

2011 Technical Panel on Assumptions and Methods



REPORT TO THE
SOCIAL SECURITY ADVISORY BOARD

September 2011

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2011
Technical Panel Report
on Assumptions and Methods

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Table of Contents

| | |
|---|------------|
| Panel Charter | i |
| Introduction and Acknowledgments | iii |
| Executive Summary | 1 |
| 1. Methodology | 13 |
| 1.1 Presentation of Uncertainty | 13 |
| 1.2 Actuarial Metrics | 23 |
| 1.3 Models and Methods | 33 |
| 1.4 Implications of Health Care Reform | 39 |
| 2. Demographic Assumptions and Methods | 45 |
| 2.1 Fertility | 45 |
| 2.2 Mortality | 55 |
| 2.3 Immigration | 64 |
| 2.4 Disability | 74 |
| 3. Economic Assumptions and Methods | 91 |
| 3.1 Labor Force Participation Rate | 91 |
| 3.2 Real Wage Growth Rate | 97 |
| 3.3 Unemployment Rate | 107 |
| 3.4 Interest Rates | 107 |
| 3.5 Inflation | 110 |
| 3.6 Taxable Share of Covered Wages | 110 |
| References | 115 |
| Compilation of Technical Panel Recommendations | 125 |

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 specified by the Board of Trustees of the Old-Age and Survivors Insurance Trust Fund and the Disability Insurance Trust Fund and the methods used by the Social Security actuaries to project the future financial status of the programs. The Panel shall deliver a written report to the Advisory Board within nine months of the Panel's first meeting.

Specifically the Panel is asked to:

- Review the assumptions regarding key demographic and economic factors – including mortality, fertility, immigration and disability incidence and termination, productivity, real wage growth, interest rates, price increases, labor force participation, and rates of employment and unemployment.
- Review and assess current projection methodologies.
- Review in particular:
 - The factors that affect trends in the taxable wage base such as trends in non-wage compensation and the growth rate of wages above and below the taxable maximum wage.
 - Methods of projecting prevalence of disability and labor force participation of older workers.
 - Evidence of structural economic changes as a result of the recent financial crisis that would affect key economic assumptions and frameworks, both in the short- and long-terms.
 - Ways to improve the presentation of key concepts in the Trustees Report, including the interaction of the funds with the federal budget, so as to make them more accessible and informative to the public.
- Review and assess the status of the recommendations of previous Technical Panels appointed by the Advisory Board.

Introduction and Acknowledgments

The 2011 Technical Panel on Assumptions and Methods was convened by the Social Security Advisory Board in September 2010 to review the assumptions specified by the Board of Trustees and to evaluate the methods used by the Office of the Chief Actuary to project the future financial status of the Old-Age and Survivors Insurance and Disability Insurance Trust Funds. We have worked diligently over the past year, both individually and collectively, to fulfill this mandate.

In addition to several closed-door meetings, the Technical Panel held six public meetings at the offices of the Social Security Advisory Board in Washington, DC, on:

- October 1, 2010
- November 5, 2010
- December 13, 2010
- January 28, 2011
- February 25, 2011
- May 5, 2011

We benefited greatly from the presentations made at those meetings and from the questions and comments of those in attendance and the ensuing discussion.

The staff in the Social Security Administration's Office of the Chief Actuary attended all of our public meetings, made several presentations to the Technical Panel, answered countless questions by e-mail, fielded many requests for data, and ran all of the projections presented in this report. We appreciate the tireless support of Chief Actuary Stephen Goss and recognize the help of many others in the actuary's office who contributed to our work, including Deputy Chief Actuary Alice Wade (Long Range), Deputy Chief Actuary Eli Donkar (Short Range), Chris Chaplain, Anthony Cheng, Karen Glenn, Steve F. McKay, Michael Morris, Da-

vid Olson, Jason Schultz, and Pat Skirvin. Felicitie Bell, Tiffany Bosley, Mark Bye, Danielle Huston, Johanna Maleh, Kent Morgan, Bill Piet and Karen G. Smith Michael L. Stephens provided assistance with data, projections and other technical issues.

Robert Reischauer and Charles Blahous, the two public trustees of the Social Security Trust Fund, graciously met with the Technical Panel soon after their appointment. We appreciate their time and insights and their support of our efforts.

Samuel Preston, co-chair of a National Research Council panel on international differences in longevity at older ages, shared the collective wisdom of his panel with the Technical Panel, helping us better understand the drivers of mortality at older ages. Louise Sheiner, a member of the 2010 Medicare Technical Review Panel, made a presentation to the Technical Panel on the growth in long-term health care costs, informing our discussions about the implications of health care reform for Social Security finances. Jonathan Schwabish, Julie Topoleski, and Michael Simpson from the Congressional Budget Office and Karen E. Smith of The Urban Institute participated in a thought-provoking discussion on microsimulation modeling. Joseph Newhouse, co-chair of the Medicare Technical Review Panel, and Jonathan Gruber of the Massachusetts Institute of Technology were also helpful sounding boards in considering the interplay between health care reform and Social Security. Frederick Hollmann and Jennifer Ortman from the Census Bureau provided useful feedback on immigration and census population projections. Jason Fichtner, David Pattison, and Mike Leonesio of the Social Security Administration also provided valuable insight and advice.

In addition to those named above, we owe a debt of gratitude to the many individuals who spoke informally with members of the Technical Panel over the past year and helped shape our understanding

of key issues. We are indebted to many individuals at the Congressional Budget Office, the Census Bureau, the Social Security Administration, and other government agencies and to academic and other professional colleagues.

Finally, Joel Feinleib, the Technical Panel's executive director and the Social Security Advisory Board's chief economist, has been "on loan" from the Social Security Advisory Board to support the Technical Panel over the past year. He has been indispensable, doing things both big and small to move our work forward and making many substantive contributions along the way. We are also grateful for the help of the other staff at the Social Security Advisory Board, including Kate Thornton, Robin Walker, Beverly Rollins, Debi Sullivan, David Warner, Peter Flynn, and Jeremy Elder. Carol Soble edited this report expertly and quickly.

As the Chair, I am thankful to the panelists for their dedicated service. As we have learned to work together as a group, I have come to respect each panel member tremendously. Although each panelist brought to the Technical Panel expertise in different domains, the report reflects the group's consensus. We agreed to most of our recommendations only after several rounds of discussion and debate. We learned much from each other during the process.

Brigitte C. Madrian, Chair

The 2011 Technical Panel on Assumptions and Methods was convened by the Social Security Advisory Board in September 2010 to review the assumptions specified by the Board of Trustees and to evaluate the methods used by the Office of the Chief Actuary to project the future financial status of the Old-Age and Survivors Insurance and Disability Insurance Trust Funds.

As noted by the 2007 Technical Panel, “The Social Security actuaries and the Trustees of the Old Age, Survivors, and Disability Insurance (OASDI) Trust Funds have perhaps the most difficult analytical task in government – projecting demographic and economic developments over the next 75 years.” We appreciate the enormity of the task and note that much of what is done in this process is fundamentally sound. We have focused on identifying areas where change might be warranted as well as on articulating the justifications for such proposed changes.

As part of the process, we have examined the assumptions adopted by the Trustees in the 2010 and 2011 Trustees Reports, along with changes to the Trustees’ assumptions since issuance of the last Technical Panel report in 2007. We have also assessed the status of recommendations made by earlier Technical Panels. In cases where the 2011 Technical Panel concurs with earlier Technical Panel recommendations, we have so noted in our report.

Following the 2007 Technical Panel, we begin with an assessment of the methods used to evaluate the financial status of the OASDI Trust Funds and to communicate those results to the government, the media, and the public. This includes a section on the implications of health care reform for the financial status of the OASDI program. We then turn to the key demographic and economic assumptions.

■ Methodology

Presentation of Uncertainty

The baseline projections on system finances in the Trustees Report are sensitive to several assumptions that reflect some degree of uncertainty. The 1999, 2003, and 2007 Technical Panels all made recommendations on how to evaluate and convey the impact of uncertainty on system finances, and the Office of the Chief Actuary has followed up with some important methodological innovations in this regard. The Trustees Report now contains three types of uncertainty analysis: high- and low-cost scenarios, stochastic simulation, and sensitivity analysis. Although some work remains in the empirical analysis of uncertainty, the Technical Panel focused primarily on how uncertainty is presented in the Trustees Report. Building on the suggestions of earlier Technical Panels, we set forth recommendations intended to make the presentation of uncertainty more useful to a broad spectrum of readers.

Summary Table II.C1 in the Trustees Report lists the key assumptions used in projecting system finances and evaluating the uncertainty about these projections. The Technical Panel recommends expanding the list of key assumptions to include labor force participation, disability incidence and termination, and the taxable share of wages. In addition, the Technical Panel recommends presenting the values for key assumptions in a way that is more useful to readers. For example, Table II.C1 currently reports the “average annual percentage reduction in total age-sex-adjusted death rates,” a precise concept, but one that is probably lost on most readers. Instead, most readers would likely understand the increase in life expectancy implied by the assumed

average annual percentage reduction in total age-sex-adjusted death rates.

Given that sensitivity analysis is the foundation for other types of uncertainty analysis, the Technical Panel recommends that the discussion of uncertainty in the Summary chapter focus on sensitivity analysis for each of the key drivers of system finances. The selection of the low- and high-cost values should be consistent, in a probabilistic sense, both within and across assumptions. The low- and high-cost values for any given variable should be equally likely relative to the intermediate case even if they imply an asymmetric range between the intermediate and high- and low-cost assumptions (the 2007 Technical Panel made the same point). Further, the likelihood of realizations within the range of outcomes should be the same across all key assumptions.

The Technical Panel also recommends consolidating all uncertainty analyses into a single chapter on uncertainty; currently, such analyses are scattered throughout various sections of the Trustees Report (including Chapter II, Chapter IV, Appendix D, and Appendix E). The uncertainty chapter should explain the approaches to evaluating uncertainty: high- and low-cost scenarios, integrated scenarios, and stochastic simulation. It should also compare and contrast the results from the various approaches.

Actuarial Metrics

The Technical Panel benefited from the membership of two actuaries; we drew on their expertise to help us evaluate the actuarial metrics used in the Trustees Report, something not comprehensively addressed in the 1999, 2003, or 2007 Technical Panel reports. The annual Trustees Report presents several actuarial metrics, both short- and long-range, that illustrate the relationship of workers to beneficiaries, current and projected funded status, and the change in funded status from the previous year and historically. We evaluated the metrics and concluded that they satisfy the Actuarial Standard of Practice for Social Insurance (ASOP 32) as well as the Federal Accounting Standards Advisory Board Exposure Draft on reporting the financial status of the Social Security system in the context of the unified budget. Overall, the Technical Panel's assessment is that the set of metrics is comprehensive and used appropriately and presented clearly.

We also evaluated the metrics used by other experts and organizations, including the Congressional Budget Office (CBO) and Canadian Office of the Chief Actuary of the Canada Pension Plan (CPP). This review led the Technical Panel to the assessment and recommendation that micro-level financial measures provide another useful way to evaluate the Social Security system and help the public relate its financial status to the level of benefits. Our report includes specific examples of how the Trustees Report could incorporate such metrics.

The Technical Panel also recommends that the Trustees Report expand the discussion of sustainable solvency. We present several potential metrics that could help illustrate the types of system changes that would be required to achieve sustainable solvency. The new metrics will aid readers in understanding the financial status of Social Security. A more comprehensive discussion of sustainable solvency would also eliminate the need for the Infinite Horizon metric. The uncertainty associated with the Infinite Horizon projection is so great – taxes, benefits, taxable payroll, and Gross Domestic Product (GDP) are projected hundreds of years into the future – that the results are often misused in policy discussions. The Technical Panel agrees that a solid assessment of sustainable solvency would be more informative than an Infinite Horizon projection.

Models and Methods

The 2007 Technical Panel called for “more transparency in the models and data the actuaries use, as well as the assumptions that drive their results.” The 2011 Technical Panel applauds the Office of the Chief Actuary's (OACT's) significant progress in increasing the transparency of its model and methods, including posting to their web site documentation of the approach, assumptions, and methods used in the Trustees Report, along with single-year tables from the Trustees Report. We recommend continued efforts on this front to facilitate comparisons across Trustees Reports and to make the documentation more user-friendly. The full report contains specific suggestions.

Reliable estimation of Social Security's long-run finances requires vast amounts of highly detailed and representative data. The Technical Panel strongly supports the investments made in recent years by various divisions within the Social Security Administration (SSA) to institute

and maintain data linkages, such as the matched survey-administrative data files for the Survey of Income and Program Participation (SIPP) and the Health and Retirement Study (HRS). OACT's efforts to share data files developed by members of its staff for internal use have helped validate and improve models developed by other parts of SSA. A prime example is the OACT Microsim database file that is based on administrative sources, including the Current Work History Sample (CWHHS) and Master Earnings File (MEF). The Technical Panel recommends continued efforts to facilitate research and analysis within different parts of SSA and within the larger research community.

Models of Social Security serve several purposes, and different types of models embody different strengths and weaknesses. Earlier Technical Panels called for accelerated efforts to use dynamic microsimulation techniques to augment findings from the segmented model. In recent years, SSA has increased its reliance on dynamic microsimulation models to produce distributional estimates of reform proposals. The 2011 Technical Panel recommends that OACT develop a strategic plan for integrating its segmented and microsimulation strategies. One objective of this strategic plan should be to increase coordination of dynamic microsimulation efforts within SSA in order to maximize existing resources. The Technical Panel recommends that the Social Security Advisory Board monitor progress on the development of these plans. The Board should consider convening or hosting a regular series of meetings of model developers within SSA and across various government agencies to review innovations, challenges, and prospects for collaboration. In deciding how to allocate scarce modeling resources, SSA should assign high priority to policies with potentially significant but uncertain effects on OASDI's fiscal position.

The Social Security actuaries are charged with projecting the financial status of the program under current law. In several substantive areas, many independent analysts view current law as unrealistic or unsustainable over long periods. Uncertainty about policy direction should factor into developers' plans for model investments and maintenance and should shape thinking about ongoing specification choices and the plausible bands for high- and low-cost assumptions. For example, the real wage differential, immigration levels and immigrant composition, and income from taxation of benefits are all key determinants of system finances that are

likely to be influenced by policy changes in the coming years. The Technical Panel encourages developers to be forward-looking to ensure that they are positioned to adapt to possible policy changes that would materially affect Social Security financing.

In making their projections, the OASDI Trustees typically assume that current law will remain in effect in most areas. They deviate significantly in a few instances, including establishing an income tax baseline and, less important, the treatment of refugees under immigration law. Since Social Security benefits became subject to income taxation in 1984, revenue from taxation of benefits has grown steadily and is expected to become an increasingly important share of total OASDI revenue in the coming years. The importance of this revenue source is uncertain, however, and warrants additional discussion in the Trustees Report. The Technical Panel recommends basing the intermediate projection of revenues from taxation of OASDI benefits more closely on the current income tax code rather than on historical shares of income subject to federal income taxation. The Technical Panel also recommends basing the projections of OASDI's long-range actuarial status on two alternative sets of assumptions about future taxation; the assumptions are analogous to "current law"/"extended baseline" and "current policy"/"alternative fiscal" scenarios, as adopted by other government and private forecasting groups. At a minimum, the Technical Panel strongly recommends that the Trustees add sensitivity analysis to the Trustees Report to demonstrate how projections of the long-range financial status of the OASDI program vary with alternative assumptions about laws governing personal income tax.

Implications of Health Care Reform

The 2010 passage of the *Patient Protection and Affordable Care Act* and the *Health Care and Education Reconciliation Act* represents the most dramatic change to the U.S. health care system since the enactment of Medicare in 1965. Although the goals of health care reform primarily relate to health care – expanded health insurance coverage, increased affordability of health care, reduction in long-term increases in the cost of health care – the new laws also have implications for the financial status of the OASDI program.

The 2010 Trustees Report calculated that health care reform would increase the long-range OASDI actuarial balance by 0.14 percent of taxable payroll. The assumed mechanism was a decline of 0.1 percent in the ratio of earnings to compensation resulting from the excise tax on employer-sponsored health insurance that takes effect in 2018. The Technical Panel believes that health care reform could affect system finances through several channels, not just through the ratio of earnings to compensation. Other potential effects include (1) changing the level and/or composition of employment, (2) changing the taxable share of wages, (3) changing the incentives to apply for Disability Insurance (DI), and (4) changing health. The full report discusses each of these effects in greater detail.

The Technical Panel believes that health care reform generates increased uncertainty around several major assumptions, which leads to our recommendation to increase the range of uncertainty around the assumptions likely to be affected by health care reform, including labor force participation and the earnings ratio. The expanded range reflects the uncertainty inherent in how health care reform will unfold. Over time, the extent of uncertainty is likely to narrow, at which point the recommended ranges for the affected assumptions will lend themselves to reduction.

Given the uncertainty about how health care reform will play out, the Technical Panel also recommends research into the impacts of health care reform on relevant outcomes as reform provisions start to take effect. Such outcomes include labor force participation, disability receipt, the earnings ratio, the taxable share, and mortality. The research findings should help determine the need for changes to the relevant assumptions and the need for adjustments to the range of uncertainty.

Specific Assumptions

Table 1 lists the Technical Panel's recommendations for the key demographic and economic assumptions made by the Trustees and used by OACT in its projections of OASDI finances. In some cases, we concluded that the Trustees' intermediate-, low-, and high-cost assumptions were all reasonable. In other cases, we concluded that the Trustees' intermediate assumptions were reasonable but that the range of uncertainty implied by the low- and high-cost assumptions was either too narrow or should

not be symmetric around the intermediate assumption. In still other cases, we identified the need to revise the intermediate assumptions as well as the range of uncertainty around those assumptions. Where we recommended changes to the intermediate assumptions or the range of uncertainty around those assumptions, we have explained our justifications in the body of the report and, more briefly, in the rest of the executive summary. We discuss, first, our recommendations on the demographic models and assumptions and then turn to the economic models and assumptions.

Demographic Assumptions and Methods

Fertility

The Technical Panel examined historical trends in fertility in the United States and internationally as well as the factors that explain both temporal trends in fertility and cross-country differences in fertility at a point in time and over time. Even though the United States has experienced high fertility for several decades relative to other developed countries, the factors driving U.S. fertility have been relatively stable for several decades. We see no compelling reason to expect significant changes to the currently assumed total fertility rate of 2.0 in the future. While the Technical Panel views stable fertility rates as the most likely future scenario, we agree with the 2007 Technical Panel that asymmetric low- and high-cost assumptions are appropriate, although our current estimate of such asymmetry is modest. In particular, the Technical Panel recognizes a greater likelihood of declining rather than increasing fertility.

Economic downturns consistently reduce fertility, as is the case with the most recent economic downturn. As of December 2009 (the most recent data available), the severe recession during 2007–2009 produced a near doubling of the unemployment rate (4.5 to 9 percent) and fertility declines of roughly 5 percent. The Technical Panel believes that the recession effects may persist for three or four years but that much of the fertility decline is the result of postponed childbearing rather than of a reduction in family size. As a consequence, on a 75-year horizon, the fertility effects of the recent

Table 1. Summary of Assumption Recommendations

| Assumption | Intermediate-Cost | Low-Cost | High-Cost |
|--|-------------------|-------------------|------------------|
| Total fertility rate | | | |
| 2011 Trustees Report (TR) | 2.0 | 2.3 | 1.7 |
| Technical Panel recommendation | 2.0 | 2.2 | 1.6 |
| Life expectancy in 2085^a | | | |
| 2011 TR | 85.0 | 81.3 | 89.0 |
| Technical Panel recommendation | 88.7 | 83.7 | 93.7 |
| Net immigration | | | |
| 2011 TR in 2085 (000s) | 1,025 | 1,310 | 770 |
| 2011 TR in 2085 (per 1,000 population) | 2.2 | 2.8 | 1.9 |
| Technical Panel recommendation | | | |
| In 2085 (000s) | 1,628 | 2140 ^b | 950 ^b |
| In 2085 (per 1,000 population) | 3.2 | 4.2 | 2.2 |
| Disability incidence rate^c | | | |
| 2011 TR | 5.2 | 4.2 | 6.3 |
| Technical Panel recommendation | 5.8 | 4.8 | 6.9 |
| Disability termination death rate in 2085 | | | |
| 2011 TR | 11.4 | 19.8 | 7.3 |
| Technical Panel recommendation | 9.9 | 17.1 | 6.3 |
| Disability termination- recovery rate^c in 2085 | | | |
| 2011 TR | 10.7 | 8.5 | 12.9 |
| Technical Panel recommendation | 8.7 | 6.0 | 11.4 |
| Labor force participation rate^c in 2085 | | | |
| 2011 TR | 66.6 | 66.3 | 66.3 |
| Technical Panel recommendation | 68.2 | 70.3 | 64.8 |
| Unemployment rate | | | |
| 2011 TR | 5.5 | 4.5 | 6.5 |
| Technical Panel recommendation | 5.5 | 4.5 | 6.5 |
| Components of real wage growth | | | |
| Productivity | | | |
| 2011 TR | 1.7 | 2.0 | 1.4 |
| Technical Panel recommendation | 1.7 | 2.0 | 1.4 |
| Compensation to GDP | | | |
| 2011 TR | 0.0 | 0.0 | 0.0 |
| Technical Panel recommendation | | | |
| First 25 years (2011–2035) | 0.0 | 0.1 | -0.1 |
| Next 50 years (2036–2085) | 0.0 | 0.0 | 0.0 |
| Earnings to compensation | | | |
| 2011 TR | -0.1 | 0.0 | -0.2 |
| Technical Panel recommendation | 0.0 | 0.1 | -0.1 |
| Hours worked | | | |
| 2011 TR | 0.0 | 0.1 | -0.1 |
| Technical Panel recommendation | 0.00 | 0.05 | -0.15 |
| PGDP-CPI price differential | | | |
| 2011 TR | -0.4 | -0.3 | -0.5 |
| Technical Panel recommendation | -0.2 | -0.1 | -0.3 |
| Net real wage growth | | | |
| 2011 TR | 1.2 | 1.8 | 0.6 |
| Technical Panel recommendation | | | |
| First 25 years (2011–2035) | 1.50 | 2.15 | 0.75 |
| Next 50 years (2036–2085) | 1.50 | 2.05 | 0.85 |
| CPI | | | |
| 2011 TR | 2.8 | 1.8 | 3.8 |
| Technical Panel recommendation | 2.8 | 1.8 | 3.8 |
| Real interest rates | | | |
| 2011 TR | 2.9 | 3.6 | 2.1 |
| Technical Panel recommendation | 2.7 | 3.6 | 2.1 |
| Taxable share of payroll | | | |
| 2011 TR | 82.9 | 83.6 | 82.1 |
| Technical Panel recommendation | 82.2 | 84.3 | 80.0 |

^a Unisex period life expectancy at birth; ^b Panel's estimates; ^c age-sex adjusted.

recession will exert only a minor effect on Social Security's fiscal position.

Mortality

The Technical Panel examined historical trends in mortality in the United States and internationally, focusing on the role of smoking and obesity as drivers of more recent differences in mortality between the United States and other developed countries. The Technical Panel's main recommendation with respect to mortality is to assume a more rapid increase in life expectancy over the coming decades. Earlier Technical Panels made similar recommendations, although our recommendation is for a greater upward revision. Specifically, for the intermediate-cost scenario, we assume an increase in life expectancy in 2085 to 88.7 years, which is 3.7 years higher than the 2011 Trustees Report assumption of 85.0 years. Recognizing the high degree of uncertainty about future mortality trends and the lack of agreement among experts, the Technical Panel also recommends increasing the range between the high- and low-cost assumptions to 10 years.

To make the mortality assumptions more understandable to readers of the Trustees Report, the Technical Panel recommends summarizing the assumptions about future mortality (as expressed here) in terms of life expectancy (at birth) at the end of the projection period rather than in terms of the ultimate annual reduction in the average percentage of total age- and sex-adjusted death rates. The Trustees Reports before 2001 presented mortality assumptions in terms of life expectancy at birth.

In addition, the Technical Panel reiterates the recommendations made by earlier Technical Panels to abandon separate projections by cause of death; such projections add unnecessary complexity and are not based on a transparent methodology.

Immigration

Immigration has long accounted for a significant share of U.S. population growth. Since 1950, net immigration has increased at an average annual rate almost three times greater than the overall rate of population growth. For most of the past two decades, immigration has exceeded levels assumed in previous Trustees Reports. The Technical Panel commends the Trustees for changes made in the

2008 Trustees Report that increased assumptions on immigration levels, revised the approach for deriving net migration assumptions, and clarified the role of the "other than legal" immigrant population. Although these changes move in the right direction, some further changes in the methodology for projecting immigration are still warranted.

The Technical Panel concurs with the 2003 and 2007 Technical Panels that, rather than basing immigration on current law, the ultimate assumption on net immigration should be linked to population size. The demographic and economic asymmetries that drive international migration are likely to persist for several decades and result in the continuation of past trends. The Technical Panel recommends that the intermediate assumption should ultimately be 3.2 net migrants per 1,000 persons. The level of net international migration implied by the Technical Panel's recommendations is about 1.6 million individuals annually by 2085, which is higher than the level assumed in the 2011 Trustees Report but not as high as the level implied by the recommendations of the 2007 Technical Panel.

Disability

Since the late 1980s, the fraction of non-elderly adults between age 25 and 64 receiving DI benefits has more than doubled, rising steadily from 2.3 percent in 1989 to 4.7 percent by 2010. The increase in DI enrollment is partly a function of the changing age structure of the U.S. population, with most of the Baby Boom cohort aging into its 50s and early 60s over the last 20 years. But the changing age structure of the U.S. population explains less than one-fifth of the rise in DI enrollment from 1989 to 2010.

The increase in DI enrollment has coincided with a steady rise in the share of Social Security expenditures paid out to DI recipients. From 1989 to 2010, that share increased from 10 to 18 percent. This rise in expenditures has not been matched with a corresponding increase in revenue allocated to the program. The DI Trust Fund does not satisfy the short-range test of financial adequacy, and the 2011 Trustees Report projects that the DI Trust Fund will be exhausted in 2018. This bleak picture may in fact be too optimistic, as trends in incidence rates, termination rates, and related variables strongly suggest that long-run projections significantly understate the program's future size.

Population size, the fraction of the population that is DI-insured, the disability incidence rate, and the termination rate from the program all influence the projection of future DI enrollment. The Technical Panel has focused on the last three determinants of DI enrollment and recommends changes to both the assumed DI incidence and termination rates.

The Trustees currently assume that DI incidence will remain stable throughout the 75-year projection period. Given the increasing trend in DI incidence at all ages, the Trustees' assumption seems implausible. Absent a significant change in DI policy, such as a tightening of the program's medical eligibility criteria, a much more likely scenario is that the trend toward increasing DI incidence will continue for some time. Thus, the Technical Panel recommends that the projected age-sex-adjusted incidence rates should increase from 5.2 to 5.8 per 1,000 insured workers.

From 1985 to 2009, the annual exit rate from DI fell from 12.0 to 7.7 percent. The average person awarded DI benefits now remains in the program for much longer than a person in earlier years. Individuals may exit the DI program for one of three reasons: (1) conversion to retired worker benefits at the full retirement age, (2) death, or (3) recovery. The Technical Panel recommends changes to the assumptions about two of the three reasons for program termination. Given changes in the underlying health of DI recipients, the Technical Panel recommends that projected mortality rates decline more rapidly than currently assumed. The Technical Panel also recommends reducing the projected recovery rate.

■ Economic Assumptions and Methods

Labor Force Participation Rate

The 2003 and 2007 Technical Panels recommended a review and restructuring of the model used to project the labor force participation assumptions presented in the Trustees Report. We reiterate the need for fundamental change. Our suggestions might be considered a refinement of earlier Technical Panel recommendations. We acknowledge that the philosophy behind the current approach offers some merit, but we believe that the current time-series-based modeling strategy fails to generate

meaningful projections of either future labor force participation rates or the uncertainty surrounding the projections.

The Technical Panel recommends moving toward a heuristic life-cycle approach to projecting labor force participation by age and sex. Ultimately, this part of the labor force participation model should be driven by life-cycle-specific labor supply measures such as typical age of first entry, percentage of the working-age population in the labor force, age of primary job exit, and fraction of the retired population still working. The Technical Panel's recommended intermediate-, high-, and low-cost values are based on consideration of labor force participation across eight age/sex groups and thus represent a move in the desired direction.

More specifically, the Technical Panel recommends a higher intermediate labor force participation rate of 68.2 percent relative to the currently assumed rate of 66.6 percent. The Technical Panel also recommends a dramatic increase in the range of uncertainty around labor force participation, with high- and low-cost values of 64.8 and 70.3 percent, respectively. And, consistent with recommendations on modeling and uncertainty, the Technical Panel recommends characterizing labor force participation rates as a basic assumption.

Real Wage Growth Rate

The methodology used in the Trustees Report to project real wage growth begins with the productivity growth rate and sequentially considers steps that link productivity growth to real wage growth. The Technical Panel evaluated all of the components that go into calculating real wage growth: annual productivity growth, the compensation share of GDP, the earnings to compensation ratio, average hours of work, and the GDP-CPI price differential.

Productivity Growth. The Technical Panel recommends no changes to the assumptions on productivity growth in the 2011 Trustees Report.

Compensation Share of GDP. The Technical Panel recommends maintaining the intermediate assumption for the compensation share at an annual growth rate of 0.0 percent. Given variation in the compensation share over the past several decades, the Technical Panel also recommends introducing differences between the low- and high-cost scenarios and the intermediate-cost assumptions. Specifically, starting from a current value of 54.5 percent

for the compensation share, the Technical Panel recommends that the high- and low-cost scenarios should range from 53 to 56 percent over the projection period. Growth rates of -0.1 and 0.1 percent per year for 25 years in the high- and low-cost scenarios, respectively, would generate the suggested range in the compensation share.

Earnings to Compensation Ratio. The Technical Panel recommends increasing the annual rate of growth for the earnings to compensation ratio to 0.0 percent in the intermediate-cost scenario, an increase from the current assumption of -0.1 percent. The adjustment for the effects of health care reform in the 2010 Trustees Report (an increase of 0.1 percent per year) is reasonable and should be maintained, pending direct observation of the law's impact in the coming years. The Technical Panel's recommendation of an intermediate-cost assumption of 0.0 percent incorporates this adjustment.

