI and DI programs. It convened two separate technical panels with no overlapping membership.

- The Technical Panel on Assumptions and Methods was appointed in August 1994 and reported in October 1995. It included a demographer, as well as economists and actuaries, and was charged with reviewing the key assumptions and projection methodology used in the OASDI report. The panel was specifically directed to build on the work of the 1991 Technical Panel and the work done by and for the Public Trustees in the intervening years.
- The Technical Panel on Trends and Issues in Retirement Saving was appointed in October 1994 to assist the Council in analyzing the relative roles of the public and private sectors in the provision of retirement income. In addition to nine economists, the panel included a law professor and three employee benefit experts. It met through March of 1995 and reported in September 1995. Its primary charge was to develop evaluation criteria and to use them to discuss a range of policy options to deal with the long-range Social Security imbalance and to improve the well being of future retirees.

4. 1999 Panel

Legislation enacted in 1994 established the Social Security Administration as an independent agency and created an independent, bipartisan Social Security Advisory Board. The Advisory Board assumed the role of the Advisory Councils in appointing technical panels to advise on the assumptions and methods used in the Trustees Report to evaluate the status of the OASDI Trust Funds. The first Technical Panel appointed by the Advisory Board met from January through September 1999 and issued this report in November. The role of the Panel was expanded to include investigation of the assumptions and methods used to evaluate various reform proposals.