Average Hours of Work. The Technical Panel recommends maintaining the intermediate-cost assumption for the annual change in hours worked at 0.0 percent. The Technical Panel believes that it is more likely that hours will decline than substantially increase relative to this benchmark and thus recommends an asymmetric range for the high- and low-cost assumptions. Specifically, the Technical Panel recommends a low-cost assumption of a 0.05 percent per year increase in hours worked and a high-cost assumption of a -0.15 percent per year decline in hours worked.

GDP-CPI Price Differential. Consistent with the recommendations of the 2007 Technical Panel, the 2011 Technical Panel recommends a smaller difference between the inflation rates of the GDP deflator and the CPI than the -0.4 currently assumed by the Trustees; specifically, the ultimate price differential assumption should be -0.2 percent per year in the intermediate-cost scenario.

Summary of Real Wage Growth. Taken together, the Technical Panel's five recommendations described above generate an intermediate assumption for real wage growth of 1.5 percent per year – a level higher than the 1.2 percent per year rate of real wage growth assumed in the 2011 Trustees Report.

Unemployment Rate

The Technical Panel recommends no change to the assumptions on the ultimate long-run unemployment rate in the 2011 Trustees Report.

Interest Rates

In our assessment of real interest rates, we examined historical data on constant-maturity Treasury Inflation-Protected Securities (TIPS) and the average annual interest rate implied by the TIPS yield curve. We concluded that the long-run real interest rate of 2.9 percent assumed in the 2011 and earlier Trustees Reports is too high relative to the market-based forecasts implicit in the current yields on TIPS. Based on those yields, the Technical Panel recommends a long-run real interest rate of 2.7 percent in the intermediate-cost scenario. The 2007 Technical Panel also recommended a reduction in the assumed real interest rate, although the 2007 recommendation of 2.6 percent is slightly lower than our recommendation. We recommend maintaining the 3.6 and 2.1 percent assumptions for the low- and high-cost scenarios, respectively; these assumptions reflect an assessment demonstrating that the range of uncertainty around the real interest rate is not symmetric and that the risk of a much higher long-run real interest rate is greater than the risk of a much lower long-run real interest rate.

The Technical Panel also reiterates the recommendation of the 2007 Technical Panel that the Trustees place more weight on the forward-looking information in recent Treasury yield curves in the determination of real and nominal interest rates.

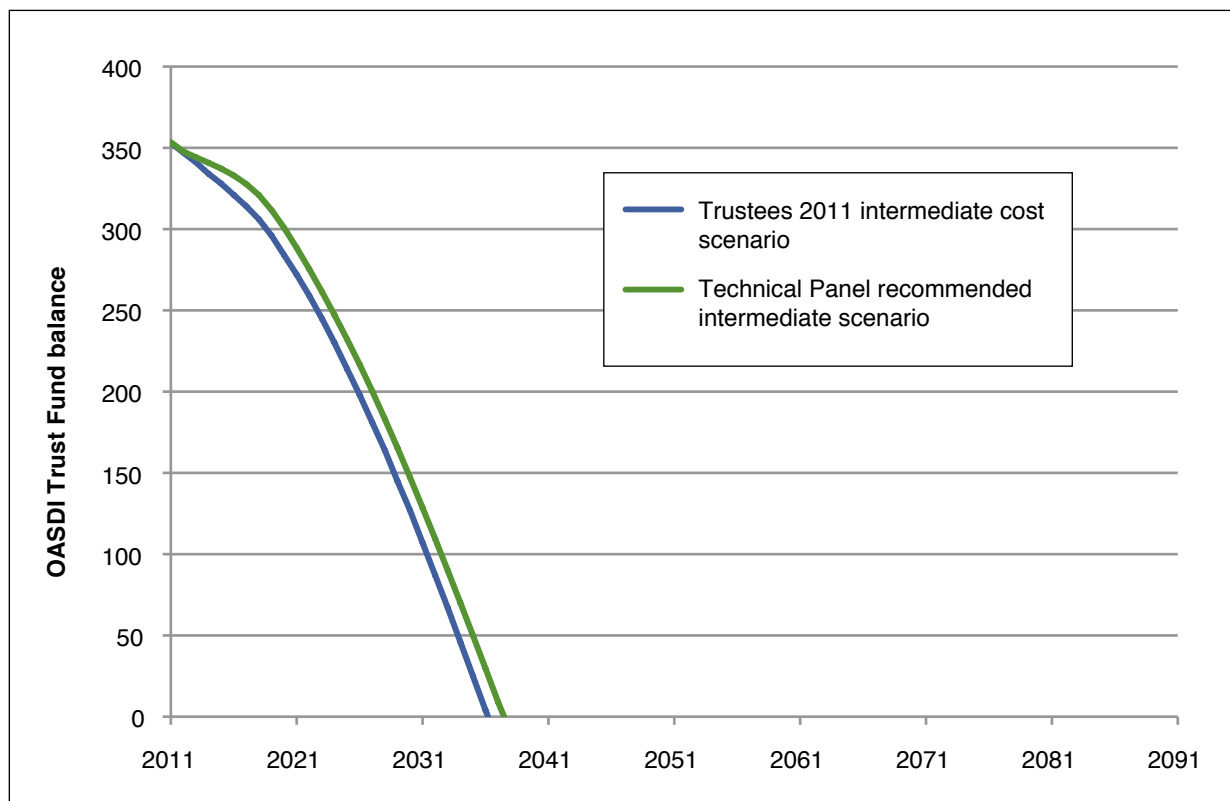
Inflation

The Technical Panel recommended no change to the CPI-W growth assumption.

Taxable Share of Covered Wages

Only earnings below the contribution and benefit base (also known as the taxable maximum) are subject to OASDI payroll taxes and counted toward Social Security benefits. Since 1983, the taxable share of all covered wages has trended steadily downward, with the only exceptions occurring during economic downturns. Rapid increases in the earnings of the very highest earners have driven this downward trend. Other contributing factors include the aging of the Baby Boomers and changes

Figure 1. Projected Annual Trust Fund Ratio under Intermediate Assumptions: Technical Panel Recommendations versus Trustees' 2011 Assumptions



Source: 2011 Trustees Report; Projections by the Office of the Chief Actuary, Social Security Administration.

in the share of compensation spent on employee benefits rather than on wages.

The literature and expert judgment are sharply divided on the question of whether the earnings of the highest earners will continue to outpace earnings at lower points in the distribution. Analysts projecting a continuation of the trend toward a lower taxable share see few institutional mechanisms that would inhibit further rapid growth in earnings for the most highly compensated workers. Those who expect the trend to slow, flatten, or reverse point to several factors: the likelihood that marginal tax rates will increase, particularly for high earners; the potential for health care reform to reduce the share of total compensation devoted to employer health insurance for middle-income workers; and a belief that bubbles fueled much of the recent growth in compensation of the highest earners and are unlikely to occur again.

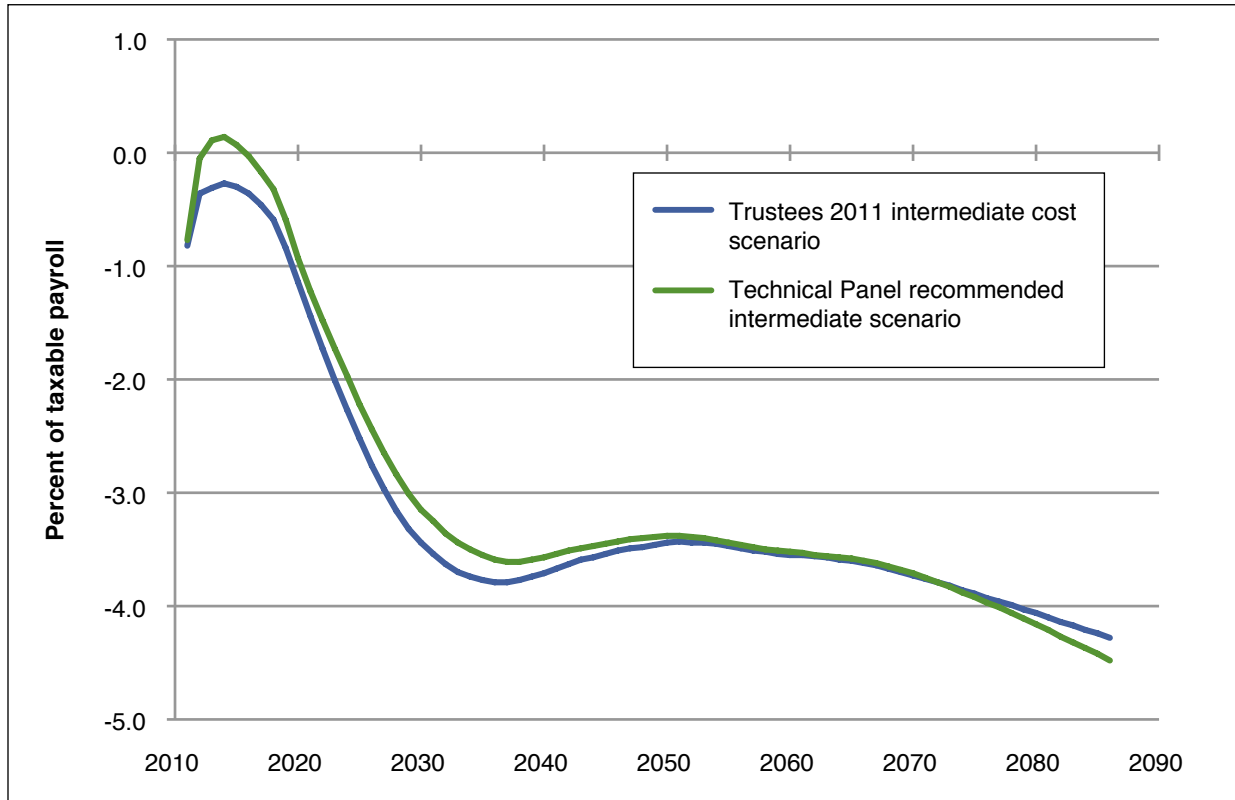
The 2011 Trustees Report assumes that the taxable share will level off at an ultimate rate of 82.9 percent of covered payroll for the intermediate-cost scenario. The Technical Panel agrees that

the arguments in favor of a continued downward trend in the taxable share are compelling but recognizes that the trend is unlikely to continue indefinitely. We therefore recommend an ultimate value of 82.2 percent for the taxable share of payroll. While the evidence supporting a change to the intermediate value of the taxable share is mixed, the Technical Panel strongly believes that the uncertainty around earnings variability in the future is high and that the currently assumed range between the low- and high-cost scenarios is too narrow. The Technical Panel also recommends that the Trustees Report include the taxable share as one of the key assumptions in Table II.C1.

■ Long-Term Financial Status of the OASDI Trust Funds under the Technical Panel Assumptions

Cumulatively, the Technical Panel's recommended changes to the Trustees intermediate assumptions would result in slightly improved medium

Figure 2. Projected Annual Balances under Intermediate Assumptions: Technical Panel Recommendations versus Trustees' 2011 Assumptions



Source: 2011 Trustees Report; Projections by the Office of the Chief Actuary, Social Security Administration.

term system finances but a slightly larger 75-year actuarial deficit. The Technical Panel believes, however, that the result of these projections is more uncertain than is currently assumed.

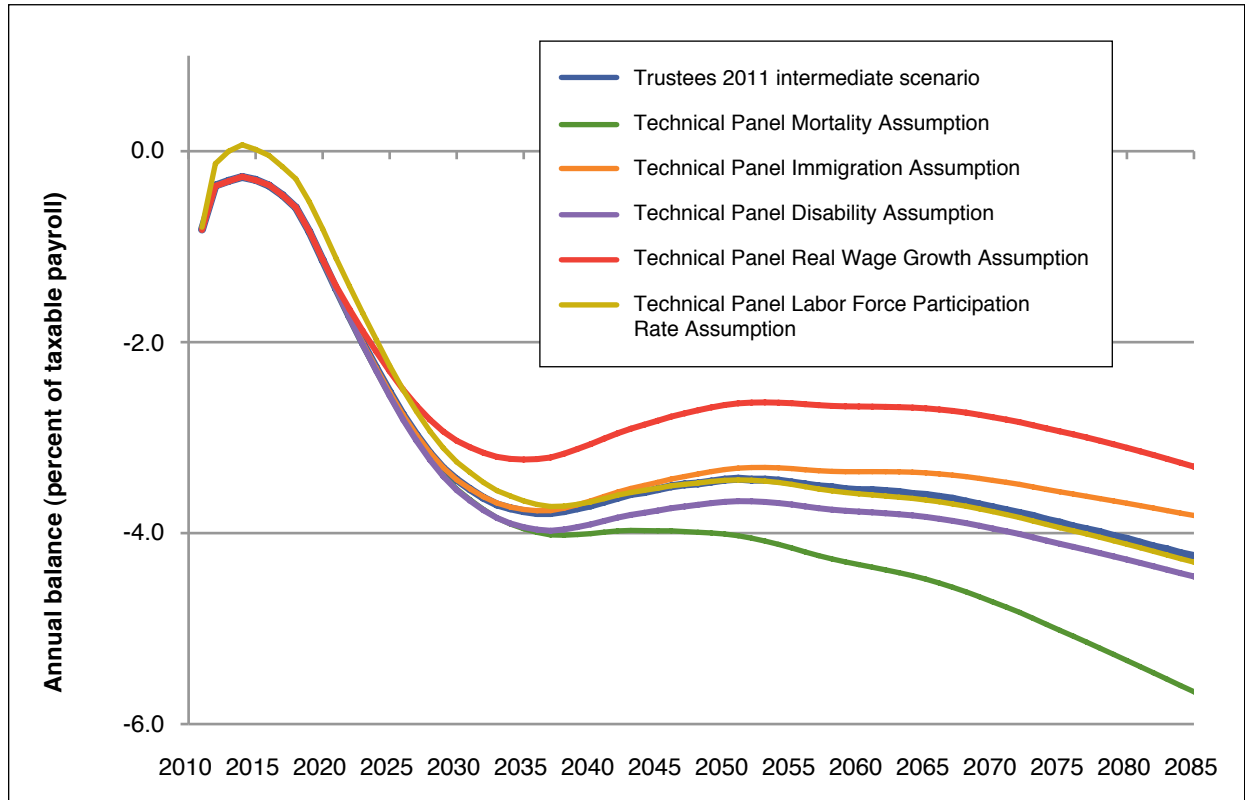
Figure 1 compares the projected Trust Fund ratio under the Panel's recommended assumptions with the 2011 projection of the Trustees. The combined OASDI Trust Fund balances remain positive only for a single year longer under the Panel's recommendations, until 2037 rather than 2036.

Figure 2 depicts the trajectory of the projected annual balance between the program's costs and income throughout the projection period. Trust Fund balances briefly return to surplus from 2013-2015 before permanently turning negative, largely because of higher labor force participation assumed in the short term. The annual balance between cost and income under the Technical Panel's assumptions is slightly higher (less negative) than assumed by the Trustees over the next 50 years, before falling lower (more negative) during the last 15 years of the projection horizon. The basic trajectory of the system's finances under either set of assumptions is very similar. Program costs increase much

more rapidly than income over the next 25 years as the baby boom generation retires, and then remain between three and four percent of payroll higher than income for roughly the next half century. By the end of the projection period, the effect of longer life spans pushes the annual deficits higher than four percent of payroll.

Figure 3 depicts graphically and **Table 2** numerically how individual assumptions affect the annual and 75-year summarized balances. In the short term, the Technical Panel's assumption of higher rates of labor force participation, especially at older ages, improves the annual balance by raising income and lower costs as older workers delay retirement. The effects of slightly higher labor force participation on near-term cash flows are significant because revenues are higher and outlays are lower. Some of this arises because of shifting cash flows across time. Younger workers paying more in taxes now will receive higher benefits later, which will mitigate the positive effect on system finances in the future. Also, to the extent that workers eligible for benefits delay collecting for a year or two, the actuarial adjustment will have an immediate effect

Figure 3. Incremental Effect of Individual Technical Panel–Recommended Assumptions on Trustees’ 2011 Projection of Annual Balances



Source: 2011 Trustees Report ; Projections by the Office of the Chief Actuary, Social Security Administration.

Table 2. Summary of Effects of Individual Recommended Assumptions on System Finances

| | 75-year balance | Change from Trustees | 25th year balance (2035) | Change from Trustees | 50th year balance (2060) | Change from Trustees | 75th year balance (2085) | Change from Trustees | Year Trust Fund ratio < 0 |
|-----------------------------------|-----------------|----------------------|--------------------------|----------------------|--------------------------|----------------------|--------------------------|----------------------|---------------------------|
| 2011 Trustees Report Intermediate | -2.22% | | -3.77% | | -3.55% | | -4.24% | | 2036 |
| Mortality | -2.68% | -0.46% | -3.95% | -0.18% | -4.33% | -0.78% | -5.66% | -1.42% | 2035 |
| Immigration | -2.14% | 0.09% | -3.75% | 0.02% | -3.36% | 0.19% | -3.82% | 0.43% | 2036 |
| Disability | -2.37% | -0.15% | -3.94% | -0.17% | -3.77% | -0.23% | -4.45% | -0.21% | 2035 |
| Labor Force Participation Rate | -2.14% | 0.08% | -3.66% | 0.11% | -3.59% | -0.04% | -4.30% | -0.06% | 2037 |
| Real Wage Growth | -1.79% | 0.44% | -3.23% | 0.54% | -2.67% | 0.87% | -3.30% | 0.94% | 2037 |
| Technical Panel Intermediate | -2.37% | -0.15% | -3.55% | 0.22% | -3.52% | 0.03% | -4.42% | -0.18% | 2037 |

on their benefit level that directly offsets the savings in costs realized in the short-term when they delayed collecting

Faster assumed real wage growth raises tax revenues sooner than it raises benefit levels and therefore has a large positive impact on annual balances throughout the projection period. Higher net immigration, assumed after 2025, improves annual balances in several ways. First, immigrants tend to enter the labor force immediately adding to the taxable payroll sooner than they begin to collect additional benefits. Second, their offspring generate larger future cohorts of workers. Third, some proportion of undocumented immigrants, working under improper Social Security numbers, may contribute payroll taxes, without ever claiming benefits from those contributions.

Faster growth of the disability system worsens annual balances by reducing the amount of taxable payroll, increasing the number of beneficiaries, and increasing the length of time that disabled beneficiaries are expected to receive benefits. Over the 75-year projection horizon the assumed increased cost of disability raises the actuarial deficit by about 0.15 percent of payroll and almost offsets the positive impact of higher assumed levels of immigration and rates of labor force participation.

The Technical Panel's assumption of longer life expectancy raises program costs as retirees are expected to collect benefits for longer periods. The impact grows over time, reducing the annual balance by -0.18 percent of payroll relative to the Trustees' projection in 2035, by -0.78 percent in 2060, and by -1.42% by 2085. Over the entire 75-year projection horizon, the assumption of longer life spans has the largest effect on system finances of any single recommended assumption, followed very closely but with the opposite impact on finances, of faster growth in real wages.

The effect of lower real interest rates is not reflected in the **Figure 3** or **Table 2**, but lower rates reduce interest income from the Trust Fund, raising the 75-year actuarial deficit. In addition, lower interest rates make values summarized in present value calculations appear larger, and the impact increases with the length of the summarized projection horizon.

1.1 Presentation of Uncertainty

The three most recent Technical Panels have all expressed dissatisfaction with the Trustees Reports' analysis and presentation of uncertainty about long-run Social Security finances. Some of that dissatisfaction has led to important methodological innovations developed by the Office of the Chief Actuary (OACT). As a result, the Trustees Report now contains three types of uncertainty analysis: high- and low-cost scenarios, stochastic simulation, and sensitivity analysis. Although some work remains to be done on the empirical analysis of uncertainty, we focus primarily on how uncertainty is presented. Building on the suggestions of earlier Technical Panels, we set forth three recommendations that are intended to make the presentation of uncertainty more useful to a broad spectrum of readers.

Presentation Recommendation P-1. The Technical Panel recommends expanding the list of key assumptions in summary Table II.C1 to include missing drivers of long-run Social Security finances. In addition, as warranted, the Technical Panel recommends presenting the values for key assumptions in a way that is useful to readers. Improved communication will likely involve reporting values for “indicator” variables that are directly determined by the more precise (but not easily interpretable) basic assumptions.

Presentation Recommendation P-2. The Technical Panel recommends removing the current presentation of uncertainty from the Summary (Chapter II) and from the section on Long-Run Actuarial Estimates (Chapter IV) and recommends replacing the Summary chapter presentation with sensitivity analysis for each of the key drivers of system finances. In addition, the Technical Panel recom-

mends basing the selection of the low- and high-cost values for key assumptions on consistency – in a probabilistic sense – both across and within assumptions. In other words, it is essential to make certain that the low- and high-cost values for any given variable are equally likely alternatives with respect to the intermediate alternative, even if this implies an asymmetric range between the intermediate and the high- and low-cost assumptions. Further, the Technical Panel recommends ensuring that the likelihood of realizations within the range of outcomes is the same across all key assumptions.

Presentation Recommendation P-3. The Technical Panel recommends adding a chapter on uncertainty that explains, compares, and contrasts the high- and low-cost scenarios with integrated scenarios and stochastic simulation. The Technical Panel also recommends emphasizing that sensitivity analysis is the starting point for every measure of overall uncertainty and noting that any overall measure of uncertainty involves varying the combinations of key assumptions in particular ways. Each scenario and stochastic approach should be presented in a comparable way, specify how the key assumptions vary in each measure of overall uncertainty, and discuss the impact on various measures of system financial outcomes.

Key Drivers of Long-Run System Finances

The Trustees Report introduces the concept of uncertainty within the first few pages of a lengthy document. Such an approach is appropriate in making readers aware that the baseline projections are sensitive to a handful of critical assumptions and that uncertainty is associated with the values for those assumptions. The first reference to uncertainty arises in summary Table II.C1, which lists three sets of long-range values for eight “key” de-

Table 3. Proposed Replacement for Table II.C1 from 2011 Trustees Report – Long-Range Values of Key Demographic, Programmatic, and Economic Assumptions for the 75-Year Projection Period

| | Intermedi- ate-Cost | Low-Cost | High-Cost |
|---|------------------------|----------|-----------|
| Long-Range Demographic Assumptions | | | |
| Total fertility rate (children per woman), starting in 2035 | 2.0 | 2.3 | 1.7 |
| Average period life expectancy at birth in 2085 | 85.0 | 81.3 | 89.0 |
| Average annual net immigration for 2011 – 2085 (000s) | 1,075 | 1,385 | 785 |
| Long-Range Programmatic Assumptions | | | |
| Disability incidence rate in 2030 (per 1,000 exposed, age-sex -adjusted) | 5.2 | 4.2 | 6.3 |
| Disability recovery-termination rates 2030 – 2085 (per 1,000) | 11.0 | 9.0 | 13.0 |
| Long-Range Economic Assumptions | | | |
| Age-sex-adjusted labor force participation rate in 2085 | 66.6% | 70.0% | 63.3% |
| Average annual real wage differential (percent) for 2021 – 2085 | 1.2 | 1.8 | 0.6 |
| Consumer Price Index (CPI), starting in 2019 | 2.8 | 1.8 | 3.8 |
| Unemployment rate (percent), starting in 2021 | 5.5 | 4.5 | 6.5 |
| Annual trust fund real interest rate (percent), starting in 2022 | 2.9 | 3.6 | 2.1 |
| Taxable share of payroll, starting in 2020 | 82.9 | 85 | 80.7 |
| Note: All values from 2011 Trustees Report, except values for low- and high-cost labor force participation rates and taxable share of payroll are specified by Technical Panel. | | | |

mographic and economic assumptions. The three sets of values pertain to the intermediate-, high-, and low-cost projections that reflect the “range of possible future experience.”

Tying uncertainty about system finances to uncertainty about input assumptions is an excellent starting point. Indeed, the Technical Panel’s first recommendation involves two marginal improvements that build on an already successful approach. The first recommendation calls for expanding the list of assumptions in Table II.C1 in order to provide the reader with a comprehensive list of the key drivers of long-run system finances. The second suggestion calls for presenting the assumptions in a more user-friendly way that could involve mapping some highly specific input assumptions into “indicator” variables with which readers enjoy some familiarity.

What Makes an Assumption “Key”?

The eight assumptions listed as key determinants in Table II.C1 receive considerable attention in the Trustees Report’s deliberations and are the focus of quadrennial Technical Panel reports. However, the Technical Panel believes that the current list is incomplete and that Table II.C1 should be expanded to include other key determinants of system finances. The Technical Panel recognizes the need to balance incremental information against the potential for overloading readers, but readers are currently

left unaware of critical sources of uncertainty about long-run system finances.

A few systematic criteria should be applied to determine if a given assumption should be included in the Summary. First, any assumption should have a significant exogenous component; that is, it should not lend itself to significant prediction by the other key assumptions in the projection. Second, the assumption itself should generate significant uncertainty. Third, varying the assumption across the range of possible future experience should have a noticeable impact on system finances.¹ Even though many assumptions could ultimately meet these criteria, the Technical Panel suggests that labor force participation, disability incidence and termination, and the taxable share of earnings are clear examples that may be added with modest effort (**Table 3**).

The first example of a missing key driver is labor force participation. Currently, labor force participation is treated as the outcome of a model described in Chapter V of the Trustees Report, along with other key elements of the projection.

¹ Interestingly, one of the assumptions on the current list – the unemployment rate – would probably not meet these criteria because the effect on system finances in the current model is second-order. The unemployment rate should remain on the list for both historical and evolutionary reasons, however. If and when the projection framework shifts to a more “bottom-up” micro-level approach for taxable earnings, the unemployment rate will become more important.

Chapter V also includes the criteria underlying the choice of values for the key assumptions in summary Table II.C1. However, the discussion in Chapter V makes it clear that labor force participation is in effect largely exogenous. Despite a structural model that relates labor force participation to (for example) longevity increases, the Trustees Report contains a telling description of the inconsistency:

“The projected labor force participation rates are not basic assumptions. They are derived from a historically-based structural relationship using demographic and economic assumptions specific to each alternative. However, the participation rates are not highly sensitive to most of the demographic and economic assumptions. Accordingly, the projected labor force participation rates do not vary substantially into the future and across alternatives.”

In sum, labor force participation is set and held fixed across alternatives, thereby eliminating any uncertainty about system finances arising from uncertainty about labor force participation. In fact, labor force participation, especially among the population age 62 and older, matters a great deal for Social Security finances. One set of estimates from OACT shows, for example, that if labor force participation among those age 45 and older returns to 1950s levels, half of the long-run summary actuarial balance would be resolved, delaying Trust Fund exhaustion by 18 years to 2055.² This assumption is probably extreme, but it arguably lies within the range of “possible future experience.” In any event, the criteria outlined above for categorizing labor force participation as a key assumption are all satisfied: labor force participation is largely exogenous with respect to the other key assumptions, there is uncertainty about whether the upward trend in labor force participation for the populations age 62 and older that has characterized the past two de-

² Based on testimony from Stephen C. Goss before the U.S. Senate Committee on Finance, July 15, 2010. Full text of the testimony may be found at http://www.ssa.gov/legislation/testimony_071510.htm. Another useful reference on the effects of varying the labor force assumption is Maestas and Zissimopoulos (2010). They show that continuation of the trend over the last two decades toward increasing labor force participation among the population age 62 and older would largely abate the projected surge in the beneficiary-to-worker ratio.

cadecades will continue, and the assumption has a first-order impact on system finances.

A second example of missing key assumptions involves disability incidence and termination. Rapid growth in the disability rolls is placing increased pressure on overall system finances, and the growth in disability prevalence may be traced back to both the incidence of disability and reduced rates of disability due to death as the nature of impairments has evolved. Interestingly, Chapter V of the Trustees Report devotes considerable attention to disability, which is also included in the sensitivity analysis of Appendix D. One complication that arises with disability is how to account for the conversion from disabled to retired worker beneficiary status that occurs at the Full Retirement Age, but that does not eliminate the need to draw out the implications of disability for overall system finances at any time point.

The third assumption suggested for inclusion in Table II.C1’s list of key assumptions is the taxable share of wages, which captures the effect of changes in the earnings distribution across the working population, but particularly around the statutory taxable threshold. Currently, the Trustees Report assumes that the taxable earnings share is effectively fixed at its most recent (cyclically adjusted) value. In fact, the taxable share has fallen in the past few decades, and there is no consensus as to why or whether the taxable share will continue to fall, stabilize, or even return to previous values. The assumed value of the taxable share matters a great deal for Social Security finances because moving a marginal dollar from just above to just below the taxable threshold has a large positive impact on system finances: the system collects revenue at a flat rate on taxable wages, but the progressive payout formula means that the benefits paid on earnings just below the taxable threshold are much lower than the revenue collected.

Specific values or ranges for the three inputs discussed above – labor force participation, disability, and, taxable share of wages – undergo review at length in later sections of this Technical Panel report. Two subthemes underlying the review are the considerable uncertainty associated with the three inputs and the notion that these inputs matter significantly for system finances. However, the suggestion for adding the inputs to the Summary chapter on uncertainty is independent of how the Trustees react to the specific suggested values presented later; the point is that readers of the

Trustees Report should know that system finances depend importantly on key input assumptions, which in turn embody considerable uncertainty. Thus, the following analysis is based on the range for these inputs as specified in the 2011 Trustees Report and not on the Technical Panel's recommended values.³

Making Reported Assumption Values User-Friendly

Some of the values for key assumptions in the Summary chapter of the Trustees Report are presented with great precision, but extreme precision can make it difficult to interpret both the intermediate assumption and the high- and low-cost range. Given the tradeoff between a high level of precision and effective communication, the Technical Panel believes that the Trustees Report should present a readily comprehensible discussion of the assumptions underlying the alternatives.

The best example of a tradeoff between precision and ease of interpretation is the presentation of mortality assumptions. The values reported in Table II.C1 pertain to the "Average annual percentage reduction in total age-sex-adjusted death rates from 2034 to 2084." While the table presents a highly precise concept, the interested reader can find the more typical measure of longevity improvement – the implied increase in life expectancy – carefully derived from the underlying death rate assumption in Chapter V of the Trustees Report. Although the other key assumptions in Table II.C1 are presented as easily interpretable growth rates or levels, some other measures in the report recommended for elevation to the level of "key" assumptions, such as disability incidence and termination rates and labor force participation, could be presented in either a more precise but less clear way, or in a less precise but more clear way.

Informed readers who have thought deeply about modeling mortality improvement will generally know exactly what assumptions undergird the table. However, the cost of specificity is that the casual reader – or even experts accustomed to looking at life expectancy projections as consumers – will find the age-sex-adjusted death rates uninformative. Thus, inserting the implied life expectancy outcomes in the summary table and moving the more detailed underlying assumption to the section

in Chapter V intended for in-depth consideration will likely improve communication with no loss in precision. Indeed, the only objection the Technical Panel can foresee is that some might argue that different profiles of decreasing death rates (by age and sex) would lead to the same change in life expectancy. Given that details about how death rates are perturbed appear in Chapter V, such an objection should not arise.

The Technical Panel recommends that the modest additions to Table II.C1 should be the first step in the Trustees Report's production and evaluation process. One reason for incrementally increasing the list of key assumption is that the Technical Panel also recommends subjecting each key assumption to sensitivity analysis, which is the second of the three suggestions regarding uncertainty as described below.

Sensitivity Analysis Should Be the Starting Point

A focus on sensitivity analysis in the Summary section will dovetail tidily with the suggested expansion of key assumptions. The relatively early introduction of sensitivity analysis will establish a key set of building blocks for the proposed new chapter on measures of overall uncertainty, also proposed by the Technical Panel (our third suggestion as described in the next section). In effect, the Technical Panel believes that much progress has been made on the analysis of uncertainty recommended by previous Technical Panels, but a reordering and change of emphasis is needed to compare, contrast, and reconcile the various measures.

The Trustees Report currently uses three approaches to presenting uncertainty. Though a case may be made for each approach, the current structure of the Report leads to confusion and even apparent inconsistencies. Currently, high- and low-cost scenarios are used in both the Summary (Chapter II) and the long-run section on actuarial estimates (Chapter IV). Stochastic simulation appears in the Summary (Chapter II) and in Appendix E, and sensitivity analysis is relegated to Appendix D. The Trustees Report does not as yet embody other types of "integrated" scenarios as recommended by the two previous Technical Panels.

Several approaches to presenting uncertainty are needed as each is characterized by strengths and weaknesses. However, there are several problems with how the three presentations are organized throughout the document.

³ The two exceptions are labor force participation and taxable share of earnings in that the current Trustees Report includes no meaningful variation for those inputs.

- In an apparent contradiction between scenario and stochastic results, the summary presentation (Chapter II) focuses on Trust Fund ratios. Specifically, it appears that the statistical likelihood of the low-cost scenario is negligible.
- Details are lacking about which input assumptions are varied and how they are varied in order to produce a range of possible outcomes for overall system finances.
- The report has a skewed emphasis on low- and high-cost scenarios; for example, only low- and high-cost scenarios appear in the long-run section of the actuarial estimates (Chapter IV).
- The unsubstantiated repudiation of stochastic results suggests that further refinement will confirm the low- and high-cost scenario ranges.
- Most important, the sensitivity of overall system finances to varying each key assumption across its feasible range, the fundamental building block for all uncertainty analysis, is buried in an appendix.

Most of these problems are the basis for our proposed new chapter on uncertainty, as described in the next section. For now, we focus on why and how sensitivity analysis should become the starting point for the discussion on uncertainty.

Any measure of uncertainty about the overall outcomes of a complicated model (in this case, the output is system finances) begins with varying the input assumptions. Scenario analysis involves moving one or more input assumptions in a systematic way; for example, the low- and high-cost scenarios shift all key assumptions (though again, it is not obvious exactly what moves) to their low- or high-cost values. For each key assumption, stochastic analysis samples from (an estimate of) the underlying probability distribution of that assumption. In both cases, the model is perturbed by introducing new values for assumptions. In other words, the initial step in any uncertainty analysis is to measure the model's sensitivity to changes in the inputs.

The reader interested in understanding uncertainty about system finances should know *why* uncertainty exists, *how* it relates to various inputs, and *when* that uncertainty will manifest itself in terms of affecting system finances. There are many ideas about how to aggregate the sensitivity of finances when varying several inputs in a scenario or stochastic framework, but varying any particular input across a fixed range and measuring the response of system finances transcends those differ-

ences. Sensitivity analysis is the starting point for any uncertainty measure.

Many approaches lend themselves to presenting sensitivity analysis in a summary format by demonstrating how system finances are affected and over what period of time. One approach to reporting the results of sensitivity analysis is to introduce a new table (what would become Table II.C2) in the Summary section that matches the new Table II.C1 along the main rows, shows the effect of varying the assumptions from high to low in sub-rows, and displays the time dimension across columns (**Table 4**). An alternative approach some readers may find more intuitive is to display ranges (**Figure 4**). Both approaches convey the extent to which uncertainty about particular assumptions leads to uncertainty about system finances and the timing of that uncertainty.

What will readers of the Trustees Report learn from the new emphasis on sensitivity analysis? One important lesson is that, despite uncertainty about the various inputs, the uncertainty associated with any input assumption is generally not sufficient to reverse the conclusion that system finances are expected to deteriorate over the next several decades. Another important lesson is that uncertainty increases dramatically with the length of the projection period, especially for assumptions involving cumulative effects such as mortality and fertility. A third important message is that some input assumptions such as labor force participation, real wage growth, and the taxable share of earnings warrant careful observation and could become key inputs into the policymaking process. A relatively modest improvement in any one of the three inputs would eliminate much of the expected deficit in the OASDI Trust Funds for all forecast horizons. If, for example, labor force participation increases, the positive effect on system finances would suggest the need for a lower near-term reduction in benefits or a smaller tax increase.

In addition to providing a more systematic approach to uncertainty, three reasons point to the advisability of leading off the Trustees Report with a discussion of sensitivity analysis. First, researchers inside and outside OACT will be better able to make direct comparisons of alternative models in terms of both the impact on baselines and how the model responds to changing inputs. Second, some observers will inevitably argue that the analysis of uncertainty in the Trustees Report neglected to highlight some important insights and therefore will suggest

Table 4. Proposed New Table II.C2. Sensitivity of Actuarial Measures to Variation in Long-Range Values of Key Demographic, Programmatic, and Economic Assumptions for the 75-Year Projection Period⁵

| | | Summary Actuarial Measure | | | |
|---|-----------|---------------------------|---------------------------|---------------------------|-------------------------------|
| | | 25-Year: 2011– 2035 | 50-Year: 2011– 2060 | 75-Year: 2011– 2085 | Annual Balance for 2085 |
| All Assumptions at Intermediate Values | | -0.60 | -1.78 | -2.22 | -4.24 |
| Effect of Varying Long-Range Demographic Assumptions | | | | | |
| Total fertility rate (children per woman), starting in 2035 | Low-cost | -0.62 | -1.70 | -1.86 | -2.43 |
| | High-cost | -0.58 | -1.88 | -2.60 | -6.50 |
| Average period life expectancy at birth in 2085 | Low-cost | -0.37 | -1.29 | -1.54 | -2.75 |
| | High-cost | -0.77 | -2.23 | -2.86 | -5.58 |
| Average annual net immigration for 2011 – 2085 (000s) | Low-cost | -0.49 | -1.60 | -2.01 | -3.88 |
| | High-cost | -0.70 | -1.97 | -2.44 | -4.66 |
| Effect of Varying Long-Range Programmatic Assumptions | | | | | |
| Disability incidence rate in 2030 (per 1,000 exposed, age-sex-adjusted) | Low-cost | -0.38 | -1.52 | -1.95 | -3.91 |
| | High-cost | -0.80 | -2.04 | -2.49 | -4.56 |
| Disability recovery-termination rates 2030 – 2085 (per 1,000) | Low-cost | -0.56 | -1.73 | -2.17 | -4.17 |
| | High-cost | -0.63 | -1.82 | -2.26 | -4.28 |
| Effect of Varying Long-Range Economic Assumptions | | | | | |
| Age-sex -adjusted labor force participation rate in 2085 | Low-cost | -0.21 | -1.45 | -1.95 | -4.15 |
| | High-cost | -1.03 | -2.16 | -2.54 | -4.34 |
| Average annual real wage differential (percent) for 2021 – 2085 | Low-cost | -0.09 | -1.01 | -1.36 | -2.71 |
| | High-cost | -1.11 | -2.58 | -3.10 | -6.00 |
| Consumer Price Index, starting in 2019 | Low-cost | -0.48 | -1.61 | -2.02 | -3.97 |
| | High-cost | -0.73 | -1.98 | -2.44 | -4.54 |
| Annual Trust Fund real interest rate (percent), starting in 2022 | Low-cost | -0.39 | -1.50 | -1.89 | -4.24 |
| | High-cost | -0.84 | -2.10 | -2.60 | -4.24 |
| Taxable share of payroll | Low-cost | -0.35 | -1.54 | -2.00 | -4.09 |
| | High-cost | -0.86 | -2.05 | -2.47 | -4.41 |

several integrated scenarios. While interaction effects militate against combining sensitivity analysis across two or more inputs, the same observers will nonetheless be better able (without direct input from OACT) to think about moving several inputs in deliberate ways to obtain new insights. Finally, sensitivity analysis may help improve coordination of uncertainty analysis between the OASDI and Medicare Trustees Reports. The two programs share many key input assumptions, but one Medicare input (the so-called excess cost growth rate) has only

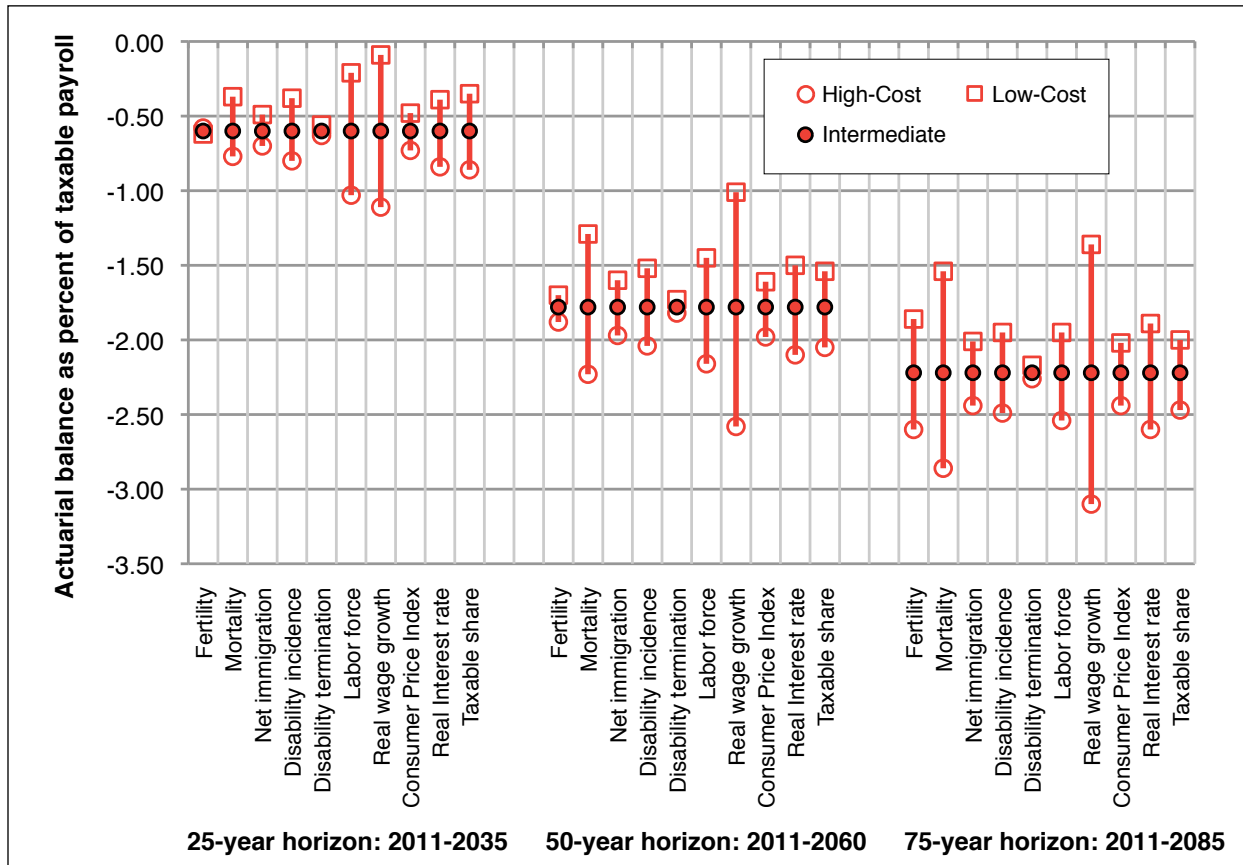
a second-order impact on OASDI (through the taxable share of compensation).

A New Chapter on Uncertainty Measures

One of the recommendations in the 2003 Technical Report called for adding a chapter on uncertainty to the Trustees Report. With that change yet to be made, the 2011 Technical Panel repeats the call for a new chapter devoted to a focused discussion on uncertainty. The Technical Panel believes that adopting our first two suggestions on presenting uncertainty makes the addition of a chapter on

⁴ All values in the table are based on Trustees Report (2011) assumptions, with the exception of labor force participation rate and taxable share, which take on the range recommended by the Technical Panel (see Table 1).

Figure 4. Sensitivity of Summarized Actuarial Balance to Range of Assumptions: 25-, 50-, and 75-Year Horizons (as a Percent of Taxable Payroll)⁴



Source: 2011 Trustees Report, Appendix D; additional estimates provided by Office of the Chief Actuary, Social Security Administration.

uncertainty both desirable and feasible. Given that the early part of the report will present a comprehensive list of key assumptions and a sensitivity analysis for each assumption, it makes sense to build on that presentation and describe how variation in the assumptions leads to different conclusions about overall uncertainty. In the absence of one perfect way to characterize overall uncertainty about Social Security system finances, the various alternatives will at least work from the same building blocks.

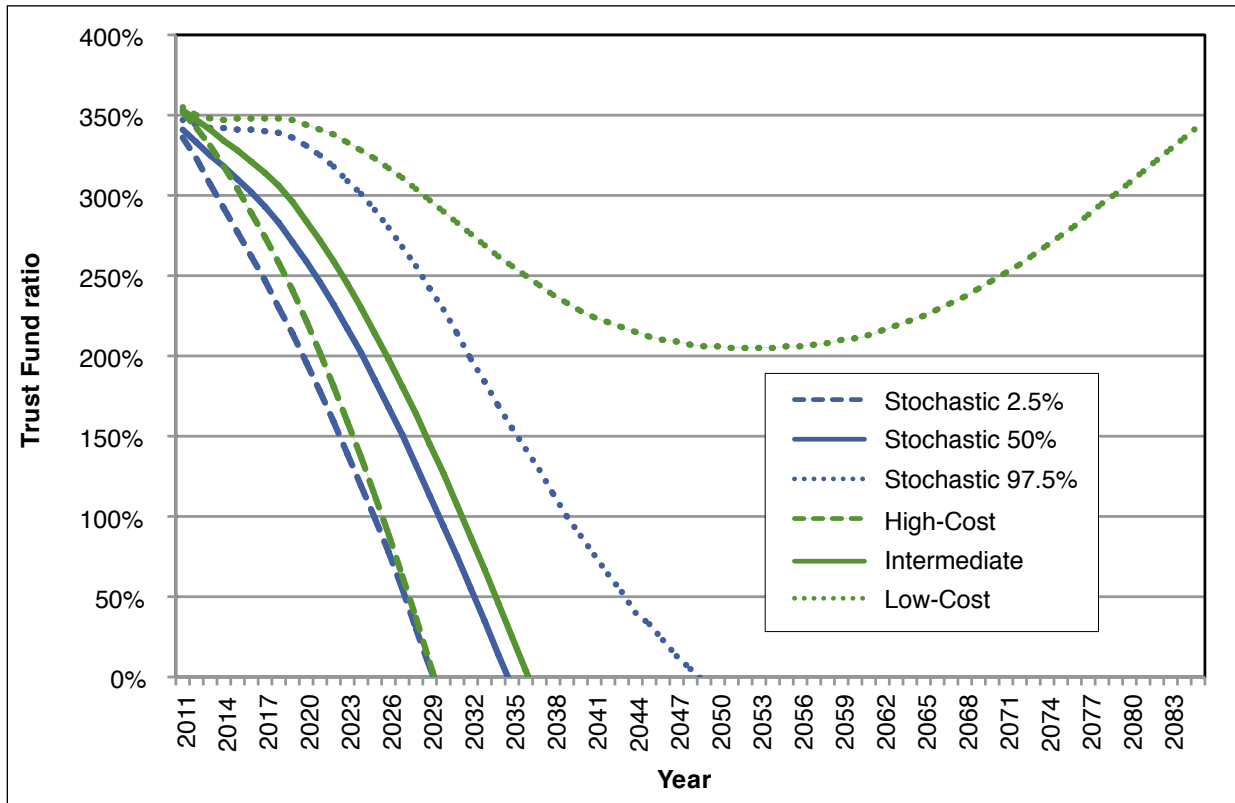
The goal of the new chapter is to consider possible ways of devoting equal attention to measuring and presenting overall uncertainty about system finances. The new chapter would explain, compare, and contrast high- and low-cost scenarios, integrated scenarios, and stochastic simulation and recognize that each approach to characterizing uncer-

tainty involves its own strengths and weaknesses and thus may be better suited to different applications. In short, the alternative approaches should not be presented as simple alternatives without explanation and a discussion of appropriate context. The new chapter should address how and why the different approaches to varying inputs lead to different conclusions about the uncertainty of overall system finances.

The case for a new chapter on uncertainty begins with the apparent contradiction that many readers experience when they first encounter the extent to which high- and low-cost Trust Fund ratios diverge from stochastic projections. That apparent inconsistency stems from the presentation on uncertainty for Trust Fund ratios in the current Trustees Report Summary chapter. The reader encounters two charts, both built around the intermediate projection, but with different bands characterizing uncertainty. To highlight the apparent contradiction, the Technical Panel has combined the data from the two charts into a single chart (**Figure 5**).

⁵ All values in the table are based on Trustees Report (2011) assumptions, with the exception of labor force participation rate and taxable share, which take on the range recommended by the Technical Panel (see Table 1).

Figure 5. Comparison of Deterministic Scenarios and Stochastic Trust Fund Ratios, 2011 Trustees Report



Source: 2011 Trustees Report, Figures II.D6 and II.D7.

The newly created chart shows that, under the high-cost assumptions, the Trust Fund is exhausted in 2029, a little less than a decade earlier than in the intermediate case. Under the low-cost assumptions, the Trust Fund remains solvent; in fact, the Trust Fund ratio rises after 2055. However, the stochastic analysis yields what appears to be a markedly different view of uncertainty. The 2.5th percentile of outcomes shows a Trust Fund that is exhausted in 2030, which is roughly the same as the high-cost outcome. However, the 97.5th percentile shows a Trust Fund that is exhausted in 2049, with a downward trajectory that diverges markedly from the low-cost scenario. As a summary chapter, the current text presents these stark differences with little context or explanation⁶

⁶ The only attempt at reconciling the two sets of uncertainty measures involves a disproportionate qualification of the stochastic projections. The accompanying text states that “. . . the relationship between the stochastic results and the low- and high-cost alternatives may change as the methodology for the stochastic simulations is further developed. As noted in Appendix E, future improvements and refinements are expected to be more likely to expand rather than reduce the indicated range of uncertainty.”

and is precisely why the Technical Panel argues for a new chapter on uncertainty.

How Do the Scenario and Stochastic Simulation Approaches Differ?

The Trustees Report is careful to describe high- and low-cost scenarios as a “range of possible future outcomes” while the stochastic projections estimate the “probability distribution of future outcomes.” This terminology does not reflect the substantive similarities and differences between approaches. The important similarities tie back to sensitivity analysis; that is, both approaches change key input assumptions and recalculate the trajectory for system finances. The important difference between scenario and stochastic analysis is *how* the key input assumptions vary.

Three dimensions warrant consideration when changing the key input assumptions and resolving the model for system financial outcomes. The first dimension is the typical *distance* from the means or expected values across input assumptions; the second dimension is the *persistence* of the deviations from the means; and the third dimension is the *cor-*

Table 5. 75-Year Values for Input Assumptions in Deterministic and Stochastic Uncertainty Calculations: 2004

| | Central Values | | Deterministic Range | | Stochastic Range | |
|---|----------------|------------|---------------------|------------|------------------|-------------------|
| | Deterministic | Stochastic | Low-Cost | High- Cost | 2.5th percentile | 97.5th percentile |
| Demographic Assumptions | | | | | | |
| Average total fertility rate | 2.0 | 2.0 | 2.2 | 1.8 | 2.3 | 1.6 |
| Increase in male period life expectancy at birth | 6.9 | 7.4 | 3.6 | 11.3 | 2.9 | 11.3 |
| Increase in female period life expectancy at birth | 5.6 | 5.9 | 2.6 | 9.6 | 2.1 | 10.2 |
| Increase in male period life expectancy at age 65 | 4.2 | 4.5 | 1.7 | 7.5 | 1.6 | 8.3 |
| Increase in female period life expectancy at age 65 | 3.9 | 4.3 | 1.4 | 7.1 | 0.9 | 8.6 |
| Average legal immigration | 812 | 811 | 1,070 | 685 | 1,127 | 491 |
| Average legal emigration | 203 | 203 | 214 | 206 | 210 | 196 |
| Average net other immigration | 320 | 320 | 470 | 570 | 207 | 75 |
| Economic Assumptions | | | | | | |
| Average unemployment rate | 5.5 | 5.6 | 4.6 | 6.4 | 4.7 | 6.7 |
| Average (geometric) inflation rate | 2.8 | 3.0 | 1.8 | 3.8 | 1.8 | 4.6 |
| Average (geometric) real interest rate | 3.0 | 3.0 | 3.7 | 2.2 | 3.9 | 2.1 |
| Average (geometric) real average covered wage | 1.1 | 1.1 | 1.6 | 0.6 | 1.7 | 0.6 |
| Programmatic Assumptions | | | | | | |
| Average male disability incidence rate | 6.1 | 6.1 | 5.0 | 7.3 | 5.6 | 6.6 |
| Average female disability incidence rate | 5.2 | 5.2 | 4.2 | 6.2 | 4.7 | 5.7 |
| Average male disability recovery rate | 11.5 | 11.5 | 13.5 | 8.4 | 12.4 | 10.6 |
| Average female disability recovery rate | 10.4 | 10.4 | 12.3 | 7.7 | 11.2 | 9.5 |

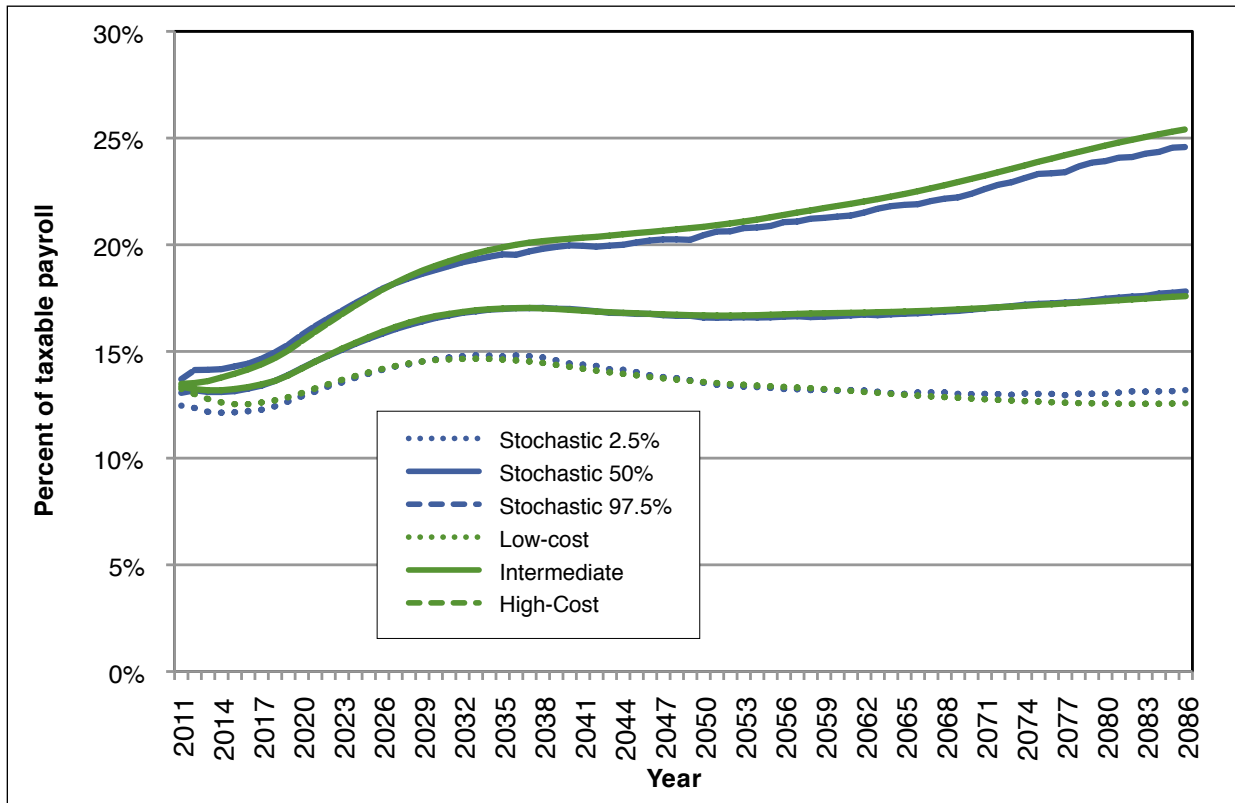
Source: Social Security Actuarial Study No. 117, September 2004.

relation in deviations from means across the various input assumptions. Every stochastic simulation involves the selection of a unique value of each key input assumption in every year of the simulation while high- and low-cost scenario analysis involves the selection of one new value that will hold for the entire projection period. However, that is just the starting point: understanding the implications for the range of system financial outcomes requires

characterizing the difference in simulation strategy in terms of the three dimensions.

The first dimension, which is the typical deviation between the baseline input assumption value and alternative simulation value(s), turns out not to be pivotal to understanding why stochastic simulations diverge from high- and low-cost simulations (**Table 5**). The high- and low-cost values for the key input assumptions do not differ significantly from

Figure 6. Comparison of Deterministic Scenarios and Stochastic Cost Rates, 2011 Trustees Report



Source: 2011 Trustees Report, Figures IV.B1 and VI.E2.

the 95 percent confidence intervals for the average realizations of the stochastic draws for those variables. Despite some differences between the high- and low-cost ranges and the 95 percent confidence range for the average of draws across inputs over the 75-year projection period, such differences are small and not systematic. That is, in some instances, the stochastic range is wider than the high- and low-cost range; in other instances, the range is narrower.⁷

Ruling out differences in typical deviations from central tendencies across input assumptions has a testable implication for the system’s financial projections. In any given year of the projection, the range of average realized values for every input through that particular projection year is similar to the range for the high- and low-cost values. In other words, in any given projection year, the range

for system flows in that particular year should be similar. This is distinct from saying that the range of cumulative outcomes through that particular projection year should be similar; it is effectively a flow versus stock concept.

The prediction associated with the similar ranges for the key input assumptions is supported by data from the Trustees Report (**Figure 6**). The cost rate is effectively benefits paid divided by taxable payroll in any given year. The range of the 95 percent confidence interval for cost rates from the stochastic projections is very similar to the high- and low-cost scenario cost rates, especially at long horizons. Indeed, had a figure such as **Figure 6** been the first item a reader encountered, the differences between stochastic and high- and low-cost scenario analysis might be considered second-order.

Given that the ranges for (average) values across the input assumptions are not markedly different and that the resulting ranges for annual system financial flows are similar, why do the ranges for projected Trust Fund ratios differ so dramatically? Clearly, it is the approach of cumulating *persistent*

⁷ This is actually a reassuring finding because it suggests that, although there is no specific probabilistic interpretation assigned to the high- and low-cost ranges, the ranges are consistent in practice with the time-series decomposition of historical variation that underlies the stochastic approach.

and *correlated* deviations across input assumptions in the high- and low-cost scenarios that leads to the apparent contradictions about Trust Fund ratios, not the range for any given input assumption in any given year. This is the crucial message that the reader of the Trustees Report never sees. Rather, the divergence in ranges for Trust Fund ratios is inappropriately attributed to fundamentally different beliefs about the input assumptions.⁸

Should a reader of the Trustees Report think of the low-cost projection for the Trust Fund ratio as a serious possibility? The decomposition above makes it clear what would be involved. Not only would *every* input assumption need to be realized at what can be thought of as its 97.5th percentile low-cost value, it would also have to do so in *every* projection year. It is the persistence of and correlation between input assumptions that drives the cumulative outcomes such as the Trust Fund ratio, not some fundamental disagreement about the possible future range for any given input assumption. The low-cost range seems unlikely from the perspective of the stochastic simulations because it requires an unlikely combination of movements in input assumptions, not because any given input assumption moves in an unlikely way.

In addition to comparing and contrasting the various approaches to presenting uncertainty, one other aspect of the suggestion for adding a new chapter on uncertainty is equal treatment. The alternative measures – high- and low-cost scenarios, integrated scenarios, and stochastic analysis – should all be presented on an even footing. Establishing equality will involve reorganizing some long-standing presentations in the Trustees Report. In particular, although the current Trustees Report presents both stochastic and high- and low-cost analysis of Trust Fund ratios in the Summary, the discussion of uncertainty about long-run actuarial measures in Chapter IV presents only high- and low-cost scenarios. That discussion could just as easily address 95 percent confidence intervals from the stochastic analysis, and in a comprehensive chapter on uncertainty, it would be useful to include both (or even some integrated scenarios). In effect, a fundamental shift in the presentation of uncertainty can and should be the basis for recasting the apparent superiority of the high- and low-cost scenario approach that still dominates the Trustees Report.

⁸ See Footnote 6.

1.2 Actuarial Metrics

Method Recommendation M-1. The Technical Panel recommends providing micro-level (individual) financial measures of the Social Security system in conjunction with macro-level (program-wide) financial measures of the system.

Method Recommendation M-2. The Technical Panel recommends adding a subsection to Chapter IV, Section B of the Trustees Report that provides more discussion and analysis of sustainable solvency.

Method Recommendation M-3. If the Trustees accept Recommendation M-2, then the Technical Panel recommends eliminating the Infinite Horizon metric.

Actuarial Metric Review

The annual Trustees Report presents several actuarial metrics, both short- and long-range, that show the relationship of workers to beneficiaries; current and projected funded status; and the change in funded status from the previous year and historically. Overall, the metrics are comprehensive and presented clearly. The Trustees Report provides metrics that satisfy the Actuarial Standard of Practice for Social Insurance (ASOP 32) as well as the Federal Accounting Standards Advisory Board Exposure Draft on reporting the financial status of the Social Security system in the context of the unified budget.

The following measures used in the Trustees Report are summarized and discussed below:

- Worker-to-Beneficiary Ratio
- Short-Range Measure (Trust Fund ratios)
- Long-Range Measures

Worker-to-Beneficiary Ratio

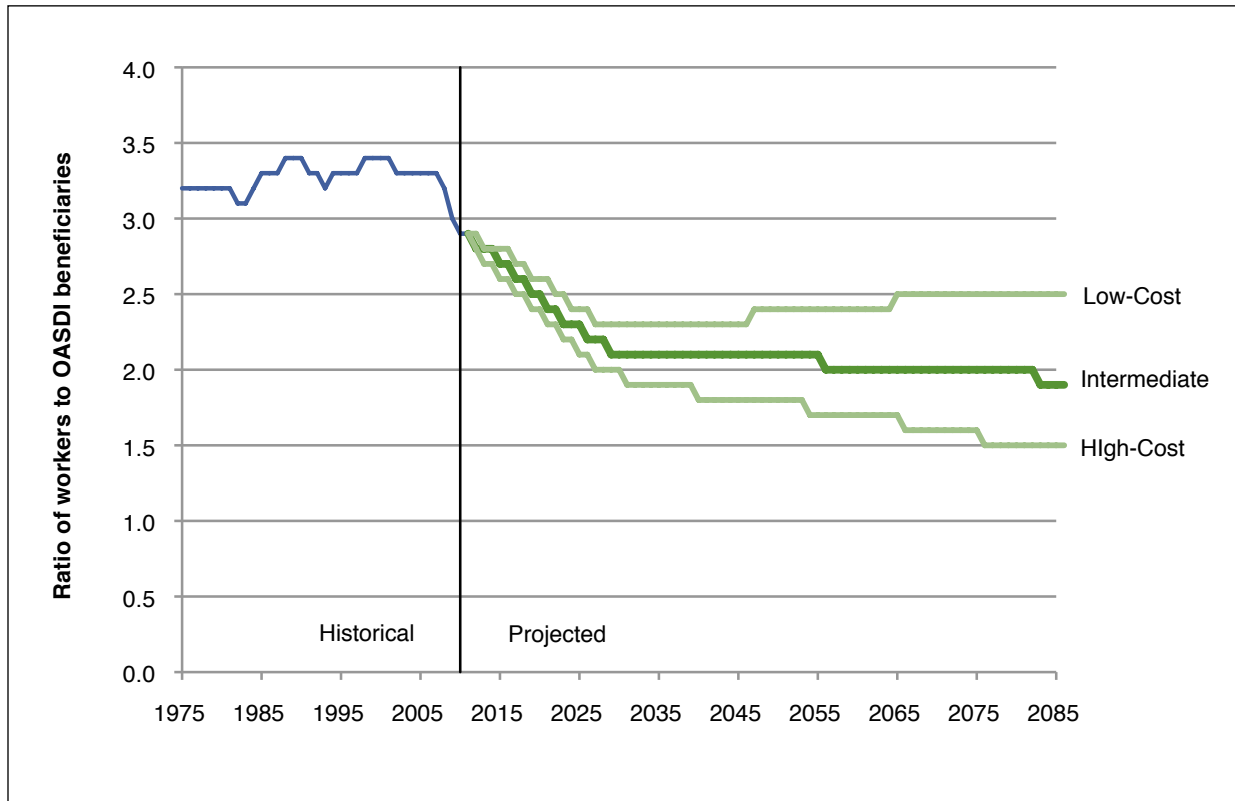
A pay-as-you-go (pay-go) system will work if the following equation is true for any period of time:

$$B \times \text{Number of beneficiaries} = C \times \text{Number of workers}$$

where B = average annual benefit (in dollars) and C = average annual contribution (in dollars). We rewrite the equation as follows:

$$\frac{B}{C} = \frac{\text{Number of workers}}{\text{Number of beneficiaries}}$$

Figure 7. Covered Worker to OASDI Beneficiary Ratio: Historical (1975–2010) and Trustees’ Projection (2011–2086)



Source: 2011 Trustees Report, Table IV.B2.

If the Worker-to-Beneficiary Ratio is decreasing such that the number of beneficiaries is increasing faster than the number of workers, then a pay-go system will work only if the benefits (B) decrease or the contributions (C) increase by a corresponding amount. **Figure 7** presents the Worker-to-Beneficiary Ratios as depicted in the 2011 Trustees Report.

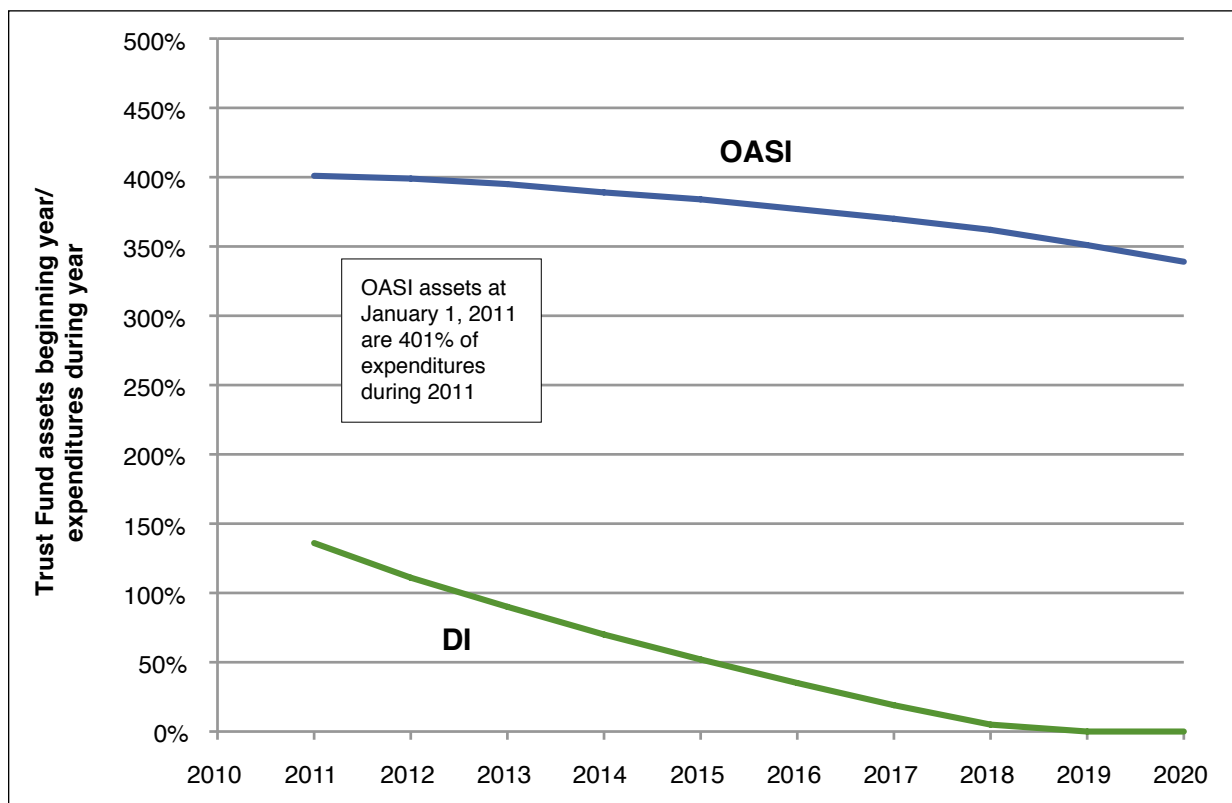
The Worker-to-Beneficiary Ratio remained relatively stable at approximately 3.3 from 1975 to 2000. Since 2000, the ratio has dropped to 2.9. Under the intermediate assumptions, the ratio is projected to decrease significantly until 2035 and then become stable again at approximately 2.0. For a given level of contributions, a dependency ratio of 2.0 will support only 60 percent (2/3.3) of the benefits that a dependency ratio of 3.3 will support under a pay-go system. Social Security is not a strictly pay-go system; therefore, the decrease in benefits required to maintain solvency is not 60 percent as suggested by the example; the example indicates, however, the significance of the dependency ratio for a plan that is largely pay-go.

Short-Range Measures (Trust Fund Ratios)

The Actuarial Standards Board (ASB) establishes professional standards for actuarial work. In ASOP 32, the ASB sets forth standards for actuaries practicing in the field of social insurance. For social insurance programs whose funding level is set through legislation, the standard requires the actuary to:

1. Establish a test for financial adequacy, based on criteria such as:
 - Required Trust Fund levels under best-estimate assumptions
 - Positive Trust Fund levels under pessimistic assumptions
 - Sufficiently low probability of ruin or an acceptable range of possible outcomes under a stochastic model
2. Apply the test to both short- and long-range periods
3. Note significant differences between income and cost toward the end of the valuation period

Figure 8. Projected OASI and DI Trust Fund Ratios: 2011-2020



Source: Trustees Report, Table IV.B3, 2011.

The Trustees Report includes a short-range test for financial adequacy based on Trust Fund ratios, defined as the assets at the beginning of a year (BOY) expressed as a percent of cost during a year. A ratio of 100 percent (i.e., enough assets at BOY to cover the coming year’s “scheduled” benefit payments) is considered a reasonable “contingency reserve.” The short-range test, applied to OASI and DI separately, is satisfied as follows:

- If the ratio is greater than 100 percent at the beginning of the projection period, then it must remain above 100 percent for the 10-year projection period; or
- If the ratio is less than 100 percent at some point during the projection period, then it must reach 100 percent within five years (without first reaching zero) and stay above 100 percent for the remainder of the projection period.

As shown in **Figure 8**, the OASI Trust Fund passes the short-range test for financial adequacy but the DI Trust Fund fails. This important metric sends a strong signal to the readers of the Trustees

Report that disability benefits are not financially secure under the current program of benefits and contributions and thus warrant attention.

Long-Range Measures

The Trustees use several metrics for presenting the long-range financial status of the Social Security system, including:

- A. Trust Fund Ratios
- B. Projected Annual Balances
- C. Actuarial Balance
- D. Open Group Unfunded Obligation
- E. Infinite Horizon Unfunded Obligation
- F. Closed Group Unfunded Obligation

A. Trust Fund Ratios

For the long range, Trust Fund ratios are indicators of the adequacy of financial resources at a point in the future. Of course, a Trust Fund ratio of zero indicates the exhaustion of the Trust Fund and implies insufficient assets to pay all scheduled benefits. The year of exhaustion, the stability during the period, and the trend at the end of the peri-

od are important for assessing the fund's actuarial status. For example:

- Near-term exhaustion indicates the need for immediate action.
- If the ratio is positive during the period and level or increasing at the end of the period, then projected adequacy is likely to continue into future periods.

B. Projected Annual Balances

Projected Annual Balances are developed by OACT and used to assess the Trust Fund's financial status. Projected Annual Balances are defined as the difference between the Annual Income Rate and Annual Cost Rate. The Annual Income Rate is the income from payroll taxes plus the revenue from the taxation of benefits, with the result expressed as a percentage of OASDI taxable payroll or Gross Domestic Product (GDP) for the year. The Annual Cost Rate is the sum of the scheduled benefit payments for the year, administrative expenses for the year, net transfers to Railroad Retirement for the year, and payment of vocational rehabilitation services for disabled participants for the year, with the result expressed as a percentage of OASDI taxable payroll or GDP for the year.

The Annual Balance is then defined as the difference between the Annual Income Rate and Annual Cost Rate or the net cash flow rate, without taking into account interest earnings on the Trust Fund. As with the Trust Fund ratios, the level and trend of the Annual Balances at the end of the long-range period demand special attention.

C. Actuarial Balance

Related to the Projected Annual Balances, the Actuarial Balance presents a present-value analysis that compares the Summarized Income Rate to the Summarized Cost Rate as defined below.

The **Summarized Income Rate** is the ratio of the sum of the present value of scheduled tax income for each year of the period to the sum of the present value of taxable payroll for each year of the period. The Summarized Income Rate is adjusted to include the present value of the Trust Fund's assets at the beginning of the period.

The **Summarized Cost Rate** is the ratio of the sum of the present value of cost for each year of the period to the sum of the present value of taxable payroll for each year of the period. The Summarized Cost Rate is adjusted to include a targeted ending Trust Fund bal-

ance equal to one year of benefit payments in the year following the end of the forecast period.

The **Actuarial Balance**, defined as the difference between the Summarized Income Rate and Summarized Cost Rate, is developed for 25-, 50-, and 75-year periods. The varying periods allow for an assessment of the financial adequacy of the Trust Fund over different-length periods. One shortcoming of the Actuarial Balance is that it shows funding status only at one time point and does not provide information about what happens in the interim. The Test for Close Actuarial Balance, described below, addresses this shortcoming by looking at 66 valuation periods.

Test for Close Actuarial Balance. Consistent with ASOP 32, the Trustees Report presents a long-range test (Test for Close Actuarial Balance) for financial adequacy as described below. The failure of the test indicates that, over the long term, the current-law level of financing is not adequate to pay for currently scheduled benefits.

The Actuarial Balances over 66 valuation periods are useful in developing a test of "close" actuarial balance. The 66 separate valuation periods are:

- The first 10-year period
- The first 11-year period
- The first 12-year period
- Successive periods each longer by one year through the full 75-year projection period

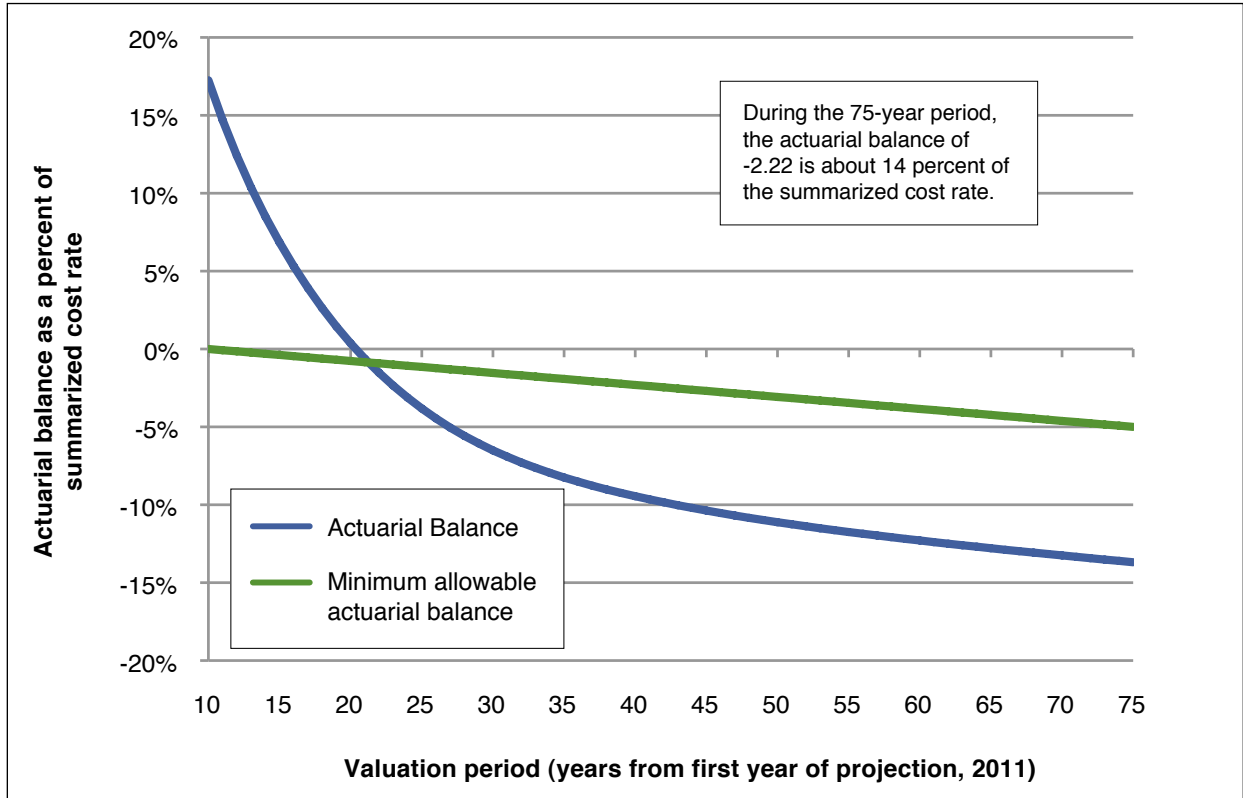
The test is met if (1) the Actuarial Balance is not less than zero in any valuation period, or (2) if negative, then by no more than a specified percent of Summarized Cost Rate for the same period. The specified percent is zero before 10 years, with a maximum of 5 percent at the end of the 75-year period. The notion is that the longer the projection period, the less certain are the results, with more deviation allowed. The 2011 Trustees Report provides the results of the Long-Range Close Actuarial Balance test as shown in **Figure 9**.

D. Open Group Unfunded Obligation

The Open Group Unfunded Obligation, which includes all participants (i.e., past, current, and future) projected over a 75-year period, is defined as:

- The present value of future costs, minus
- The present value of future taxes, minus
- The Trust Fund at the beginning of the period.

Figure 9. Long-Range Test for Close Actuarial Balance: Comparison of Long-Range Actuarial Balances with the Minimum Allowable for Close Actuarial Balance, Based on Intermediate Assumptions



Source: Trustees Report, Figure IV.B4, 2011.

The 2011 Open Group Unfunded Obligation is expressed in dollars (in trillions) and as a percentage of either taxable payroll or GDP as follows (under the intermediate assumptions):

| | |
|--|--------|
| Dollars in Trillions | \$6.50 |
| Percent of Taxable Payroll | 2.1 |
| Percent of Gross Domestic Product | 0.7 |

The difference between the 2011 Trustees Report 75-year Actuarial Balance of -2.22 percent and the Open Group Unfunded Obligation expressed as a percentage of taxable payroll of 2.1 percent (in addition to its opposite sign) is that the Actuarial Balance includes an additional obligation equal to the present value of the ending target Trust Fund.

The Open Group Unfunded Obligation shows another view of the adequacy of funds over a long period. While important, the uncertainty associated with a 75-year projection may be large. It can also hide some of the shorter-term financial issues if not used with short-term metrics.

E. Infinite Horizon Unfunded Obligation

The Infinite Horizon Unfunded Obligation results from extending the projection of the unfunded obligation for one thousand years into the future. The extension assumes that the current law remains in force and that demographic and economic assumptions remain unchanged into the future. Of course, even more than a 75-year projection, the uncertainty of such estimates is substantial.

The Trustees use the Infinite Horizon Unfunded Obligation to provide an estimate of the immediate increase in the payroll tax rate or immediate decrease in paid benefits that would eliminate the actuarial deficit. The 2011 Infinite Horizon Unfunded Obligation under the intermediate assumption is 3.6 percent of payroll or 1.2 percent of GDP.

F. Closed Group Unfunded Obligation

The Open Group Unfunded Obligation described above may be disaggregated into the unfunded obligation for past, present, and future participants. The unfunded obligation for past and current par-

ticipants (limited to individuals who attain age 15 or older in the valuation year) is then referred to as the Closed Group Unfunded Obligation.

Purpose of Metrics

The Trustees Report uses several long-range metrics. The purpose for which a Social Security metric is to be used determines the proper group of participants (e.g., current versus current and future participants) for inclusion in a particular calculation of liabilities. The long-range metrics used by the Trustees test the adequacy of income during the 75-year period against benefits payable during the same period. In other words, groups of future workers expected to pay into the system any time during the period are included in the valuation, thereby making the Open Group Unfunded Obligation the relevant metric.

In accounting for the obligations of the Social Security system, the revenues generated by the group of current workers is intended to be matched against the expense incurred for the same group of current workers. For this reason, the Closed Group Unfunded Obligation is the relevant metric used by the Federal Accounting Standards Advisory Board for accounting purposes. The Technical Panel believes that Social Security is unique in the long-term nature of its obligations and thus requires the separate metrics in the Trustees Report. Accounting metrics should not blur the financial solvency perspective of the Trustees Report, which nonetheless provides the projected annual income and cost figures used by the General Accounting Office (GAO) to develop a unified budget.

Literature Review

We performed a literature review to determine what metrics other experts and organizations use to describe the financial condition of Social Security or other social insurance systems. We reviewed metrics used by:

- The Congressional Budget Office in its *Long-Term Projections for Social Security*
- The Canadian Office of the Chief Actuary in its *25th Actuarial Report on the Canada Pension Plan* (December 31, 2009)

Metrics Used by the Congressional Budget Office

The Congressional Budget Office (CBO) in its publication *Long-Term Projections for Social Security*

relies on several of the same metrics used in the Trustees Report, including the following:

- Tax revenues as a percentage of GDP
- Outlays as a percentage of GDP
- Summarized revenue – present value of revenue divided by present value of GDP (including the Trust Fund balance)
- Summarized outlay – present value of outlay divided by present value of GDP (including additional final-year outlay)
- Trust Fund ratios

CBO Ratios. CBO presents “revenue” and “outlays” as a percentage of GDP, whereas the Trustees present “income” and “costs” both as a percentage of taxable payroll and a percentage of GDP. The difference in metrics is consistent with the different focus of the two agencies. It is important for the Trustees to present the deficit as a percentage of the taxable payroll because it gives the order of magnitude of the tax rate increase that would be required to eliminate the deficit. The CBO focuses on the budget for all federal government programs and needs to present Social Security financial results as a percentage of GDP in order to compare and combine results with other budget items.

CBO Uncertainty. CBO presents the uncertainty related to its financial measures by using a stochastic analysis (500 stochastic trials). The Trustees, however, present uncertainty related to their financial measures in several ways, including stochastic analysis. The Trustees have chosen high- and low-cost scenarios as their most prominent method for presenting uncertainty. In the previous section of this report, the Technical Panel provides a detailed recommendation for presenting uncertainty.

CBO Individual Metrics. CBO provides the following individual metrics for 10-year birth cohorts, separately for men and women and separately for low, medium, and high earners:

- Median first-year Social Security benefits in current-year dollars (net of income taxes) assuming age 65 claiming age
- Median first-year replacement rates
- Median present value of lifetime Social Security benefits (net of income taxes)
- Present value of net lifetime benefits and present value of payroll taxes paid, by earnings quintile

Table 6 is taken from the individual measures provided by CBO in its 2010 projection report.

Table 6. Median Initial Age 65 Benefit for All Retirees

| 10-Year Birth Cohort | Benefit |
|----------------------|----------|
| 1940s | \$17,000 |
| 1960s | \$18,000 |
| 1980s | \$22,000 |
| 2000s | \$29,000 |

Source: Congressional Budget Office, 2010.

The Trustees also provide individual metrics in Appendix F of their report in a section titled “Estimates in Dollars.” **Table 7** (excerpted from Appendix F of the 2011 Trustees Report) provides the annual scheduled benefit at full retirement age and at age 65 for scaled medium earners by year of attainment of age 65.

Table 7. Annual Age 65 Scheduled Benefit for Scaled Medium Earner

| Year Attain Age 65 | Benefit | Percent of Earnings |
|--------------------|----------|---------------------|
| 2011 | \$17,000 | 41% |
| 2030 | \$20,000 | 36% |
| 2050 | \$25,000 | 36% |
| 2070 | \$32,000 | 36% |

Source: 2011 Trustees Report, Appendix F.

Metrics in the 25th Actuarial Report on the Canada Pension Plan (CPP)

The Canada Pension Plan uses several different actuarial metrics in evaluating their system finances:

- Asset-to-expenditure ratios
- Projected pay-as-you-go rates
- Net cash flow
- Contributory earnings (similar to Social Security taxable payroll)
- Shortfall (defined as expenditures minus contributions) as a percentage of investment earnings
- Investment earnings as a percentage of revenue (contributions plus investment earnings)

The CPP report provides financial status metrics in tabular form as both nominal amounts and amounts adjusted to 2010 dollars. It presents an-

nual amounts for 35 years and then in 5-year increments for an additional 40 years. The financial status metrics are developed for two alternative contribution assumptions (minimum rate and steady-state rate).

The 2011 Trustees Report provides dollar values in Appendix F, Tables VI.F8 and VI.F9. Nominal annual amounts are provided for 20 years and then in 5-year increments. The Trustees Report does not provide pay-as-you-go contribution amounts but otherwise provides metrics similar to those in the CPP report.

CPP Uncertainty. The CPP report presents uncertainty in terms of the following alternative scenarios:

- Younger Population Scenario (higher fertility, more immigration, slower mortality improvement, higher unemployment, earlier retirement, lower real wage increases, lower inflation, higher real rates of return)
- Older Population Scenario (lower fertility, less immigration, faster mortality improvement, lower unemployment, later retirement, higher real wage increases, higher inflation, lower real rates of return)
- Investment Policy Alternatives
- Financial Market Tail Events
- Economic Slowdown

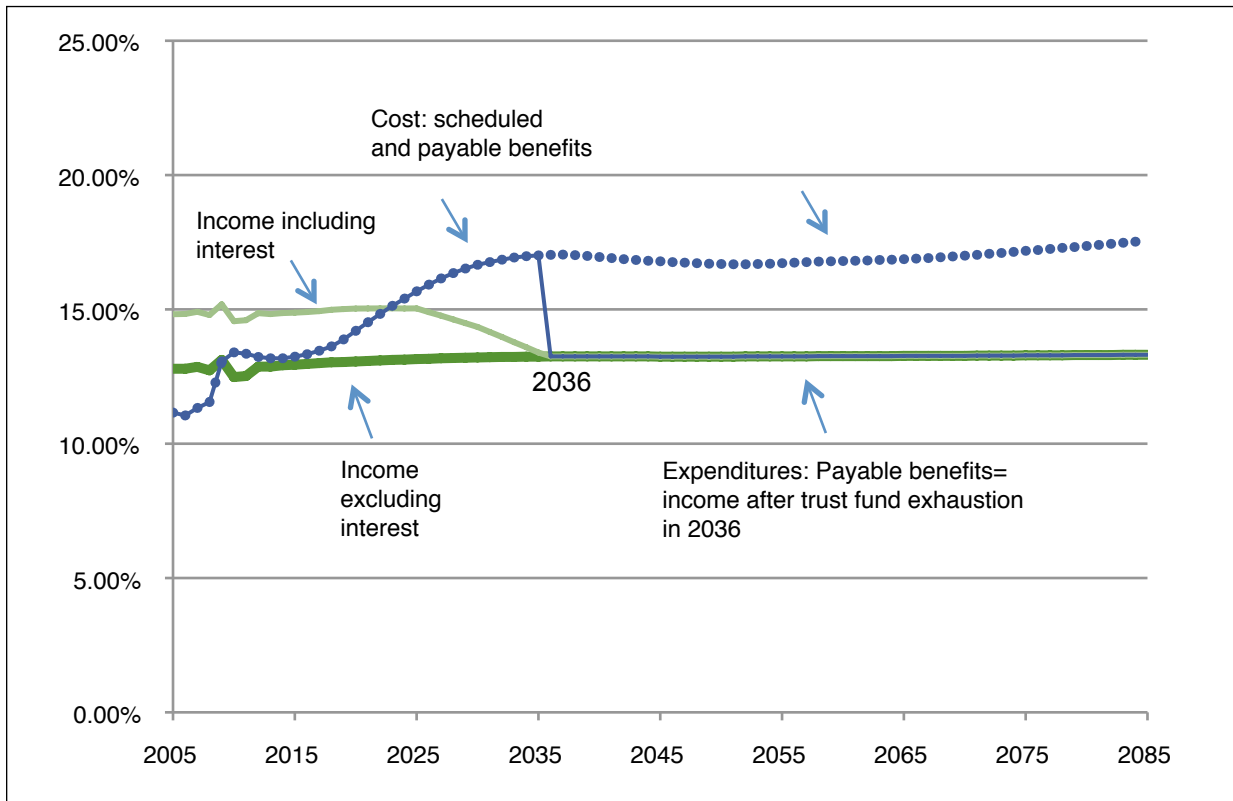
Financial results (assets-to-expenditure ratios) for the two alternative population scenarios (younger, older) are presented in tabular form for representative years. In addition, sensitivity tests on individual assumptions are based on stochastic modeling techniques for the individual assumptions listed below.

- Fertility rate
- Mortality/life expectancy at age 65
- Net migration rate
- Participation rate and unemployment rate⁹
- Rate of increase in prices
- Real-wage differential
- Real rates of return
- Disability incidence

Probability distributions quantified a range of possible outcomes for each selected assumption. The distributions were constructed by using time-series modeling based on historical data. A minimum of 1,000 outcomes was generated for each year

⁹ Deterministic approach rather than stochastic approach.

Figure 10. Projected OASDI Annual Cost Rates (Scheduled and Payable) and Income Rates (With and Without Trust Fund Interest) as Percentage of Taxable Wage Base



Source: 2011 Trustees Report.

in the projection period. The metrics in the sensitivity analysis are pay-go rates for 2025, 2050, and 2084, identifying the first year that benefits exceed contributions and specifying assets-to-expenditure ratios. All metrics are presented in tabular form.

CPP Summary Measures. The appendix to the CPP report presents closed group actuarial accrued liability and unfunded liability as balance sheet items and as one indicator of the plan’s financial health. Actuarial Balance was reported in the 23rd report on the CPP (December 31, 2006) but was eliminated in the 25th report. The CPP actuarial valuation places less emphasis on summary measures by relegating them to the appendix and stressing the importance of the year-by-year numbers within the text. The summary measures, particularly Actuarial Balance, are more prominent in the 2011 Trustees Report than in the CPP report. The 2007 Technical Panel recommended placing less emphasis on summary measures.

CPP Individual Metrics. The appendix to the CPP report provides internal rates of return by birth cohort, average monthly pensions payable

as of December 31, 2009, and projected average monthly pensions for representative years. The CPP report does not prominently incorporate individual metrics.

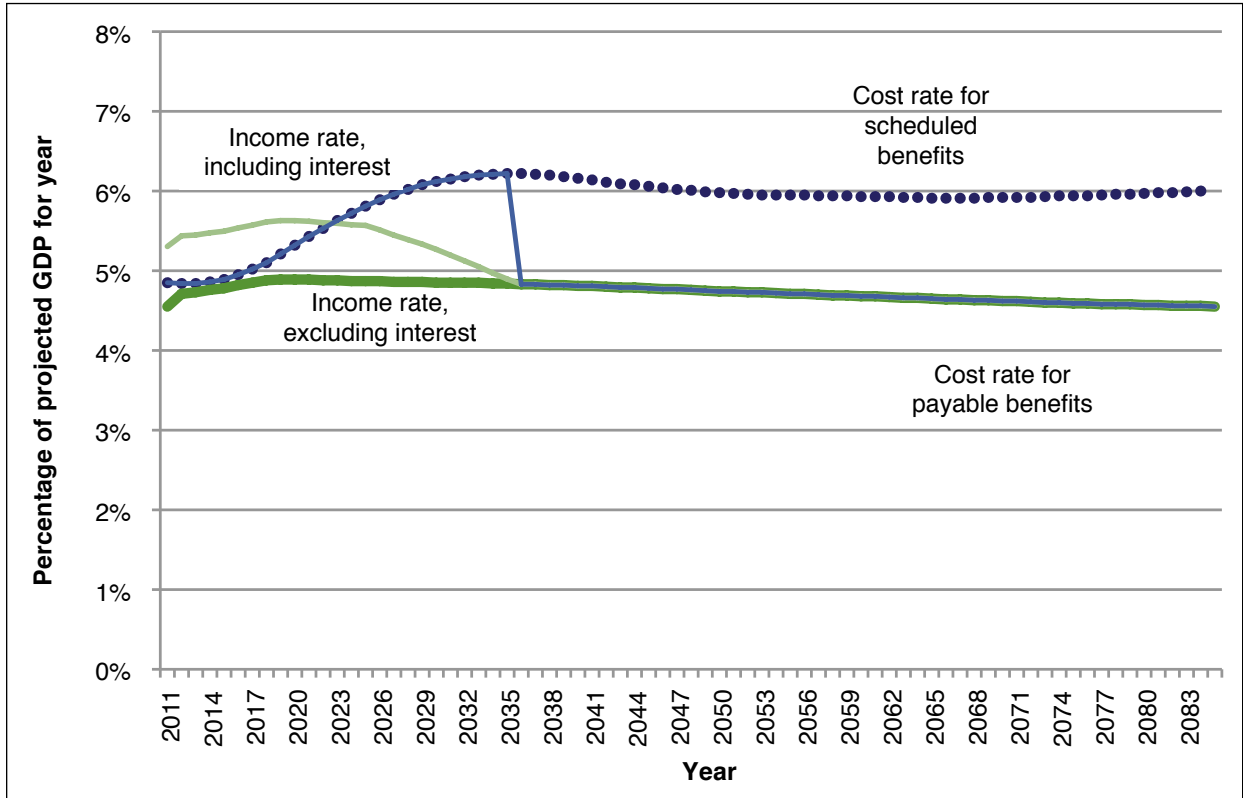
Recommendations

After completing the actuarial metrics review and literature review, the Panel recommends the following:

Method Recommendation M-1. The Technical Panel recommends providing micro-level (individual) financial measures of the Social Security system in conjunction with macro-level (program-wide) financial measures of the system.

The Technical Panel’s review of the metrics used for Social Security by other experts and organizations revealed that micro-level financial measures provide another useful way to evaluate the system and help the public relate financial status to the level of benefits. Examples of where the Trustees could incorporate individual metrics follow:

Figure 11. Projected Annual OASDI Cost (Scheduled and Payable) and Income (With and Without Trust Fund Interest) as Percentage of GDP



Source: 2011 Trustees Report.

- Add a chart to the Highlights chapter showing replacement ratios, accompanied by an explanation that the financial metrics described in the chapter are based on providing the level of benefits shown in the chart.
- Add a table of scheduled and payable benefits related to the discussion of what happens when either the OASI (in 2036) or DI (in 2018) Trust Fund assets are exhausted.

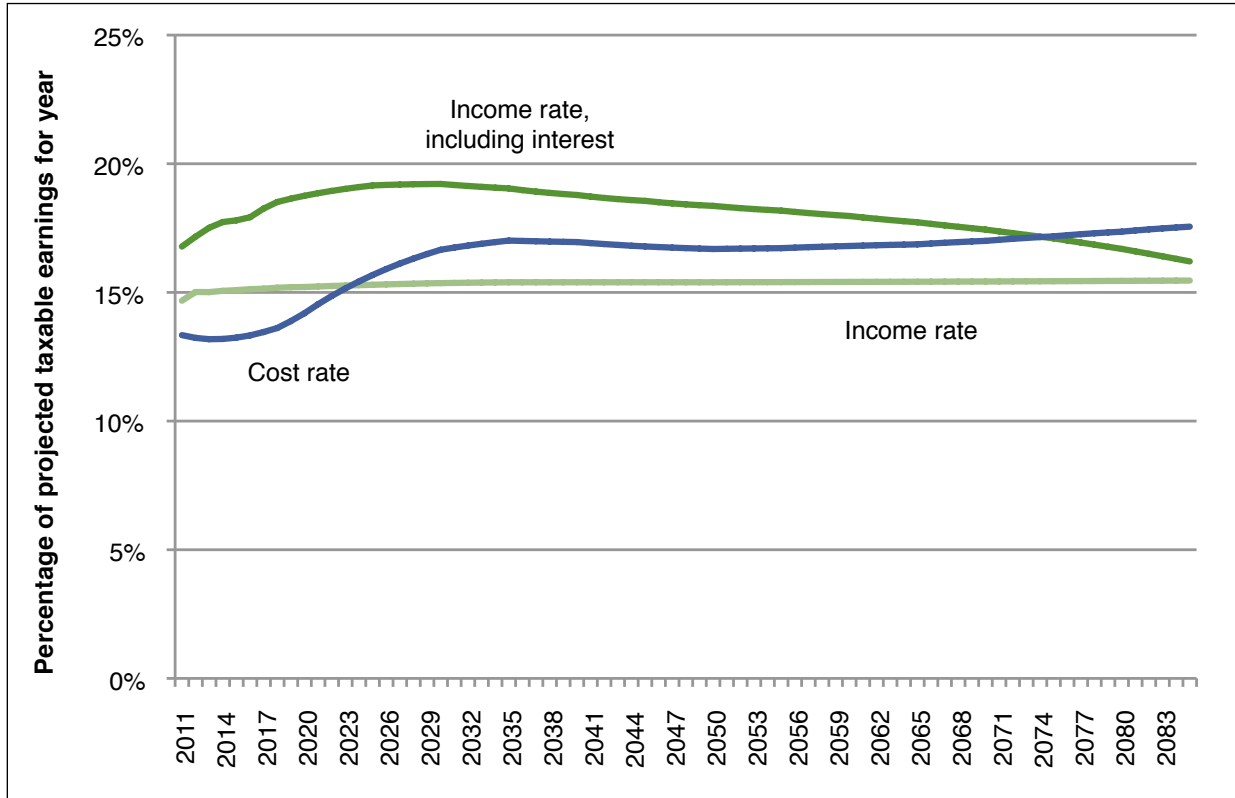
An important concern of the Trustees is that the Social Security program meet certain retirement income goals while maintaining financial solvency. If the program is solvent but over time does not provide a meaningful benefit, then one aspect of the solvency analysis is missing. The presentation of individual metrics is one way of relating benefit levels to the solvency analysis. Consider a hypothetical case in which both taxes and benefits increase such that the Annual Balance in each year does not change from current law. In such a case, the Annual Balance and Actuarial Balance would not change, but benefits certainly would, as could be easily shown by using micro-level measures.

Method Recommendation M-2. The Technical Panel recommends adding a new subsection to Chapter IV, Section B of the Trustees Report that provides more discussion and analysis of sustainable solvency.

Sustainable solvency is defined as positive Trust Fund ratios throughout the period, with stable or rising Trust Fund ratios at the end of the period. One option for achieving sustainable solvency would allow the Trust Fund to remain at a sufficiently high level such that interest on the Trust Fund plays a significant role in financing benefits. On a long-term basis, expenditures can exceed non-interest income only if the interest earnings on the Trust Fund are sufficient to make up that difference. Examples of information that might be useful in a sustainable solvency section follow:

- Add a revised version of the Trustees Report’s Figures II.D2 and II.D5 showing the role of Trust Fund interest. **Figures 10** and **11** provide examples of the revised figures.
- Provide the tax rate increase and benefit percentage reduction amounts that would be re-

Figure 12. Projected Income and Cost Rates, Assuming a Tax Increase of 2.15 Percentage Points



Source: 2011 Trustees Report; Panel calculations.

quired to achieve sustainable solvency. The “Conclusion” paragraph of the Highlights chapter of the 2011 Trustees Report provides the amounts needed to achieve 75-year actuarial balance (i.e., a tax increase of 2.15 percentage points or a benefit percentage decrease of 13.8 percent would, if adopted in 2011, achieve 75-year actuarial balance). How would the amounts change if sustainable solvency is the goal rather than 75-year actuarial balance?

- Provide individual metrics showing the impact on benefit replacement ratios of the required tax increase or the benefit decrease required to achieve sustainable solvency.
- Provide graphs showing cost and income rates, including Trust Fund interest over the 75-year period for the 2.15 percentage point and 13.8 percent metrics. **Figures 12** and **13** are illustrative.
- Similarly provide cost and income rates, including Trust Fund interest over the 75-year period for sustainable solvency metrics that are equivalent to the 2.15 percentage point and 13.8 percent metrics.

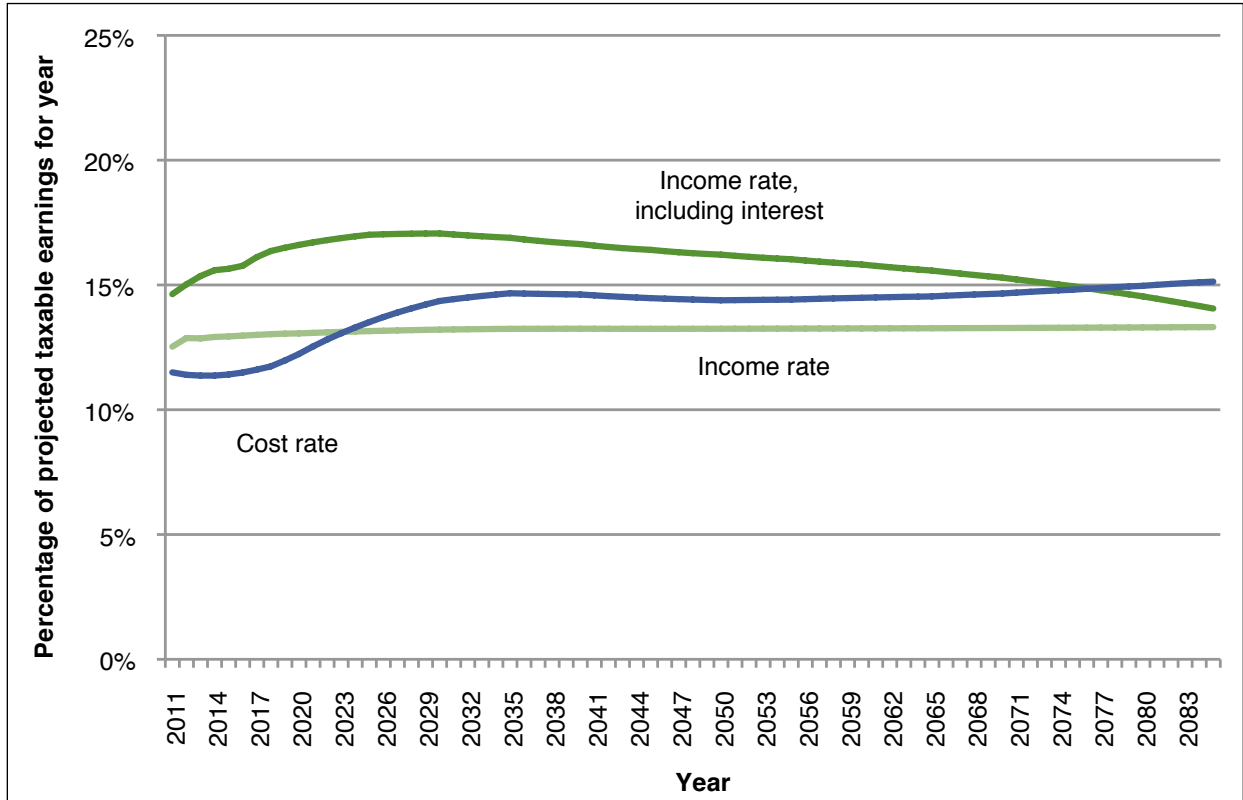
- Provide graphs showing cost and income rates, including Trust Fund interest over the 75-year period equivalent to the 2.15 percentage point and 13.8 percent metrics but assuming that any change in income or benefit levels is delayed for 10 years and then separately for 20 years, 30 years, and so forth.

Sustainable solvency is mentioned in the Overview and defined and discussed in Chapter IV.B of the Trustees Report. The Technical Panel believes that the recommended additional section and metrics will aid the reader in understanding the financial status of Social Security.

Method Recommendation M-3. If the Trustees accept Recommendation M-2, then the Technical Panel recommends eliminating the Infinite Horizon metric.

The Infinite Horizon metric requires the projection of taxes, benefits, taxable payroll, and GDP hundreds of years into the future. At present, no information is provided on the uncertainty associated with these projections, despite this infinite pro-

Figure 13. Projected Income and Cost Rates, Assuming a 13.8 Percent Benefit Decrease in Each Future Year versus Current Law



Source: 2011 Trustees Report; Panel calculations.

jection period. When the metric is expressed as a ratio to taxable payroll or GDP, some of the concern about uncertainty is reduced, as the factors that give rise to the uncertainty would often move taxes, benefits, taxable payroll, and GDP in the same direction. However, the Infinite Horizon metric is most often quoted in policy discussion without this scaling – for example, as \$17.9 trillion, rather than 3.6 percent of taxable payroll or 1.2 percent of GDP, even though all three are reported in the Trustees Report. Further, this projection of \$17.9 trillion is often compared by analysts to other measures of government indebtedness, without recognition of the substantial uncertainty inherent in the projection. The Panel believes that the Infinite Horizon metric may shift focus away from more useful metrics for determining the finances of the system and that the information in the recommended new section on sustainable solvency would eliminate the need for an Infinite Horizon metric.

1.3 Models and Methods

Method Recommendation M-4. The Technical Panel commends OACT for its progress in increasing the transparency of its methods and in communicating detailed information to policymakers and the research community through its web site. The Technical Panel recommends maintaining and expanding these efforts in the coming years.

Method Recommendation M-5. The Technical Panel commends the Social Security Administration (SSA) for investing in the development of matched data files that link survey information with administrative records on earnings and benefit receipt. The Technical Panel recommends making continued investments a high priority.

Method Recommendation M-6. The Technical Panel recommends that SSA develop a strategic plan for expanding its dynamic microsimulation capacity and for integrating its segmented and microsimulation strategies. One objective of the strategic plan should be to increase coordination of dynamic mi-

crossimulation efforts within SSA in order to maximize existing resources. The Technical Panel recommends that the Social Security Advisory Board monitor progress on the development of these plans. The Board should consider convening or hosting a regular series of meetings of model developers within SSA and across various government agencies to review innovations, challenges, and prospects for collaboration. In deciding how to allocate scarce modeling resources, the Technical Panel recommends assigning a high priority to policies with potentially significant but uncertain effects on OASDI's fiscal position.

Method Recommendation M-7. The Technical Panel recommends basing the intermediate projection of revenues from taxation of OASDI benefits more closely on the current income tax code rather than on historical shares of income subject to federal income taxation. The Technical Panel also recommends basing the projections of OASDI's long-range actuarial status on two alternative sets of assumptions about future taxation that are analogous to "current law"/"extended baseline" and "current policy"/"alternative fiscal" scenarios, as is the practice of other government and private forecasting groups. At a minimum, the Technical Panel strongly recommends adding sensitivity analyses to the Trustees Report to demonstrate how projections of the long-range financial status of the OASDI program vary with alternative assumptions about laws governing personal income tax.

Documentation and Transparency

The Technical Panel applauds OACT's significant progress in increasing the transparency of its model and methods. OACT's posting of documentation, including the *Long-Range OASDI Projection Methodology*, on its web site is a tremendous advance that significantly aided the Technical Panel in its work and further permits researchers both internal and external to SSA to understand more fully the approach, assumptions, and methods in the Trustees Report.¹⁰ OACT analysts have been highly responsive to researcher requests for disaggregated information about certain Trustees assumptions and now regularly post single-year tables from the Trustees Report on OACT's web site.¹¹ The Technical Panel encourages continued dissemination efforts, especially through

OACT's web site, and collaboration with interested researchers. Additional efforts to expand OACT's web site to facilitate comparisons across Trustees Reports would be especially welcome.

While the documentation of the long-range Trustees Report methodology is comprehensive and lays out the basics, it could be presented even more clearly and thus require less effort on the reader's part. For example, to enhance rapid comprehension of underlying models, the documentation could array coefficients in similarly specified models in a set of tables rather than rely on equations presented in the Trustees Report's text. The description of the labor force component of the model would especially benefit from such organization. Similarly, while the documentation contains complete definitions of key variables, greater use of descriptive variable names rather than abbreviations and acronyms could substantially increase clarity in many cases. Succinct summary specification tables would be another valuable addition to the document. For example, a summary specification table could indicate the number of equations used, major stratifying variables, and the data sources from which variables are estimated for each important module in the segmented model.

Data Development and Dissemination

Reliable estimation of Social Security's long-run finances requires extensive amounts of highly detailed and representative data. The Technical Panel strongly supports the investments made in recent years by various divisions of SSA to institute and maintain data linkages. For example, SSA's coordination with the Census Bureau to develop matched survey-administrative data files for the Survey of Income and Program Participation and with the University of Michigan and National Institute on Aging to develop matched survey-administrative data files for the Health and Retirement Study is exemplary. The matched longitudinal survey records are extraordinarily valuable tools for developing effective distributional models and contributing to basic scientific knowledge that benefits developers/estimators who use both actuarial and more distributional strategies to understand Social Security's financial position and the effects of proposed changes to the program.

Likewise, the Technical Panel applauds OACT's posting of detailed data on the U.S. earnings dis-

¹⁰ See OACT, 2011.

¹¹ See <http://www.ssa.gov/OACT/TR/2011/lrIndex.html>.

tribution on its web site.¹² The information could be even more useful if the current categorical presentation were supplemented with quantiles (for example, percentiles, with extra detail in the top percentile), given that relatively large brackets at the top of the earnings distribution coupled with inflation make it difficult to compare these data across years.

Similarly, OACT's efforts to share data files developed by members of its staff for internal use have helped validate and improve models developed in other parts of SSA. A prime example is the OACT Microsim database file that is based on administrative sources, including the Current Work History Sample (CWHs) and Master Earnings File (MEF). The Technical Panel encourages continuation of such efforts.

The Technical Panel and many others in the research community would welcome additional public-use files featuring information on earnings histories.¹³

Model Development

Models of Social Security (and, more broadly, of retirement income) serve several purposes, and different types of models embody different strengths and weaknesses (e.g., Anderson 1997; Burtless 1996; Citro and Hanushek 1991, 1997; Favreault 2000).

Earlier Technical Panels called for accelerated efforts to use dynamic microsimulation techniques to augment findings from the segmented model (for example, to supplement OACT work on the interrelationships between earnings and benefits). The same Technical Panels also detailed attractive features of such an approach (for example, straightforward integration of interactions, ability to simulate complex policies directly, and capacity for detailed distributional analyses). Further, the earlier Technical Panels identified certain modeling and policy areas where a microsimulation strategy would be particularly useful. For example, integrating differential mortality is extremely straightforward with the use of a dynamic microsimulation strategy. In the policy arena, proposals to implement earnings

sharing are a quintessential example of a type of policy that is best examined through dynamic microsimulation. Similarly, proposals tied closely to the number and timing of work years, such as minimum benefits and hardship exemptions of the type proposed by recent fiscal commissions, readily lend themselves to examination and comparison with the use of dynamic microsimulation models.

In recent years, SSA has increased its reliance on dynamic microsimulation to produce distributional estimates of reform proposals. For example, since the last Technical Panel report, the Report of the Commission on Fiscal Responsibility and Reform has cited distributional projections from SSA models in addition to OACT cost estimates (National Commission on Fiscal Responsibility and Reform 2010, Figure 13).

While the Technical Panel applauds the above progress, some of these efforts could be more highly coordinated. The Office of Retirement and Disability Policy (ORDP) and, specifically, the Office of Research, Evaluation, and Statistics (ORES) within ORDP have continued to develop Modeling Income in the Near Term (MINT) and recently completed development of MINT6, a version of the model that relies on data from the 2001 and 2004 panels of the Survey of Income and Program Participation matched to administrative earnings, benefit receipt, and mortality records. (The Office of Retirement Policy uses MINT extensively in its policy analyses.) At the same time, the Office of the Actuary has continued (with significant assistance from ORDP) to develop Polisim, a large-scale dynamic model that uses extracts from the 1980 Public-Use Microdata Sample files from the U.S. Census.

To date, development efforts for the two models appear to have been fairly independent of one another. One rationale for the separate tracks was that the models were a response to markedly different objectives. MINT's horizon was originally the "near term"; the model addressed a narrow set of birth cohorts (originally the 1926 to 1964 birth cohorts) and distributional issues and placed significant emphasis on income sources other than earnings and Social Security (for example, pensions and financial assets). Polisim focused on the 75-year projection horizon used by OACT for the Trustees

¹² Wage data for 2009, for example, are available at <http://www.ssa.gov/cgi-bin/netcomp.cgi?year=2009>.

¹³ One recent example of such a file is the Earnings Public-Use File, 2006, which was released in 2011; it is available at <http://www.ssa.gov/policy/docs/microdata/epuf/index.html>. An earlier example is the Benefits and Earnings Public-Use File, 2004, which was released in 2005; it is available at <http://www.ssa.gov/policy/docs/microdata/earn/index.html>.

Report, the entire Social Security Area population,¹⁴ and distributional estimates coupled with a potential for cost estimation; thus, the model's income projections narrowly addressed earnings and Social Security benefits.

Now that well over a decade of intensive development has passed, the two models have become far more similar in scope, particularly as MINT's projection horizon and cohort coverage have expanded with time and its processing structure has moved from what was once described as semidynamic to a strategy more consistent with an Orcutt-style, fully dynamic microsimulation model. As the models converge in content, it is appropriate to ask whether each is appropriately leveraging investments in the other.¹⁵ Given that dynamic microsimulation models are time-consuming and expensive to build and maintain, each model could almost certainly be improved more rapidly and less expensively if developers made a concerted effort, as feasible, to share knowledge, data extracts, and even parameters from microdynamic equations used to "age" the population. Cross-model validation within SSA is also likely to be a cost-effective strategy for increasing the models' reliability.

Further, multidisciplinary cooperation can be extremely valuable for a complex endeavor such as building a large-scale dynamic microsimulation model. SSA staff members command wide-ranging background and expertise in fields such as actuarial science, computer science, demography, economics, sociology, and statistics as well as varying levels of familiarity with data availability and limitations and programmatic details. High levels of cooperation among staff with different areas of expertise could

help SSA advance its goals of maintaining reliable microsimulation models for distributional analysis and developing the capacity to use the models to inform cost estimates as soon as possible.

The Technical Panel therefore recommends that the Social Security Advisory Board monitor progress in this area and perhaps consider convening regular developers' meetings to explore opportunities to accelerate development and cross-validation of SSA distributional models. While convening Social Security employees would be a sufficient first step, such meetings could be enhanced by inviting modelers from other parts of the government (for example, the Congressional Budget Office's Long-Term Modeling Group) and private organizations that work intensively to develop dynamic microsimulation models.

The Technical Panel recognizes that efforts at cooperation are difficult when the relevant parties face a host of deliverable requirements. However, it makes sense to use resources for collaboration rather than for duplication and to avoid reliance on outdated parameters in either model. To remain valid and produce reliable results, the parameters in dynamic microsimulation models must be re-estimated regularly, especially if the underlying processes (e.g., earnings or marriage) are subject to change or science about a process is advancing. Updating equations to include new data and scientific knowledge is almost always preferable to using alignment to meet known targets. The marginal cost of re-estimating new equations developed for one model to ensure compatibility with another model is low relative to completely re-estimating a set of equations.

Analogously, the starting databases in dynamic microsimulation models, while requiring less frequent updating than equation parameters, should undergo periodic review. Collaboration with users familiar with candidate databases can help identify the most promising strategies for making investment decisions about databases. When making choices about starting databases for microsimulation models, modelers should pay special attention to the availability of matched earnings history data from a period close to the model baseline.

The Technical Panel thus recommends that OACT develop a strategic plan for keeping its dynamic microsimulation models updated and valid. Ideally, the plan would leverage cross-SSA resources where possible. The Retirement Research Consortium (RRC) provides one instructive example of

¹⁴ The Social Security Area population includes residents of the 50 states and the District of Columbia, members of the U.S. armed forces, federal civilian employees overseas as well as their dependents, other citizens overseas, crews of merchant marine vessels, and civilian residents of Puerto Rico, the U.S. Virgin Islands, Guam, American Samoa, Palau, and the Northern Mariana Islands (OACT 2011).

¹⁵ The question about the appropriateness of maintaining two separate models is important. In modeling such a large and complex system as the evolution of the U.S. population and its earnings/income distribution over a 75-year horizon, replication offers many important advantages. Development of several models is not necessarily wasteful or duplicative given that the "correct" answer is inherently unknowable. Comparing output from two models may be one of the fastest ways of unearthing problems in either or both. It is not uncommon for analysts in large-scale scientific and technical projects to use strategies of "double programming." SSA may analogously deem parallel development an appropriate strategy given the importance of sound policy estimates, the various client bases served by SSA, and analysts' investments in model-specific knowledge.

intra-agency coordination. The RRC has called for and funded research in areas that earlier Technical Panels identified as understudied and important for developing improved Social Security cost and distributional estimates. The same approach should be replicated and encouraged to advance SSA modeling.

Within OACT, the Technical Panel recommends further study and strategic planning to integrate the dynamic microsimulation model with the segmented model. Some Technical Panel members are concerned that dealing with the two models as completely separate entities slows progress toward more valid and effective microsimulation projections. An integration plan could reap benefits for the segmented model itself by requiring maximal automation and linking of existing procedures.

Effects of Policy Changes in a Model Based on Current Law: Challenges and Implications for Model Development

Social Security actuaries are charged with projecting the financial status of the program under current law. For several reasons, the task is enormously challenging. Among other considerations, it requires assumptions about future tax law, which is subject to frequent changes and contains many interacting policies and provisions. In several substantive areas, many independent analysts view current law as unrealistic or unsustainable over long periods. Analysts note that persistent, large annual and long-run deficits will eventually (perhaps sooner rather than later) require legislative action that could change workers' incentives to work, save, and claim Social Security benefits and thus pose significant analytic challenges. Similarly, the gradual phase-in of legislative changes, including those associated with the *Affordable Care Act*, could translate into dramatic changes to work supports and incentives linked to various benefits (e.g., both OASI and DI). As discussed in section 2.4 on disability, SSA's policy and capacity relative to the performance of Continuing Disability Reviews appear to be significantly associated with DI caseloads and changes to the medical eligibility criteria for DI.

Model developers should catalogue the outcomes and assumptions embedded in Social Security cost estimates that are most amenable to policy change. Uncertainty about policy direction should factor into developers' plans for model investments and maintenance and should shape thinking about ongoing specification choices and the plausible bands

for high- and low-cost assumptions. For example, the real wage differential, immigration levels and immigrant composition, and income from taxation of benefits will likely be highly susceptible to policy changes in the coming years. The Technical Panel encourages developers to be forward-looking to ensure that they are positioned to adapt to possible policy changes that would materially affect Social Security financing.

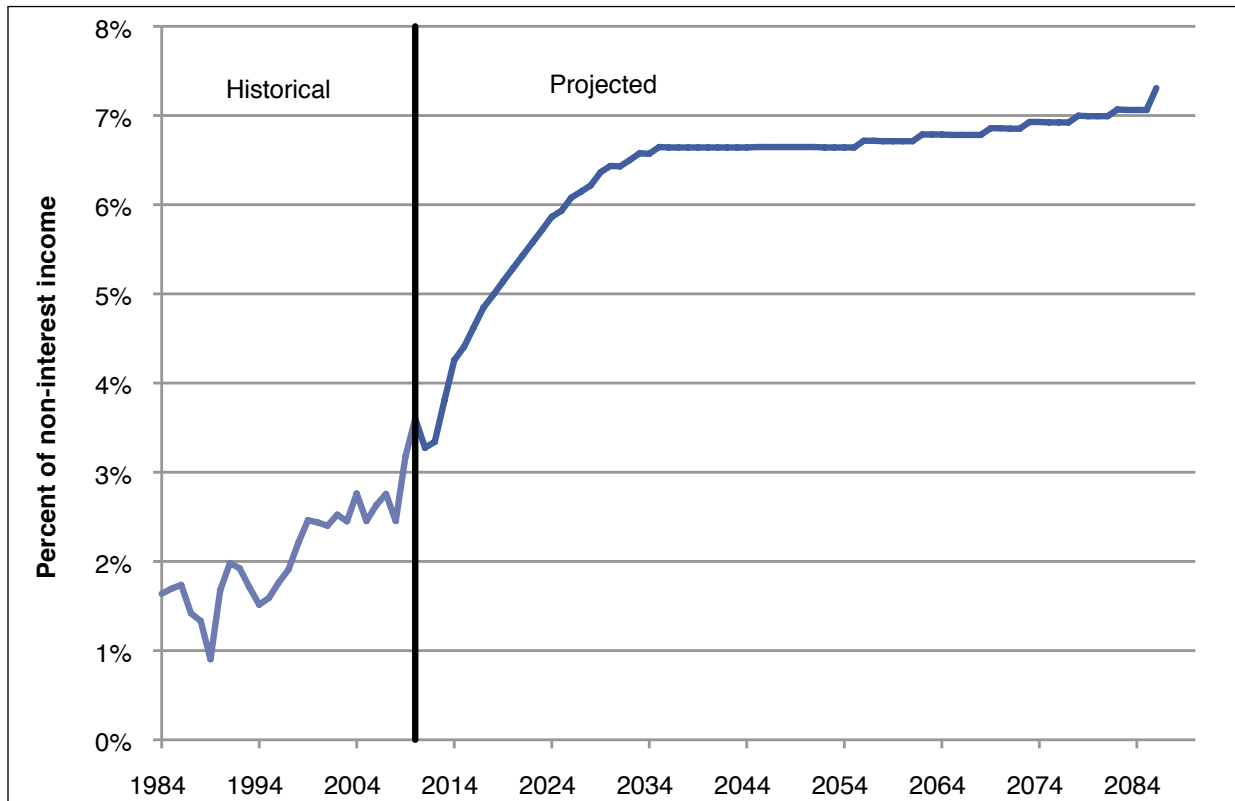
Projecting Income Tax Revenues from Taxation of Benefits

Since Social Security benefits first became subject to income taxation in 1984, revenue from the taxation of benefits has grown steadily and is expected to become an increasingly important share of total OASDI revenue in the coming years (**Figure 14**). The precise importance of the revenue is uncertain, however, and thus warrants additional discussion in the Trustees Report.

Throughout their annual report, the OASDI Trustees assume that current law generally remains in effect. They break significantly from their assumption in just a few places, including the establishment of an income tax baseline and, less important, the treatment of refugees under immigration law. The Trustees currently assume implicitly that Congress will continue to make ad hoc adjustments to the tax law to maintain a relatively constant tax burden. Therefore, projections of income from the taxation of Social Security benefits account for the fact that the modified Adjusted Gross Income (AGI) thresholds for taxing benefits are not indexed – even for inflation – and that an increasing share of beneficiaries will thus be liable for personal income tax on their benefits. But the projections do not address the “bracket creep” that is implicit elsewhere in current law, whereby most tax parameters are indexed to price inflation at the same time that income (and thus modified AGI) typically grows at a faster rate (because, for example, of the historical real wage differential). Current methods also implicitly assume that shares of income of different types will be fairly consistent for the beneficiary population in the coming decades; such an assumption is worthy of empirical analysis and justification.

Efforts to provide cost and distributional estimates for policy proposals premised on changes to current income tax law are exceedingly difficult. Yet, as such proposals increase in both frequency and prominence, OACT and the Trustees must invest in improving the components of the Trustees Report

Figure 14. Share of Non-Interest Income from Taxation of OASDI Benefits Source: 2011 Trustees Report; Panel calculations.



Source: Office of the Chief Actuary, Social Security Administration, Single-Year Tables Consistent with 2011 Trustees Report, Components of Annual Income Rates [see <http://www.ssa.gov/oact/TR/2011/lr4b10.html>].

projections that address the taxation of benefits, thereby ensuring greater capability and reliability.

Recognizing that it is tremendously complex to implement a full-scale tax model and that any single assumption about the future of the tax code is likely to be controversial, the Technical Panel unreservedly recommends that the Trustees Report assign much higher prominence to the issue of Social Security integration with the tax code. Our preferred approach would present two projections in the top-line findings of the Trustees Report. The use of several baselines has become common practice among many forecasting groups as a response to how regularly Congress has shifted tax policy away from current law (under which many ongoing tax breaks are set to expire in the relative near term) and toward extending tax cuts and patching the Alternative Minimum Tax (AMT).

The Technical Panel believes that it is important to make clear to policymakers and the public that changes to federal income tax law have significant implications for OASDI’s long-run fiscal balance. For example, the Congressional Budget Office projects that the actuarial balance would be 0.42 per-

centage points of payroll lower (“worse”) under its “alternative fiscal scenario” – which assumes that tax revenues remain closer to their historical average share of GDP – compared to the “extended baseline” that assumes current tax rates remain unchanged.¹⁶ This is a difference of over a quarter of the long-range deficit under the 2011 extended baseline (Congressional Budget Office 2011). The current Trustees Report gives readers no information about the sensitivity of projections to the tax policies currently under debate. At a minimum, the report should present two plausible tax baselines in the spirit of the Congressional Budget Office’s tax projections. Similarly, the Office of Management and Budget presents two alternative revenue options in its discussion of the long-term budget in its *Analytical Perspectives* (2011).¹⁷

¹⁶ The alternative fiscal scenario “incorporates several changes to current law that are widely expected to occur or that would modify some provisions of law that might be difficult to sustain for a long period” (CBO 2011).

¹⁷ Under the base option, tax receipts reach 21.2 percent of GDP by 2085. The alternative scenario allows revenues to increase by an additional 2 percentage points of GDP.

1.4 Implications of Health Care Reform

Assumption Recommendation A-1. The Technical Panel recommends increasing the range of uncertainty around the major assumptions, including those regarding labor force participation and the earnings ratio, that are likely to be affected by health care reform. The expanded range reflects the uncertainty inherent in how health care reform will unfold. Over time, the extent of uncertainty is likely to narrow, at which point the recommended ranges for the affected assumptions will lend themselves to reduction.

Research Recommendation R-1. The Technical Panel recommends research into the impacts of health care reform on relevant outcomes as reform provisions start to take effect. Such outcomes include labor force participation, disability receipt, the earnings ratio, the taxable share, and mortality. The research findings should help determine the need for changes to the relevant assumptions and the need for adjustments to the range of uncertainty.

The passage of the *Patient Protection and Affordable Care Act* (March 23, 2010) and the *Health Care and Education Reconciliation Act* (March 30, 2010) represents the most dramatic change to the U.S. health care system since the enactment of Medicare in 1965. Although the goals of health care reform are primarily related to health care – expanded health insurance coverage, increased affordability of health care, reduction in the long-term increases in the cost of health care – the new laws also have implications for the financial status of the OASDI program. Health care reform could affect system finances through several channels: (1) by changing the level and/or composition of employment, (2) by changing the share of earnings in compensation, (3) by changing the taxable share of wages, (4) by changing the incentives to apply for DI, and (5) by changing health. The 2010 Trustees Report calculated that the two laws increased the long-range OASDI actuarial balance by 0.14 percent of taxable payroll (p. 71). As described in that report, the higher actuarial balance results from a reduction in the assumed average annual rate of decline of 0.1 percent in the ratio of earnings to compensation. The rationale for the change is that the excise tax on employer-sponsored health insurance that takes effect in 2018 will lead to slower growth

in the total cost of employer-sponsored health insurance, which will in turn reduce the rate of decline in the ratio of earnings to compensation.¹⁸ As discussed below, however, health care reform could potentially affect OASDI system finances in several other ways.

Health Care Reform and Employment

A distinctive feature of the U.S. health care system is the fundamental role of employers in providing insurance to workers and their dependents. **Figures 15** and **16** show the sources of health insurance coverage for adults age 18 to 64 and for children under age 18 from 1994 to 2009.¹⁹ For both children and adults, the primary source of insurance is employment-based: 60 percent of adults and 56 percent of children carried employment-based coverage in 2009. It is important to note, however, that the prevalence of such coverage has been falling over the past decade, from a rate of 69 percent for adults and 65 percent for children in 1999. About one out of every 10 adults and one out of every three children are covered by Medicaid, a source of health insurance that has been increasing over time, especially for children. And approximately 10 percent of children and 22 percent of adults are uninsured. While the fraction of uninsured children has been decreasing (largely because of the expanded availability of public health insurance for children), the fraction of uninsured adults has been increasing. For those over age 65, the situation is different, as almost all elderly receive health insurance coverage through Medicare, potentially with supplemental coverage from a current or former employer, a privately purchased (Medigap) policy, or Medicaid.

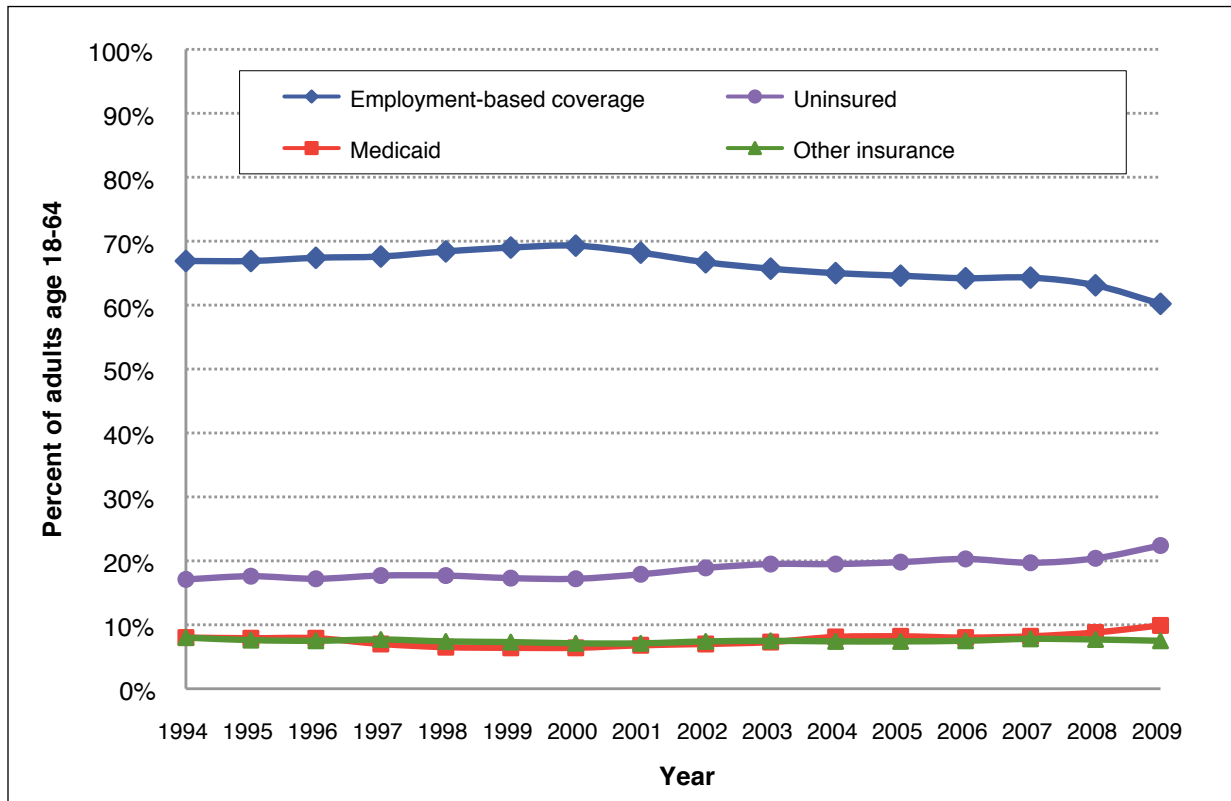
A large body of literature has documented the relationship between the U.S. system of health insurance provision and employment outcomes.²⁰ For older individuals, health insurance affects the age of retirement. Individuals who would give up employer-sponsored health insurance coverage by retiring before age 65 are more likely than individuals with alternative sources of health care (employment-based retiree or COBRA) coverage to delay retirement until they are eligible for Medicare. In addition, individuals who would likely lose or face more costly health insurance if they left their cur-

¹⁸ See the Trustees Report, 2010, p. 97.

¹⁹ The statistics in these figures are taken from Fronstin (2010).

²⁰ See Gruber and Madrian (2004) for a review of the literature.

Figure 15. Sources of Health Insurance Coverage for Adults, Age 18–64: 1994–2009



Source: Fronstin, 2010.

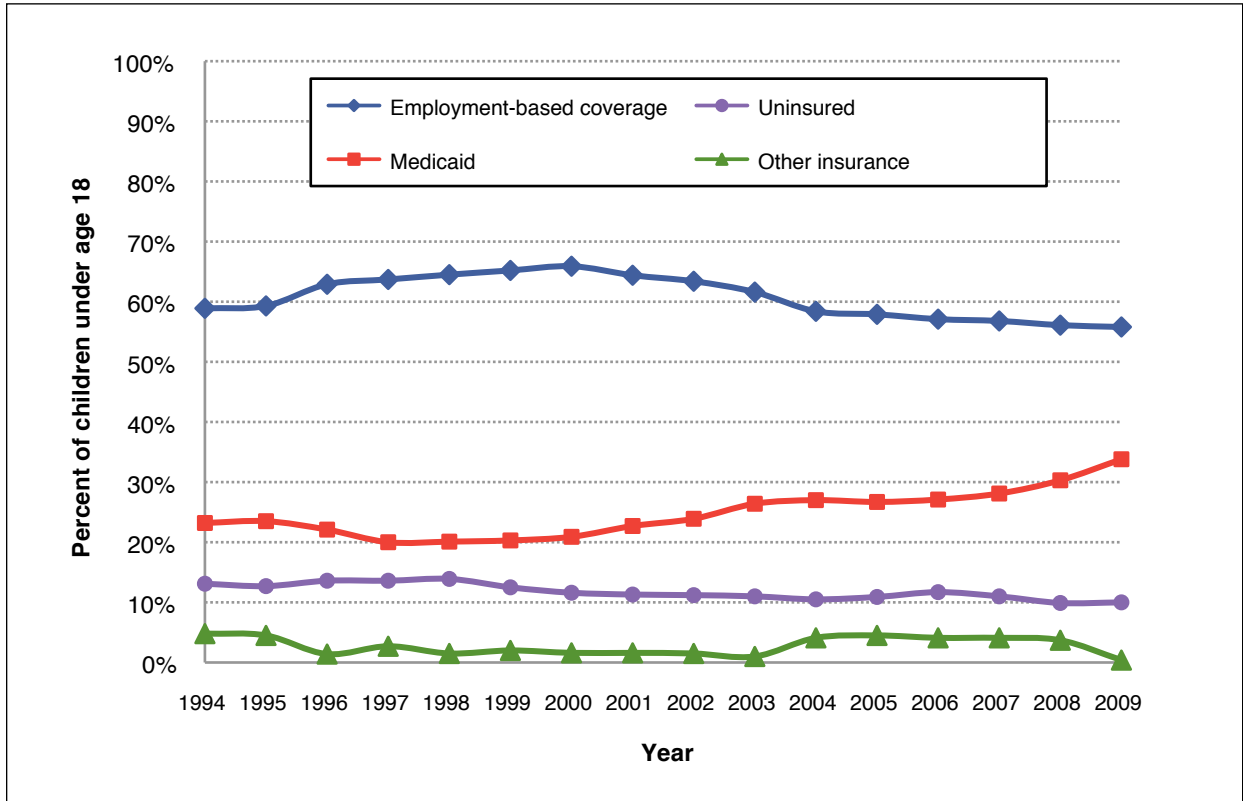
rent employer are less likely to change jobs. At the same time, individuals with health insurance coverage through a spouse are more likely to work in part-time jobs without health insurance, whereas individuals without potential coverage as a dependent are more likely to work in full-time jobs that offer health insurance. As the costs of health insurance increase, employers either shift demand from full-time workers with health insurance to part-time workers without health insurance or hire fewer workers to work longer hours.

Several features of health care reform could affect employment outcomes relevant to OASDI system finances. First, health care reform requires the states to establish health insurance exchanges that facilitate health insurance purchases in the individual market and may facilitate small businesses' provision of health insurance. Second, health care reform offers premium subsidies to low- and middle-income individuals and families to help them purchase health insurance in the individual market if they are not covered through their own or a family member's employment. As shown in **Table 8**, the premium subsidies may be large, and they decline

with income. The phase-out of premium credits with income is effectively an increase in the tax on income for individuals and families below 400 percent of the federal poverty line (FPL). Third, health care reform involves a "pay or play" mandate for all but the smallest employers, requiring them to offer health insurance to their full-time employees or pay a fine.²¹ Fourth, health care reform, if successful in limiting the growth of health care costs and increasing the competitiveness of health insurance markets, could lower the decades-old upward trend in the cost of employer-provided health insurance.

²¹ Employers with 50 or more full-time employees that do not offer coverage and have at least one full-time employee receiving a premium credit will face a fine of \$2,000 per full-time employee (less the first 30 employees). Employers with 50 or more full-time employees that offer coverage but have at least one full-time employee receiving a premium credit will pay the lesser of \$3,000 for each employee receiving a premium credit or \$2,000 for each full-time employee (less the first 30 employees) (Kaiser Family Foundation 2011).

Figure 16. Sources of Health Insurance Coverage for Children under Age 18: 1994–2009



Source: Fronstin, 2010.

Table 8. Premium Credits for the Purchase of Health Insurance on the Exchanges

| Income (as a percentage of the federal poverty line): | Premium Contributions Limited to: |
|---|-----------------------------------|
| Up to 133% | 2% of income |
| 133–150% | 3–4% of income |
| 150–200% | 4–6.3% of income |
| 200–250% | 6.3–8.05% of income |
| 250–300% | 8.05–9.5% of income |
| 300–400% of FPL | 9.5% of income |

Source: Kaiser Family Foundation, 2011.

On the supply side, health care reform is likely to reduce the total amount of labor input. The increased availability of non-employment-based health insurance coverage through the health insurance exchanges, coupled with premium subsidies to low- and middle-income families, will encourage some individuals who would have otherwise continued to work until their age-65 Medicare eligibility date to make an early exit from the labor force.

For the same reason, secondary earners who were working primarily to provide health insurance coverage for their families may either leave the labor force entirely or cut back on hours worked, choosing part-time work in jobs without health insurance over full-time work in jobs with insurance. The unemployed, some of whom feel pressured to find a job in order to secure health insurance for themselves and/or their families, may take more time to search for a new job. And younger individuals may delay the transition from school to employment. For individuals and families who receive premium subsidies to purchase insurance on the exchanges, the phase-out of the subsidies with income will further depress labor supply.

On the demand side, two countervailing effects are at work. The “pay or play” mandate requiring employers to offer health insurance to qualifying employees (or else pay a penalty) will increase labor costs (largely among those not currently offering health insurance) unless employers can pass the costs on to workers in the form of lower wages. Even though research suggests that employers may

be able to pass much of the cost on to workers,²² employers of lower-wage workers may be less likely to do so. Lower-wage workers may be less willing than higher-wage workers to accept lower wages in exchange for health insurance coverage; further, their wages may already be at or near minimum wage. Levy and Baicker (2008) estimate that “0.2 percent of all full-time workers and 1.4 percent of uninsured full-time workers would lose their jobs because of a health insurance mandate.” Such job losses would be concentrated among high school dropouts, women, and minorities. The “pay or play” mandate may also change the composition of labor demand as the mandate applies only to full-time workers. An alternative to reducing employment in the face of the mandate would be to substitute part-time for full-time workers.²³ Cutler and Sood (2010), however, point out that, to the extent that health care reform succeeds in slowing the growth of health care costs, it could lead to increased labor demand. They estimate that reductions in the growth of employer health insurance premiums attributable to health reform would create 250,000 to 400,000 jobs in the next decade.

The net effect on employment is difficult to predict. Colla, Dow, and Dube (2011) evaluate a “pay or play” health insurance mandate enacted by San Francisco in 2006. They conclude that the mandate had at most a small negative impact on total employment and earnings, although it did increase consumer prices. The Congressional Budget Office (2010), in its assessment of the impact of health care reform on labor markets, concludes that “the legislation, on net, will reduce the amount of labor used in the economy by a small amount – roughly half a percent – primarily by reducing the amount of labor that workers choose to supply” (p. 47). The assessment seems plausible in light of the current evidence. It is important to note that such a reduction in labor input is relative to what it would have been in the absence of health care reform; section 3.1 discusses recent trends in and the Technical Panel’s recommendations on labor supply.

²² See Madrian (2007) for a review of the literature on the extent to which employers can pass on the costs of health insurance to workers in the form of lower wages.

²³ Thurston (1997) and Buchmueller, DiNardo, and Valletta (2009) document such an effect in Hawaii, which adopted a health insurance mandate in 1975.

Health Care Reform and the Earnings Ratio

If health care reform changes the extent or cost of employer-provided health insurance, it will have implications for the earnings ratio – the share of compensation represented by earnings rather than by non-wage compensation. The share of compensation devoted to employer health insurance is a function of the fraction of employees covered by employer health insurance, the generosity of the insurance offered by the employer, and differences in the rates of health insurance cost and wage growth.

Health care reform could affect the fraction of individuals covered by employer-provided health insurance by directly changing employer incentives to offer health insurance and indirectly changing how firms structure the composition of their workforce between employees who are eligible and ineligible for health insurance. How health care reform will change an employer’s offer of health insurance is still ambiguous. The law contains provisions that encourage an employer’s provision of health insurance, including the “pay or play” mandate for firms with 50 or more employees and tax credits for small businesses that offer health insurance. In addition, the requirement for all individuals to carry health insurance may increase the demand for employers to offer health insurance. The exchanges may also spur the offer of insurance among small businesses. In Massachusetts, the fraction of workers covered by employer-sponsored health insurance increased from 70 to 76 percent from 2005 to 2009 as the state implemented its own health care reform, which subsequently provided a model for the federal law (Gruber 2011). An increase in an employer’s offer of health insurance would decrease the earnings ratio by shifting compensation from taxable wages to non-taxable expenditures on health insurance.

On the other hand, well-functioning health insurance exchanges that offer individuals a reasonable alternative to employer-provided coverage may motivate some employers to drop their health insurance. Singhal, Stueland, and Ungerman (2011) argue that 30 percent of employers would benefit by eliminating coverage even if they fully compensated employees through higher salaries and paid the penalties levied on firms that do not offer insurance. Some employers may also find it attractive to change the composition of their workforce, substituting part-time employees not under the employer “pay or play” mandate for full-time workers. Employees, too, may be less interested in employer-provided coverage once the exchanges

are operational and may be more willing to accept either full- or part-time jobs without health insurance. These outcomes would reduce employer expenditures on health insurance and increase the earnings ratio.

The Congressional Budget Office (2010) projects that health care reform will reduce by 2.5 percent the number individuals with employer-provided health insurance, although other analysts such as Singhal, Stueland, and Ungerman (2011) believe that the decline in employer-sponsored coverage could be much larger. And, as the Massachusetts experience suggests, it is possible that employer coverage could increase, even though none of the experts consulted for this report thought that such a scenario was highly likely.

Finally, health care reform includes incentives to reduce the growth rate of employer expenditures on health insurance. Employer-sponsored health plans will be subject to an excise tax of 40 percent on expenditures in excess of \$10,200 for individual coverage and \$27,500 for family coverage. As noted in section 3.2, the threshold for premiums subject to the tax grows with the overall rate of inflation, which is expected to lag behind the growth per capita in health care costs. As a result, the fraction of health plans subject to the excise tax will increase, encouraging firms to reduce the generosity of their health benefits (or even eliminate coverage) and shifting compensation from health insurance to wages. Such a reduction in the growth rate of employer expenditures on health insurance would reinforce any increase in the earnings to compensation ratio resulting from a reduction in employer-sponsored health insurance.

Overall, there are plausible scenarios in which health care reform could either increase or decrease with the earnings ratio, thus arguing for expanded uncertainty around the earnings ratio in the long run. Such uncertainty is reflected in our recommendations for the high- and low-cost values for the earnings ratio, which increase the range relative to current assumptions.

Health Care Reform and the Taxable Share of Wages

Health care reform may also affect the taxable share of wages. The general decline in the taxable share of wages (**Figure 59**) may be partly attributable to the increasing share of compensation devoted to employer health insurance (**Figure 53**); increases in employer health insurance expenditures

have a disproportionate effect on the compensation of workers below the taxable maximum relative to workers above the taxable maximum. Health care reform could reduce the rate of expenditure growth for employer-provided health insurance for the reasons discussed above in the context of the earnings ratio and, more generally, in response to provisions that exert downward pressure on health care cost growth. With employer health insurance a fixed cost, a reduction in the expenditure growth of employer health insurance could increase the taxable share of wages relative to outcomes in the absence of health care reform.

Health care reform also includes financing provisions that increase the tax rates on both earned and unearned income among higher-income taxpayers, and these tax changes could affect the taxable share of wages. Specifically, the law increases the Medicare payroll tax by 0.9 percent on earnings above \$200,000 and imposes a new tax of 3.8 percent on unearned income above \$200,000.²⁴ These changes reduce the work incentive for higher-income tax filers, potentially increasing the taxable share of wages. On the other hand, the larger increase in the tax on unearned income (3.8 percent) relative to the change in the tax rate on earned income (0.9 percent) could encourage some higher-income individuals to restructure their compensation, potentially changing the taxable share of wages. For example, if high-income individuals take income as earnings rather than as capital income, they decrease their taxable share of wages. Given the small number of individuals affected by these tax changes and the relatively small changes in the tax rates, the Technical Panel believes that these effects will likely be minimal.

Health Care Reform and Disability Insurance Incidence

Two features of health care reform could affect the incidence of disability insurance receipt. First, reductions in employment could reduce the fraction of the population insured for DI benefits, although we believe that any such effect is likely to be small. Second, because DI recipients have a two-year waiting period before becoming eligible for Medicare, one of the costs of applying for DI is potentially limited access to health insurance for a period of time. The creation of health insurance exchanges as a part of health care reform could substantially

²⁴ The \$200,000 threshold is for individual tax filers; for married-filing-jointly tax filers, the threshold is \$250,000.

reduce the cost of applying for DI, which could, in turn, encourage more individuals to apply for DI, an outcome that would adversely affect the DI program's finances. Such an outcome seems possible, although it is hard to gauge its magnitude; this is another area where health care reform increases uncertainty about long-run outcomes.

Health Care Reform and Health

One aim of health care reform is that it will lead to improved health. A recent review of the literature on the impact of health insurance on health concludes that "policies to expand insurance can also promote health" but that "it is difficult to extrapolate from these studies to the potential health benefits of completely different policies" (Levy and Meltzer 2004). If health care reform does lead to improved health, it could affect OASDI finances in several ways. One manifestation of improved health would be a reduction in mortality, which would adversely affect OASI system finances. In addition, the DI system could experience countervailing effects of health improvements. Better health would likely reduce DI incidence and thus improve system finances, but it could be offset by reductions in mortality among DI beneficiaries, leading to longer DI spells for beneficiaries. Given that many older individuals cite declining health as a reason for retirement, improvements in health could increase the labor force participation of older workers, buoying system finances and delaying the age of benefit claiming.

The Technical Panel queried several health experts for their opinions on the impact of health care reform on mortality, disability, and the labor force participation of older workers. While all acknowledged the potential for the above effects, they agreed that any attempt to quantify the effects at this stage would be speculative at best. The Technical Panel concurs with the assessment of Holtzblatt and Page (2009) in a Congressional Budget Office report on the impact of health reform on the labor market:

"The overall impact on labor markets... is difficult to predict. Although economic theory and experience provide some guidance as to the effect of specific provisions, large-scale changes to the health insurance system could have more extensive repercussions than have previously been observed and also may involve numerous

factors that would interact – affecting labor markets in significant but potentially offsetting ways" (p. 1).

Conclusion

The Technical Panel sees significant uncertainty about how health care reform will affect many of the outcomes discussed in this chapter : employment, the earnings ratio, the taxable share of wages, incentives to apply for DI, and health. This uncertainty justifies an increase in the ranges for the high- and low-cost scenarios for many of the assumptions discussed in this report. The Technical Panel also recommends research into the impact of health care reform on these outcomes as reforms unfold. Such research would then inform whether changes should be made to the relevant assumptions and whether the range of uncertainty should be adjusted.

Chapter 2: Demographic Assumptions and Methods

2.1 Fertility

Assumption Recommendation A-2. The Technical Panel recommends retaining the intermediate total fertility rate assumption of 2.0 from the 2011 Trustees Report. The Technical Panel also recommends low- and high-cost total fertility rates of 2.2 and 1.6, respectively. We agree with previous Technical Panels that asymmetry in the range between the intermediate- and low- and high-cost values is appropriate, although our current estimate of such asymmetry is modest.

Overview

The fertility assumption is expressed in terms of the total fertility rate (TFR), which is defined as the average number of births per woman over her life time if she experienced the age-specific rates of a given year and survived to the end of her childbearing years. As a period-based measure, the TFR reflects changes in the ages at which women bear children (the timing or tempo of childbearing) and/or in the number of births to women (the quantity, or quantum). Evidence reviewed below shows that increases in ages at childbearing have depressed the TFR in recent decades, but the effect wanes with projections on a 75-year horizon. The quantum component of U.S. fertility has remained at near-replacement level (TFR of approximately 2.1) for the last two decades, and the most likely scenario is continued childbearing at slightly below that rate. Specifically, we expect that the impact of the Hispanic population's higher fertility will wane in the next two decades, providing some downward pressure on fertility. Overall, the underlying components of U.S. fertility are stable and sufficient to project near-replacement-level fertility over the 75-year horizon.

Historical and International Perspective

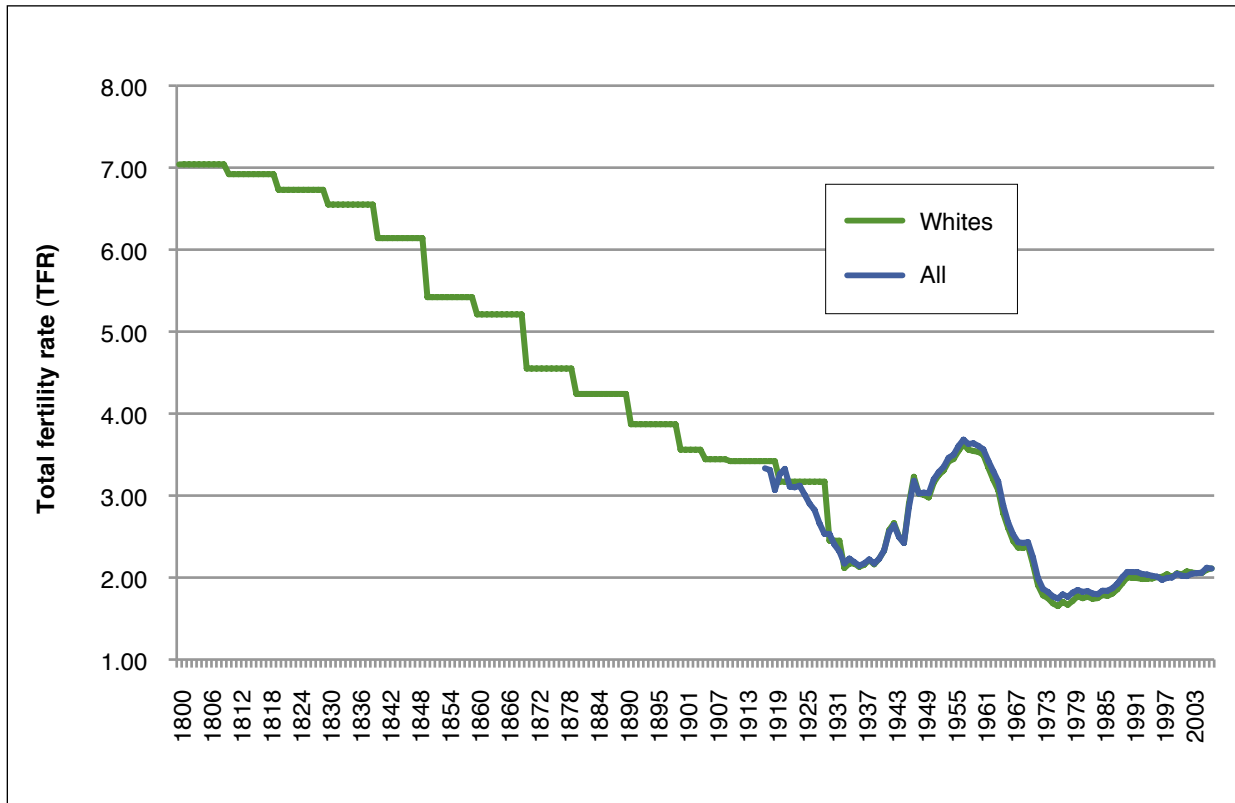
Figure 17 shows, for a period of more than two centuries, estimated trends in U.S. fertility. The blue line describes whites as presented in the last Technical Panel Report, and the red line, which is virtually indistinguishable from the blue line, represents all races. The broad contours of the decline are well known – a decline associated with urbanization, economic/social development, and improved health and longevity followed by the post-World War II Baby Boom (1944–1959) and bust (1960–1980), which were associated with rapid changes in economic growth, impacts on family formation, and perceived well-being and security (Cherlin 1992).

To put U.S. trends in perspective, we examine country-level data covering the last half-century. Following Morgan and Rackin (2010a), **Figure 18** shows 1960–2005 on the x-axis and TFR changes for 103 counties (with requisite data) on the y-axis. These countries represent 83 percent of the world's 2000 population (Morgan and Rankin 2010a:Appendix). The bold colored lines show, weighted by 2000 population, TFR averages for developing and developed countries while the lighter lines show the estimated trend for each of the 103 countries.

Figure 18 has two impressive features. The first is pervasive and secular decline captured by the two bold lines that represent aggregate trends for developing and developed countries. Over the period, the developing country average declined from 6.06 births per woman to 2.54, and developed country levels declined from approximately 2.91 births to 1.70. The second feature is the TFR range – in 1970, from over 8 births to 1.65. A surprisingly wide range remains in 2005 (from 7.03 to 0.97).

When mortality is low, as it is now in developed countries, a TFR of 2.1 is replacement-level ferti-

Figure 17. Historical Trend in U.S. Total Fertility Rate, by Race: 1800–2007



Source: Human Fertility Database; National Vital Statistics Reports (NVSr), Volume 58, Number 24, August 2010.

ity. In the long run, given a low- mortality context, replacement-level fertility must be achieved in order to realize a stable population size. This level of fertility is shown by the bold, horizontal line in **Figure 18**. In 1960, few countries were below this level; by 2005, 41 countries had reached fertility below 2.1.

The TFR changes noted above reflect tempo and quantum components. Over the long term, the quantum component dominates as reflected in smaller families. **Figure 19** shows a U.S. time series (1917–2007) of the percentage of births by parity. Increasingly, births are first or second births. While not shown here, this pattern of change holds for all countries for which data are available. Over 70 percent of 21st Century births in the United States are first or second births. The rationale for these births – the desire to become a parent and to have a sibling for the first child – has proven to be a stable rationale for childbearing while the rationale for higher-parity births has weakened (Morgan 2001, 2003).

Overlaid on the quantum changes are tempo changes. **Figure 20** shows a U.S. time series (1917–

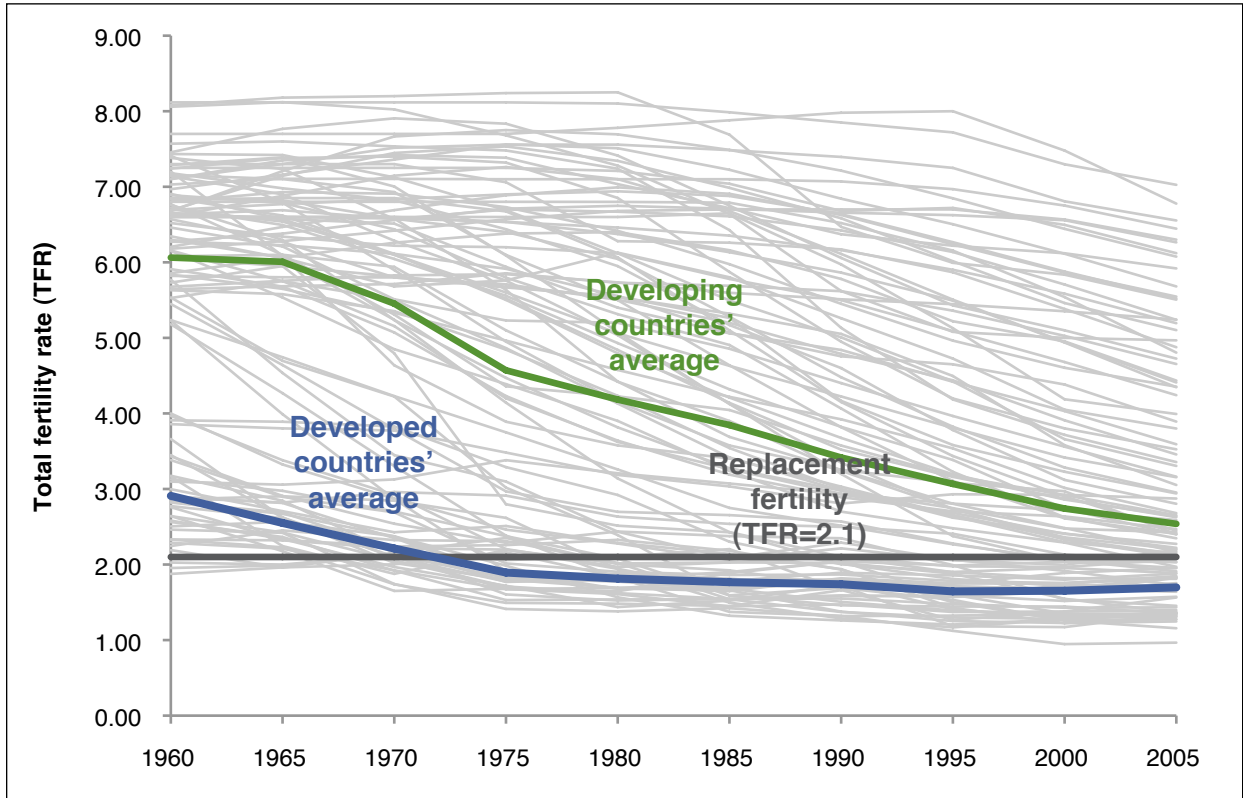
2007) of mean ages at childbearing by parity. Historically, later childbearing is associated with a lower quantum of fertility, although rising mean ages at childbearing lower the current TFR level. Declines in ages at childbearing have the opposite effects. We explore these dynamics below. At this point, it is important to note that the Baby Boom and bust were associated, respectively, with substantial declines followed by substantial increases in ages at childbearing.

In sum, the U.S. experience broadly fits international experience. Specifically, fertility has declined over time with socioeconomic development, and the decrease is driven by the decline in higher-parity births. Both the timing and pace of the decline in fertility exhibit substantial variability (Bongaarts and Watkins 1996; Morgan and Rackin 2010a) and, presumably, are attributable to cultural and institutional factors.

Disaggregation of Recent Trends

Disaggregation allows for separate projections of the components of fertility. We will employ a dis-

Figure 18. Total Fertility Rate in High- and Low-Development Countries: 1960–2005



Source: Morgan and Rackin, 2010a.

aggregation strategy several times. First, we focus on the TFR and the estimation of its tempo and quantum components by following two broad strategies for decomposition: (1) reliance on completed-cohort fertility that contains no tempo component and (2) adjustment of the period rate to remove the tempo effect. Recognizing that the strategies involve strengths and weaknesses, we will employ both strategies, which lead to the same conclusion regarding recent U.S. trends.

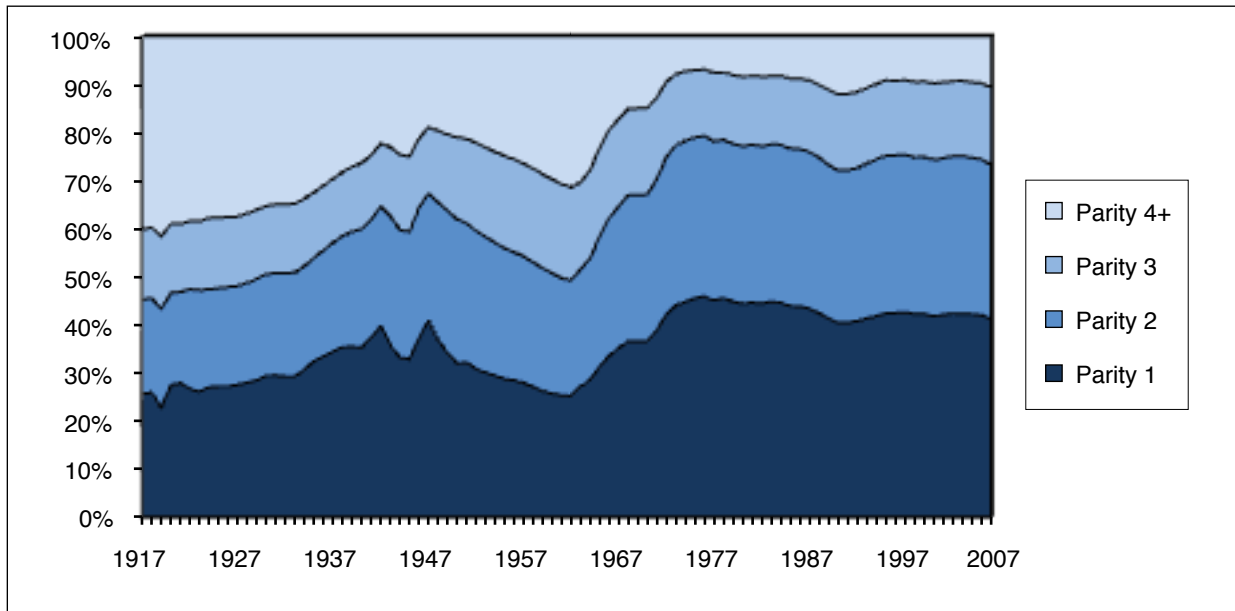
The blue line in **Figure 21** shows recent trends (1960–2008) in the TFR. The red line is a completed-cohort fertility series (CTFR)²⁵ whereby the TFR and cohort series are aligned by adding 26 to the cohort’s birth year. Clearly, the TFR is lower than the CTFR in recent years, demonstrating that, in these years, tempo effects (increasing ages at childbearing) operate to suppress the TFR relative to the

CTFR. The strength of the CTFR approach is that it provides a “pure” measure of quantum for a cohort, although any particular cohort is only one of many contributing to a given period rate. In addition, the CTFR may not be estimated reliably for cohorts still in the midst of the childbearing years because their fertility experience is, by definition, incomplete. Thus, no CTFR quantum estimate is available for the last decade of the TFR series in **Figure 21**.

Bongaarts and Feeney (1998) say that the process of fertility postponement effectively pushes births that would have occurred in year x into year $x+1$. Thus, postponement consistently lowers the TFR net of quantum (the opposite case shifts toward younger ages at childbearing and increases the TFR net of quantum). Bongaarts and Feeney propose a simple adjustment to the TFR to capture the quantum component net of timing shifts. The adjustment is parity-specific and a function of the degree of postponement. For instance, if the first-birth mean age at childbearing increases by 0.1 in year t , it implies that 10 percent of first births have been postponed to year $t+1$ and that the appropriate ad-

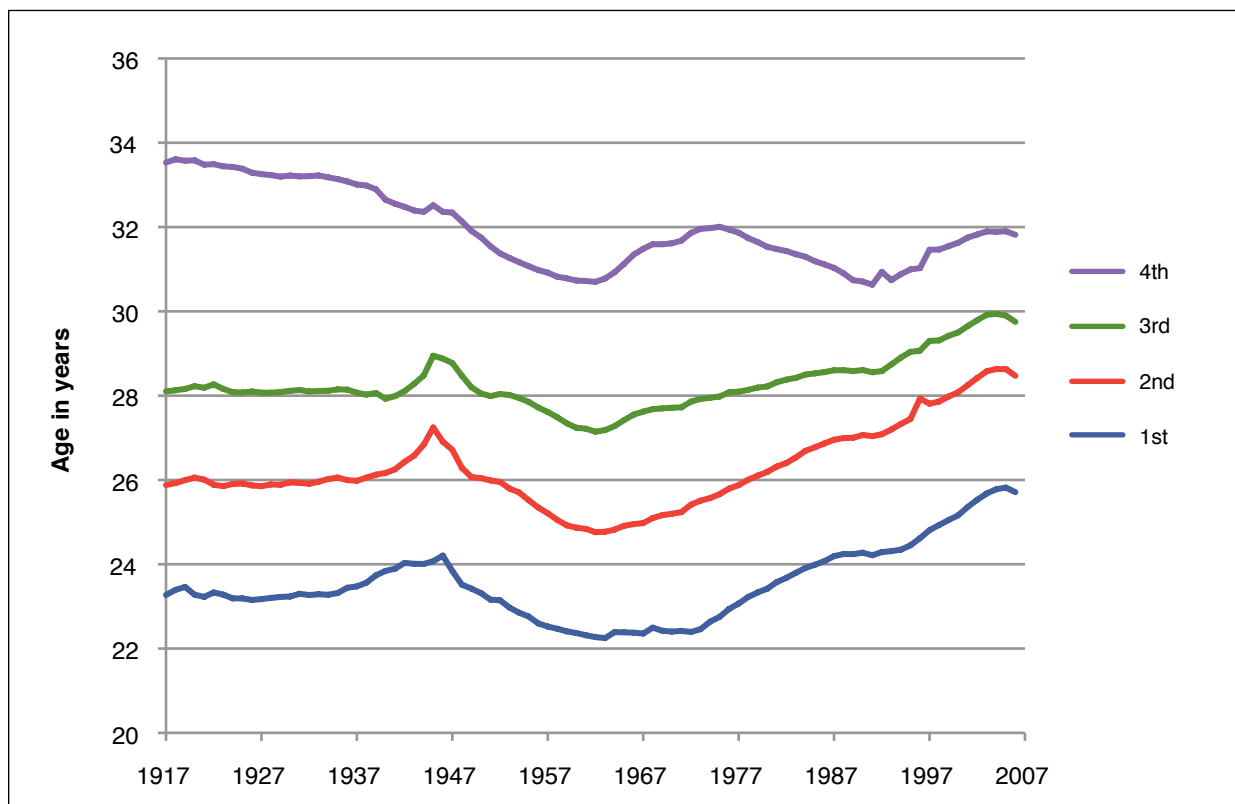
²⁵ For cohorts that have reached age 35 but cannot be observed until the end of the childbearing years (age 50), we project the fertility experience for the later years. Specifically, we assume that the average age-specific rates for the last two years observed will hold at the older ages.

Figure 19. Percentage of Births by Parity: United States: 1917–2007



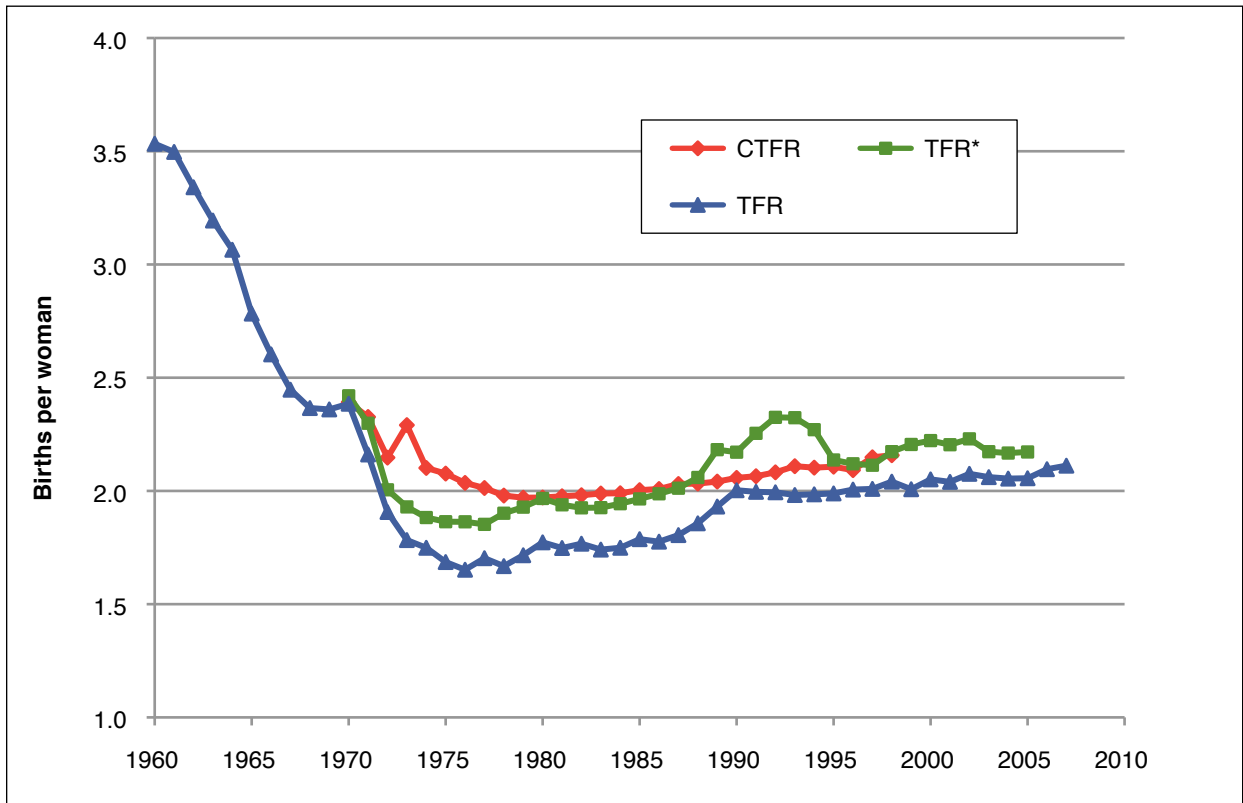
Source: Panel calculations based on data from Human Fertility Data Base at <http://www.humanfertility.org/cgi-bin/main.php>.

Figure 20. Mean Age at Childbearing by Parity: United States, 1917–2007



Source: Panel calculations based on data from Human Fertility Data Base at <http://www.humanfertility.org/cgi-bin/main.php>.

Figure 21. Trend in TFR, CTFR, and TFR*: United States, 1960–2007



Source: Panel calculations based on data from Human Fertility Data Base at <http://www.humanfertility.org/cgi-bin/main.php>.

Notes: (1) TFR available in database. CTFR estimates include some modest extension of current period age-specific rates to allow for time-series shown. (2) TFR* calculated using a smoothed change in age at first (.08 per year), and second births (.06 per year) over years 1963-2005. (3) TFR* assumes no change in timing for higher order births.

justment to estimate first-birth TFR quantum is a 1.1 factor.²⁶ The green lines in **Figure 21** show this tempo-adjusted TFR (TFR*).²⁷ AS with the CTFR, these TFR* estimates consistently exceed TFR by about 10 percent. Thus, the underlying quantum component is consistently at or near replacement level. The tempo component, however, is a “temporary” effect; the age at childbearing cannot continue to increase indefinitely, but it can exert and in fact has exerted downward pressure on the TFR since about 1970.

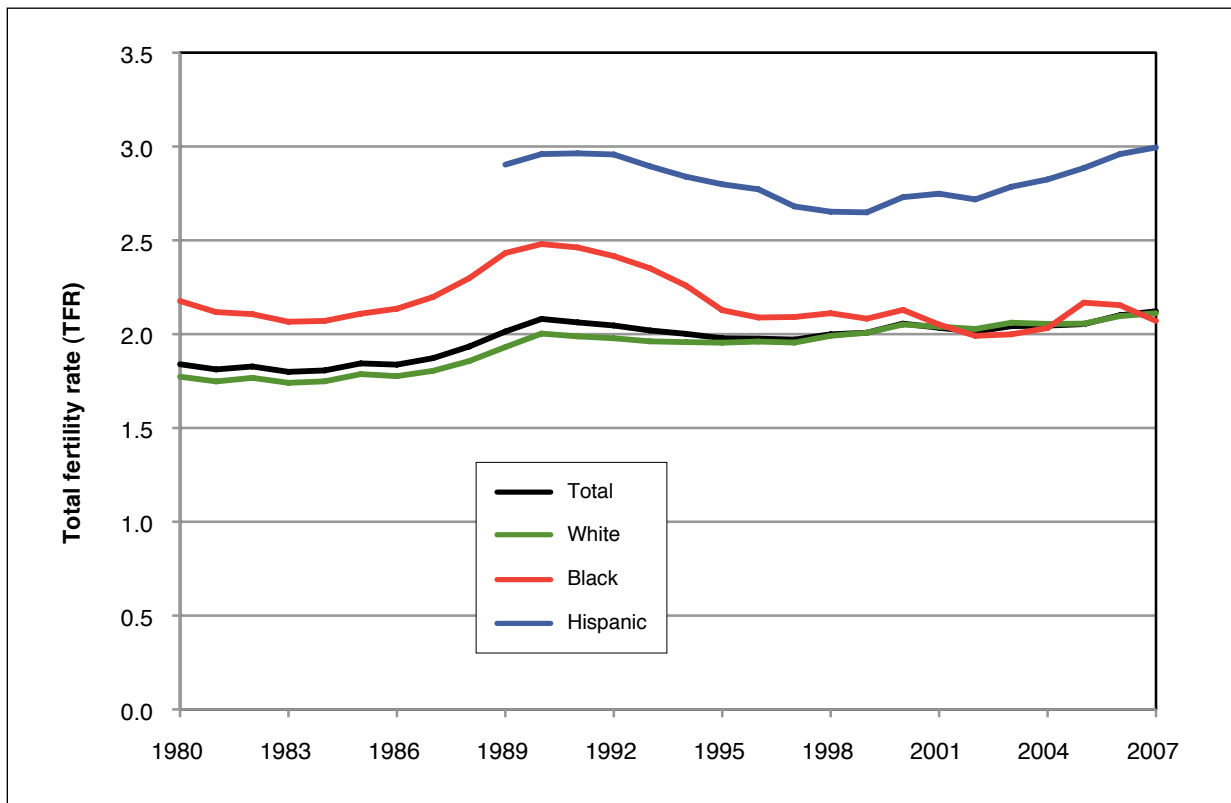
²⁶ Several elaborations of the model (e.g., Zeng and Land 2002; Kohler and Ortega 2004) followed the publication of Bongaarts and Feeney, 1998.

²⁷ In estimates shown here, the change in mean age at childbearing at parities one and two was smoothed, producing a consistent upward drift in mean age at childbearing at these parities. There was little evidence of change at higher parities. Taken together, these adjustments (using the Bongaarts and Feeney approach) produced a consistent upward shift of TFR* relative to TFR, as shown in **Figure 5**.

In sum, on a 75-year horizon, the most important TFR component is quantum, and it has been approximately stable at 2.0 for over three decades. Tempo changes may be important over several decades, but continued increases in age at childbearing are time-limited (unless the ability to have children at advanced ages increases dramatically).

The second disaggregation strategy focuses on race and ethnicity. We look at the higher Hispanic TFR (e.g., between Hispanics and others) and/or changing composition of the population (e.g., larger proportion of the population Hispanic). **Figure 22** shows strikingly higher fertility for Hispanics over the last 15 years, but convergence for whites and blacks. Given the strong likelihood that Hispanic population growth will outpace non-Hispanic population growth in the coming decades (natural increase, births-deaths, and immigration), a higher Hispanic TFR will exert increasing upward pressure on the overall U.S. TFR. This explanation produces the common claim that U.S. fertility is

Figure 22. Race/Ethnic Total Fertility Rate Trends in the United States: 1980–2007



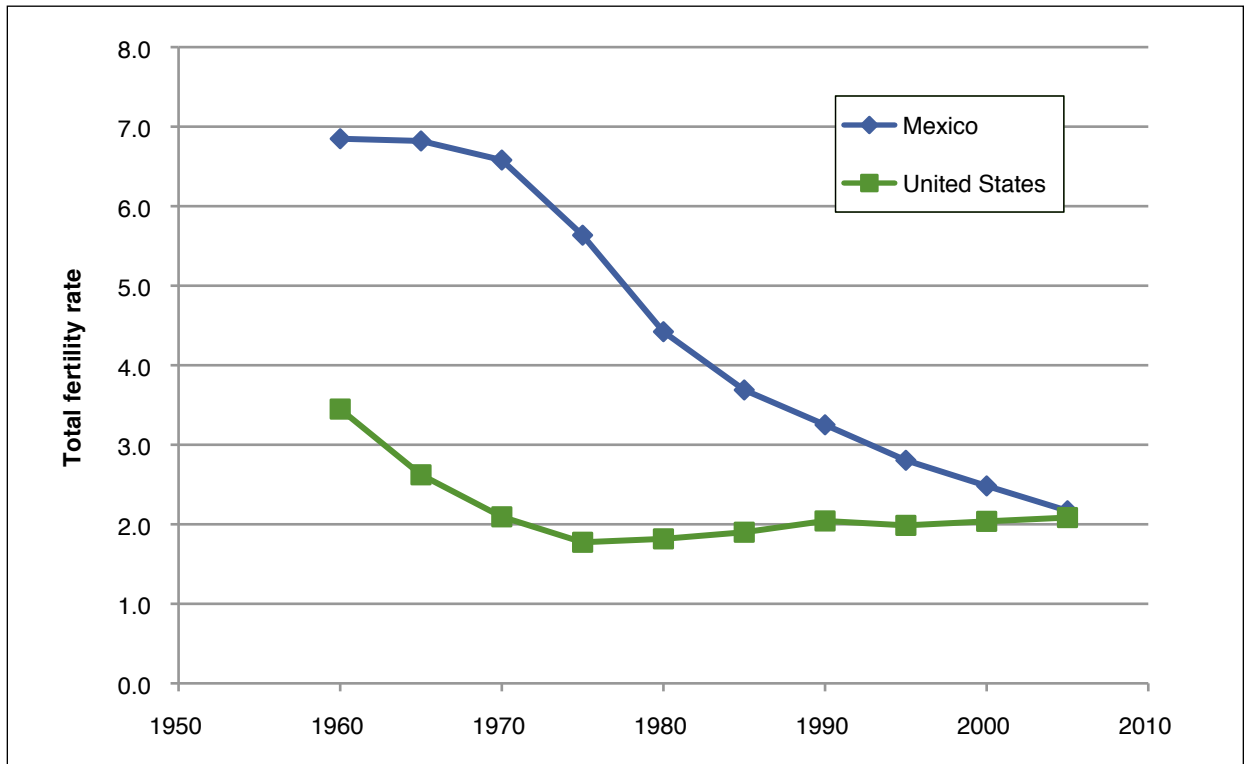
Source: U.S. National Center for Health Statistics, National Vital Statistics Reports (NVSR), Volume 54, Number 2; September 8, 2005; Volume 54, Number 8, December 29, 2005; Volume 58, Number 24, August 2010.

at or near replacement because of minority group fertility. Indeed, in 2007, U.S. fertility was approximately 9 percent higher (2.12 versus 1.94) because of the higher fertility among Hispanics. However, fertility is near replacement (1.94) even with Hispanics excluded.

Over the next few decades, it is likely that Hispanic fertility will more closely approximate that of non-Hispanic whites, as suggested by various streams of evidence. First, cross-sectional comparisons of immigrants and first- and second-generation Hispanics often show little evidence of fertility decline, an observation interpreted as counter to assimilationist expectations. However, Parrado and Morgan (2008) show that, if the data are arrayed to reflect true generations, then convergence toward white non-Hispanic fertility is observed. These authors also show via simulation that the cross-sectional result obtains when the cross-sectional fertility decline is greater than the generational decline. Second, other evidence shows that Hispanics are as responsive to socioeconomic change as are

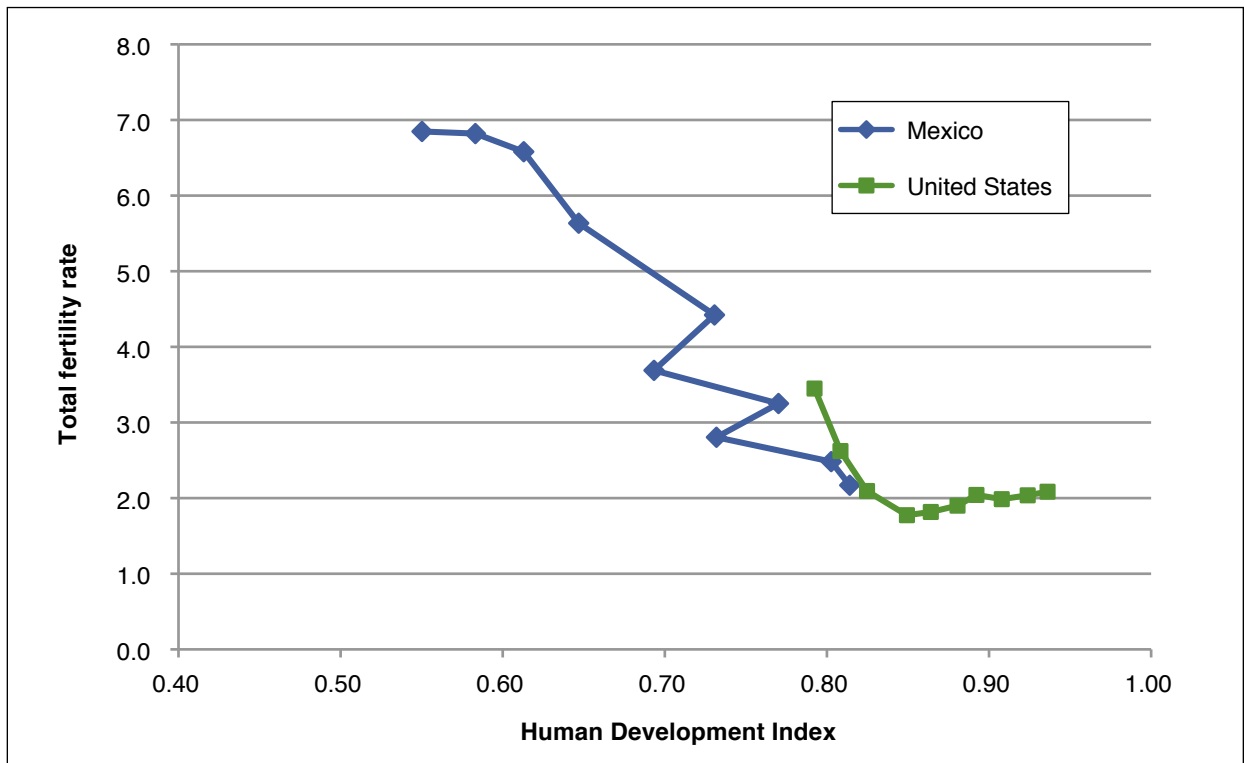
other groups. For instance, Hispanic fertility differences by education are equal to those of non-Hispanic whites (Parrado and Morgan 2008). Further, as shown in **Figure 23A**, Mexico’s (the source of the largest Hispanic immigrant stream) declining TFR reached 2.1 in 2005, approximately the same level as the United States in the same year. **Figure 23B** shows the TFR for the United States and Mexico by levels of the Human Development Index (HDI) – a commonly used measure of social and economic development (discussed below). Mexican fertility is declining at a precipitous rate vis-à-vis HDI. In fact, by 2000, Mexico’s HDI had reached 0.8, a value reached by the United States in 1965–1970. Mexican and U.S. fertility rates are comparable once HDI is 0.8 or greater. Thus, we find little evidence that Hispanic fertility is resistant to decline with rising socioeconomic development. The likely reduction of much higher Hispanic fertility over the coming decades would reduce U.S. fertility by 5 to 10 percent over the 75-year projection period.

Figure 23A. Total Fertility Rate for Mexico and the United States: 1960–2005



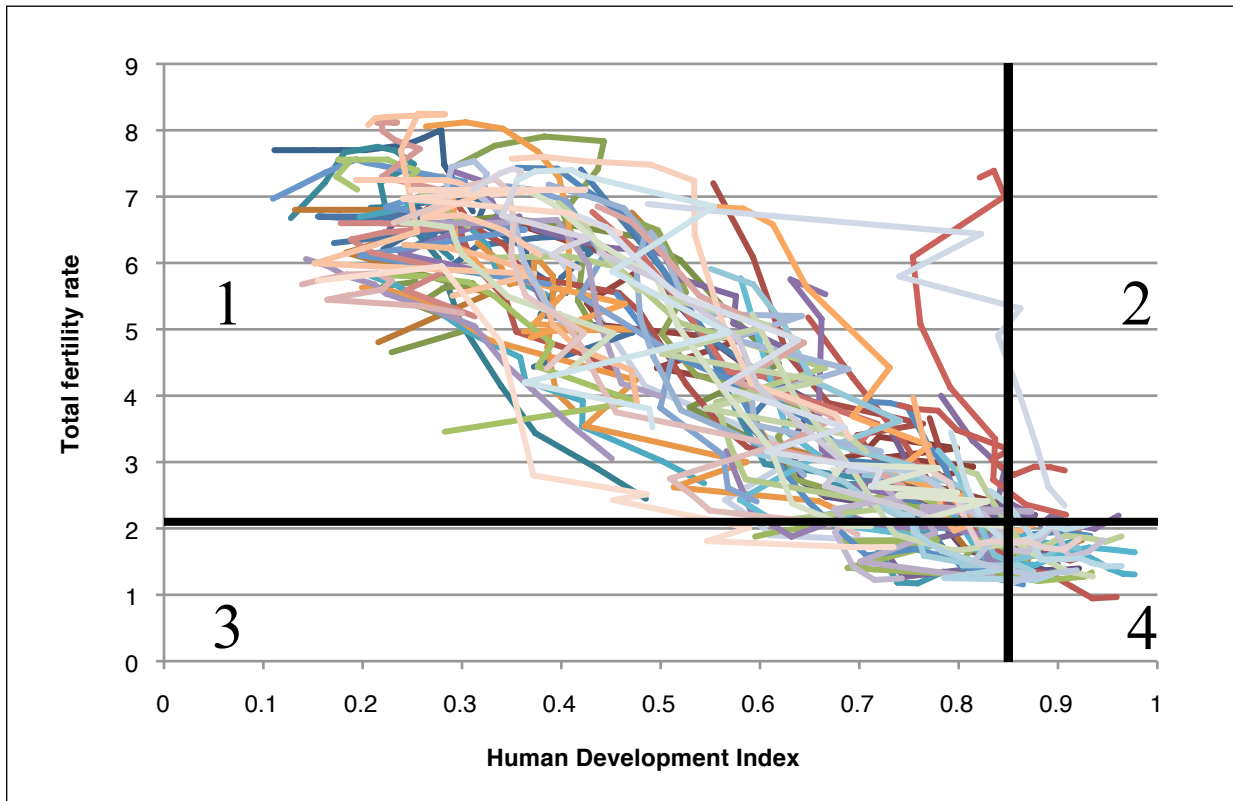
Source: Morgan and Rackin, 2010a.

Figure 23B. Total Fertility Rate by Human Development Index for Mexico and the United States: 1960–2005



Source: Morgan and Rackin, 2010a.

Figure 24. Total Fertility Rate by Human Development Index in High- and Low-Development Countries: 1960–2005



Source: Morgan and Rackin, 2010a.

It is possible to develop decomposition arguments about other sizeable contemporary differences. For instance, the more religious have more children (Hayford and Morgan 2008). With respect to evidence that the population was becoming less religious, we would observe future declines as this secular change continued. However, evidence of declining religiosity is mixed at best. Likewise, educational differentials in fertility are cross-national and have been clearly visible in U.S. data for decades. But period fertility changes have been pervasive with respect to education, and quantum fertility has remained at roughly 2.0 despite massive increases in levels of educational attainment. Thus, it is unclear if ongoing increases in education will continue; even if they do, their effects on fertility are unclear. Finally, married women have higher fertility than unmarried women, yet most women marry, and rates of non-marital childbearing (and the proportion of children born to unmarried mothers) are rising. Experience of the last four decades shows that postponed marriage and high levels of

marital disruption can co-exist with replacement-level fertility in the United States.

Cross-National Comparisons

Figure 24 displays the TFR values from **Figure 18** on the y-axis while the x-axis is an indicator of social and economic development (HDI). As noted in discussing **Figure 18**, social and economic development is a main causative factor in fertility decline. As in **Figure 18**, each line in **Figure 24** represents a single country; the line is formed by connecting TFR/HDI points chronologically (1960–1964 to 2000–2004). The general tendency for lines to slope downward from left to right indicates that persistent increases in HDI are associated with persistent TFR declines. We use the HDI to reflect its application in some important articles that provide the basis for some of our discussions (noted below) and because other socioeconomic indicators (or indices) would produce similar results.

HDI is an additive index created from components measuring income per capita, literacy and

educational enrollment, and life expectancy.²⁸ As in **Figure 18**, we show replacement-level fertility (i.e., TFR = 2.1 for low-mortality populations) with a bold horizontal line. Countries with HDI values greater than 0.85 typically exhibit fertility at replacement levels and below. We therefore identify the 0.85 level with a bold vertical line. The two lines generate four quadrants in **Figure 24**. The great majority of data falls in quadrants 1 and 4. Quadrant 1 corresponds to the fertility transition (the transition from high to low fertility); it is important to note the strong association between lower fertility and increasing HDI. Quadrant 4 demonstrates the remaining variation in TFR with little apparent association between further increases in the HDI and changes in the TFR.

The data presented thus far give rise to an important question. Does the anti-natalist effect (visible in quadrant 1) persist once fertility reaches a level of 2.1 and below (quadrant 4)? An affirmative answer strongly suggests further fertility declines. A provocative and highly visible article recently published by Myrskylä et al. (2009) suggested that, at high levels of development, further development produces a reversal in fertility, that is, an increase. A subsequent working paper by the same authors tempers these claims since much of the observed upturn in TFR was attributable to the cessation of fertility postponement. Moreover, the authors failed to offer a convincing explanation of why very high levels of development would be consistently pro-natalist. They state that “given the heterogeneity of institutional, cultural and policy contexts across developed countries, further research is required to investigate the different mechanisms that may underlie this reversal – particularly in light of exceptions such as Japan, Canada and South Korea” (p. 742). After reviewing the evidence, the Technical Panel has arrived at a more cautious but important conclusion. At high levels of social and economic development (i.e., HDI in excess of 0.85), no consistent evidence demonstrates further development impacts on fertility levels. In **Figure 25**, we show data for a small set of countries with various levels of low fertility persistent on a decadal time scale. The differences likely result from pervasive, sustainable institutional differences. We argue that increases in HDI at high levels provide little lever-

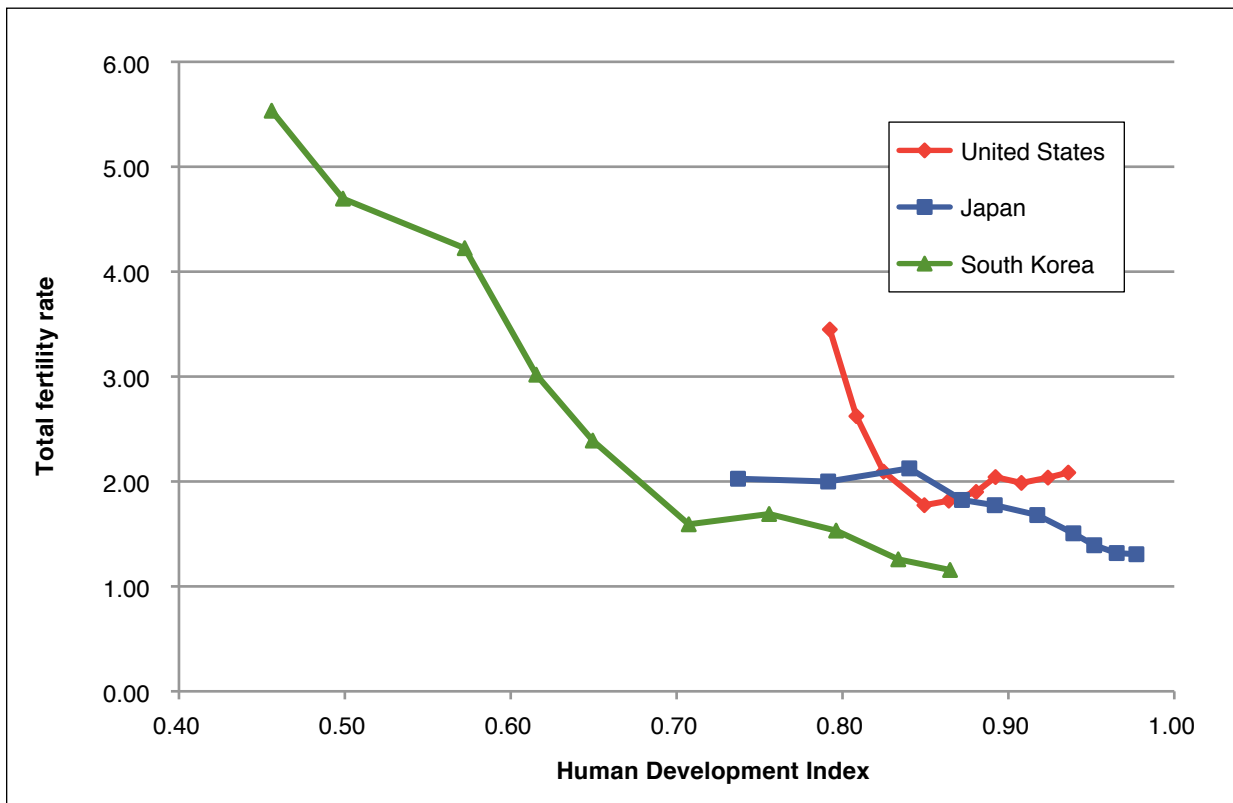
age on the direction of fertility change in the United States or elsewhere.

Insight into persistent fertility differences among low-fertility countries, such as those shown in **Figures 24** and **25**, comes from a conceptual “proximate determinants” model proposed by Bongaarts (2001; 2002) and used in a series of recent studies (e.g., Hayford and Morgan 2008; Morgan, Zhigang, and Hayford 2009; Morgan and Rackin 2010b). The aggregate model explains TFR levels as a function of the population’s family size desires/intentions conditioned by factors that impede the realization of the aggregate intention. The model first adjusts for tempo effects and then considers significant conditioning factors that lead people to exceed intentions. One such factor is birth control failure (that is, unwanted births). Other factors can produce a fertility shortfall vis-à-vis intentions. For instance, sub- or infecundity can vary across populations because of the degree of fertility postponement or other factors. In addition, persons may not realize their desired/intended family size because of competition with other activities. Thus, the model “explains” population-level differences in low fertility by other macro-level characteristics, thereby permitting speculation about trends in these components to assess whether change or convergence between countries is likely.

Taking the United States as an example, we have seen that the nation has experienced high fertility for several decades relative to other highly developed countries. Morgan (2003) argues that the major components of the country’s higher fertility include a strong commitment to both parenthood and families with more than one child (fertility desires/intentions remain at replacement levels), a high level of birth control failure (e.g., 10 to 15 percent of all births are unwanted), and institutional features that allow women to combine family and work (relatively low competition). Not only have these features been relatively stable for several decades, but the Technical Panel does not see strong evidence of change in the coming decades. In contrast, much lower fertility in other countries is a function of more anti-natalist components (lower or declining fertility desires/intentions, fewer birth control failures, and weak institutional support for resolving family/work conflicts). These persistent below-replacement fertility levels present significant problems (e.g., rapid population aging and eventual population decline). As a result, many low-fertility countries have instituted po-

²⁸ See <http://hdr.undp.org/en/statistics/indices/hdi/>. Articles discussed below (Bongaarts and Watkins 1996; Myrskylä et al. 2009) use the HDI.

Figure 25. Total Fertility Rate and Human Development Index for the United States and Other Selected Low-Fertility Countries: 1960–2005



Source: Data from Morgan and Rackin, 2010a.

lices aimed at increasing fertility. The cumulative experience of policies that do and do not succeed in raising fertility levels will likely provide developed countries with strategies to increase fertility if needed. Thus, we expect to see some international convergence of U.S. fertility rates with other low-fertility countries but expect much of the convergence to come from increases among countries with very low fertility rates.

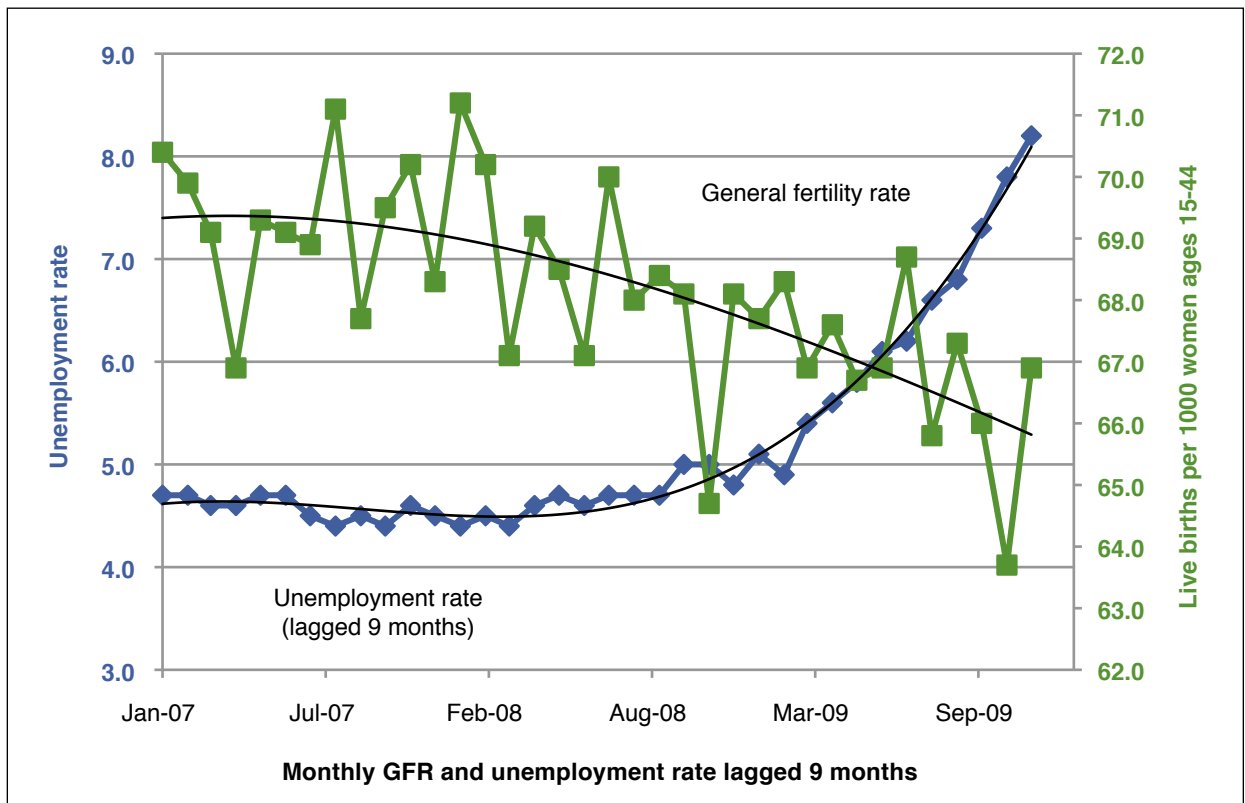
While the Technical Panel sees stability in the U.S. proximate determinants (and, thus, in fertility) as the most likely scenario, it does recognize a greater likelihood of fertility falling below a TFR of 2.0 (as opposed to increasing). This asymmetry rests on several reasonable arguments: (1) the popularity of one-child families may grow as the importance of a sibling for one’s first child declines relative to investing more heavily in a single child; (2) new contraceptive technologies may reduce unintended births more than enough to offset the effects of improvements in assisted reproductive technology; and (3) expanded non-familial opportunities

may compete with childbearing to an extent greater than can be offset by institutional adjustments that ease the conflict between non-familial and familial pursuits.

Effects of the Recent Economic Downturn

U.S. economic downturns consistently reduce fertility (Morgan, Cumberworth, and Wimer 2011). Using unemployment as a measure of an economic downturn and a less refined measure of fertility, the General Fertility Rate (GFR, births per 1,000 women age 15 to 44), **Figure 26** shows that recent sharp rises in U.S. unemployment are associated with fertility declines. The GFR for a given month is associated with the monthly unemployment rate of nine months earlier. As of December 2009 (the most recent data available), the recession of 2007–2009 produced a near doubling of the unemployment rate (4.5 to 9 percent) and fertility declines of roughly 5 percent (a GFR decline from approximately 69/1,000 to 65/1,000). We suspect that the recession effects may persist for three or four years.

Figure 26. Monthly Fertility Rates and Nine-Month Lagged Unemployment Rates, United States: January 2007–December 2009



Source: Unemployment data – seasonally adjusted <http://data.bls.gov/timeseries/LNS14000000>; fertility data – provisional, seasonally adjusted GFR (births per 1,000 women age 15–44) from National Vital Statistics Reports, various issues.

Some of the decline will be fertility postponement and thus not visible in quantum fertility. Therefore, on a 75-year horizon, the recent economic downturn will exert only a minor effect on Social Security forecasts.

2.2 Mortality

Presentation Recommendation P-4. The Technical Panel recommends summarizing the assumptions about future mortality in terms of life expectancy at birth at the end of the projection period rather than in terms of the average annual percentage reduction in total age- and sex-adjusted death rates.

Method Recommendation M-8. The Technical Panel recommends simplifying the mortality projection model by eliminating separate projections by cause of death.

Assumption Recommendation A-3. The Technical Panel recommends increasing the intermediate life expectancy assumption to 88.7 years in 2085, which is 3.7 years higher than the 2011 Trustees Report’s assumption of 85.0 years. The Technical Panel also recommends low- and high-cost assumed life expectancies of 83.7 and 93.7 years. The difference between these low- and high-cost assumptions is 10 years (93.7 minus 83.7 years) compared with 7.7 years in the 2011 Trustees Report; this range reflects the high degree of uncertainty about future mortality trends and the lack of agreement among experts about such trends.

Overview

For more than a century, life expectancy has risen in the United States as well as in several other countries. Mortality will likely continue its decline with ongoing progress in medicine, biotechnology, public health, nutrition, income, education, and access to medical services. However, analysts disagree dramatically about the pace of

future improvements (Bongaarts 2006; Wilmoth 1997, 2001). At one end of the spectrum, the pessimists (Olshansky et al. 1990; Carnes et al. 1996) believe that the most advanced countries are close to a biological limit to longevity. At the other end of the spectrum, the optimists (Oeppen and Vaupel 2002) expect life expectancy to continue to rise rapidly, reaching over age 100 later this century. Most projections by researchers and government agencies fall between these extremes. For example, the 2011 Trustees Report projects life expectancy to grow from 2006's 77.7 years to 82.2 years in 2050. That projection stands in major contrast with the figures published by EUROSTAT for France, Germany, Italy, Spain, and the United Kingdom (EUROSTAT 2011), which are expected to reach an average of 86.3 years by 2050.

In 2006, as a consequence of the high prevalence of smoking and obesity, the U.S. life expectancy of 77.7 years was lower than that of most other high-income countries. These behavioral effects will likely continue to depress U.S. life expectancy. Yet, despite their increase for decades, indicators of smoking behavior and obesity have recently plateaued (National Research Council 2011). Therefore, it is reasonable to assume that the adverse impact of these behaviors on life expectancy will remain at current levels rather than continue to rise. Taking these trends into account, the Technical Panel expects life expectancy at birth to reach 85.5 years in 2060 and 88.7 years in 2085 – somewhat below the European projection but still above the Trustees' current assumptions.

The Technical Panel's main recommendation is to assume a more rapid increase in life expectancy over the coming decades. Previous Technical Panels also made such recommendations, although our recommendation is for a larger upward revision. In addition, the Technical Panel reiterates recommendations made by previous Technical Panels to abandon separate projections by cause of death; such projections add unnecessary complexity and are not based on a transparent methodology.

Historical Background

Life expectancy in the United States started improving in the 18th Century, reaching 47.7 years in 1900, 68.4 years in 1950, and 77.7 years in 2006 (Trustees Report 2011).²⁹ Increases were most rapid in the first half of the 20th Century as infec-

tious diseases were brought under control, thereby greatly improving child survival. In contrast, increases in life expectancy since 1950 have been largely attributable to declines in adult mortality. Female life expectancy has exceeded that of males, with the gap rising until the 1970s before a modest decline (**Figure 27**).

Trends in life expectancy after 1950 show uneven progress over successive decades (**Figures 28A and 28B**). The years since 1980 represent a period of stagnation for females, but not for males, while the 1950s and 1960s represent a period of stagnation for males, but not for females. As a result, U.S. life expectancy has risen at a slower pace than that of other large high-income countries (Australia, Canada, France, Germany, Italy, Japan, Spain, and the United Kingdom). As shown in **Figure 28A**, U.S. males ranked near the top of this group of high-income countries in 1950 but fell to the bottom after 1970 and remain in last place today. U.S. females (**Figure 28B**) also ranked high in 1950 and remained close to the other countries until 1980 before dropping to last place in 2006.

Why does the United States demonstrate such a low current ranking in international mortality comparisons? This question has drawn the attention and concern of researchers and policymakers. The current situation is especially surprising given that the United States spends far more on health care than any other country. In response to these concerns, the National Research Council (NRC) appointed a panel of leading experts in 2008 to investigate the reasons for the divergence between the United States and other high-income countries. In its final report, the NRC panel reached several conclusions (National Research Council 2011):

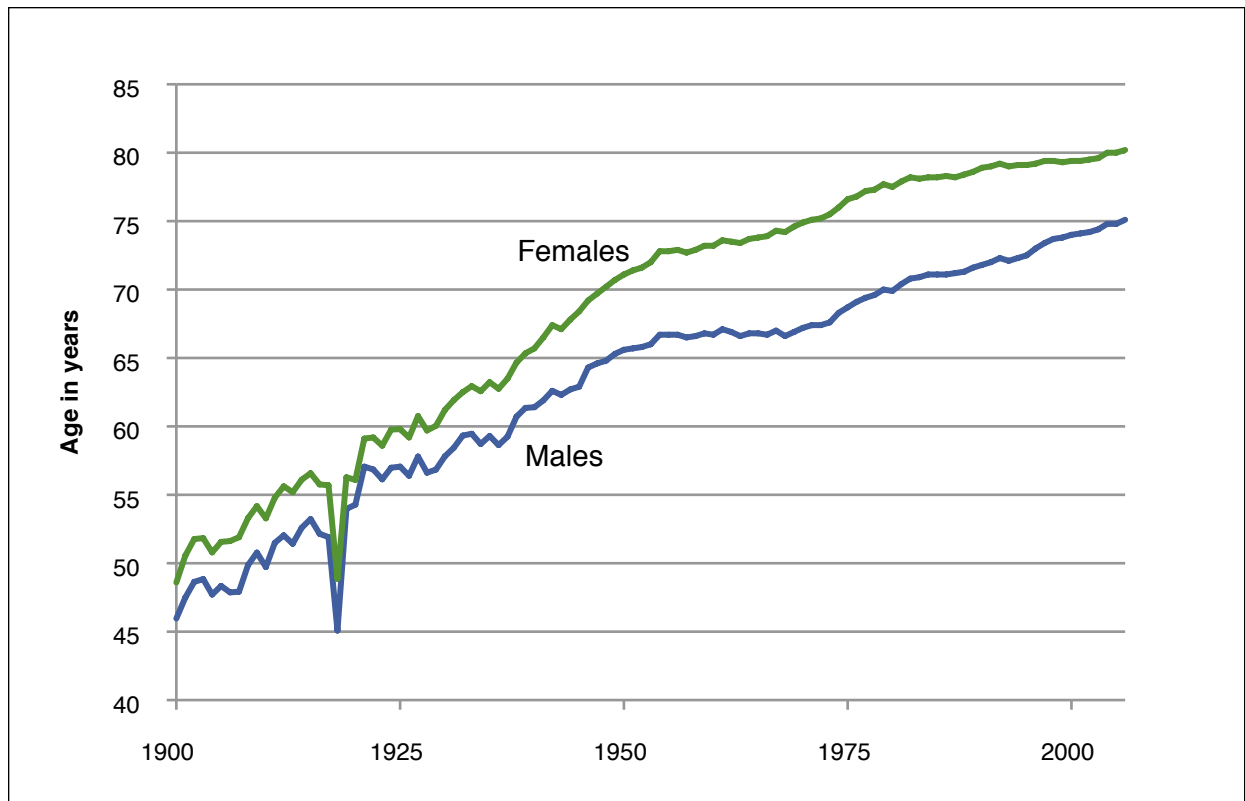
“A history of heavy smoking and current levels of obesity are playing a substantial role in the relatively poor longevity performance of the United States.”

“The damage caused by smoking was estimated to account for 78 percent of the gap in life expectancy for women and 41 percent of the gap for men between the United States and other high income countries in 2003.”

“Obesity may account for a fifth to a third of the shortfall of life expectancy in the United States relative to the other countries studied.”

²⁹ Average of male and female life expectancy.

Figure 27. U.S. Life Expectancy by Gender: 1900–2006



Source: Office of the Chief Actuary, Social Security Administration, 2011.

In addition to establishing the roles of smoking and obesity as factors in the relatively low U.S. life expectancy, the NRC report (2011) examined earlier trends in these factors and concluded:

“After 1964, when the Surgeon General’s Office released its authoritative report on the adverse effects of cigarette smoking, the increase in smoking slowed, stopped and eventually reversed in the United States.”

“Recent data on obesity for the United States suggest that its prevalence has leveled off and some studies indicate that the mortality risk associated with obesity has declined.”

These conclusions have important implications for projecting trends in life expectancy and provide the basis for Recommendation 3, as discussed below.

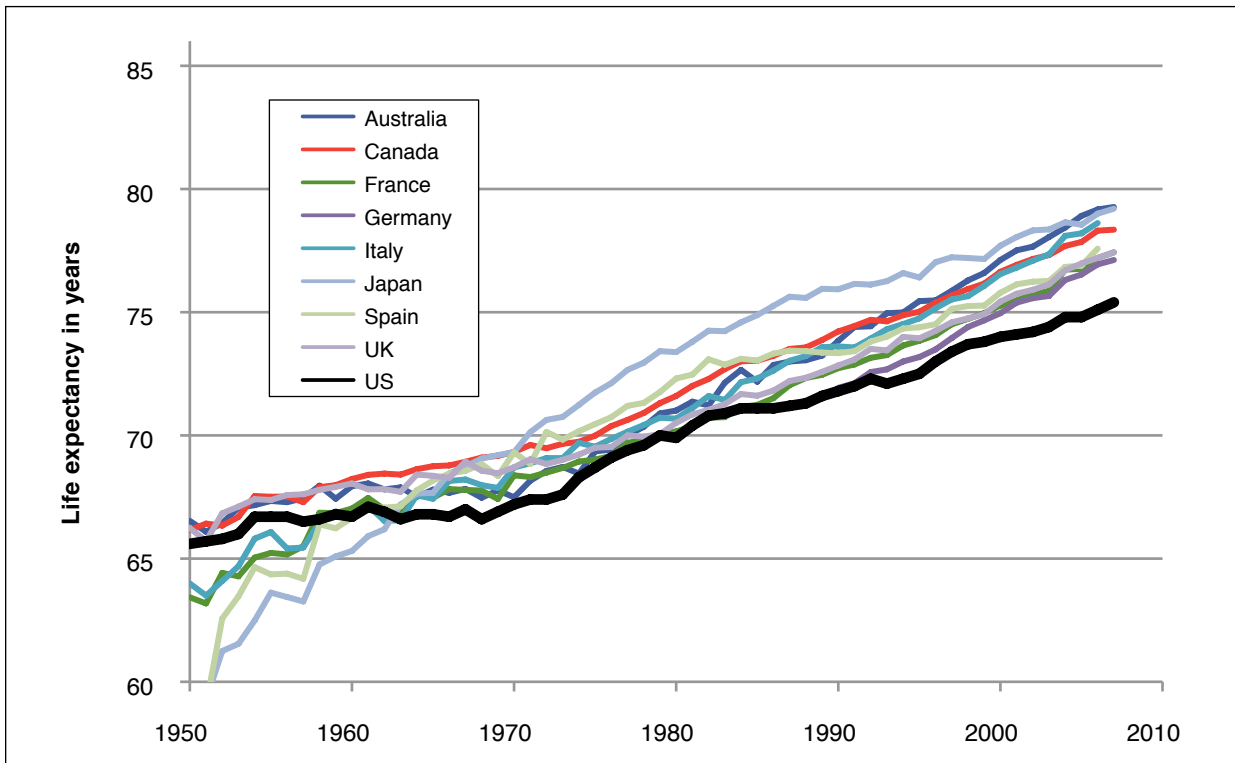
Current Trustees’ Assumptions

The methodology for making mortality projections in the 2011 Trustees Report relied on three steps as follows:

1. Calculate historical average annual rates of decline in death rates by age, sex, and cause of death for the period 1986–2006.

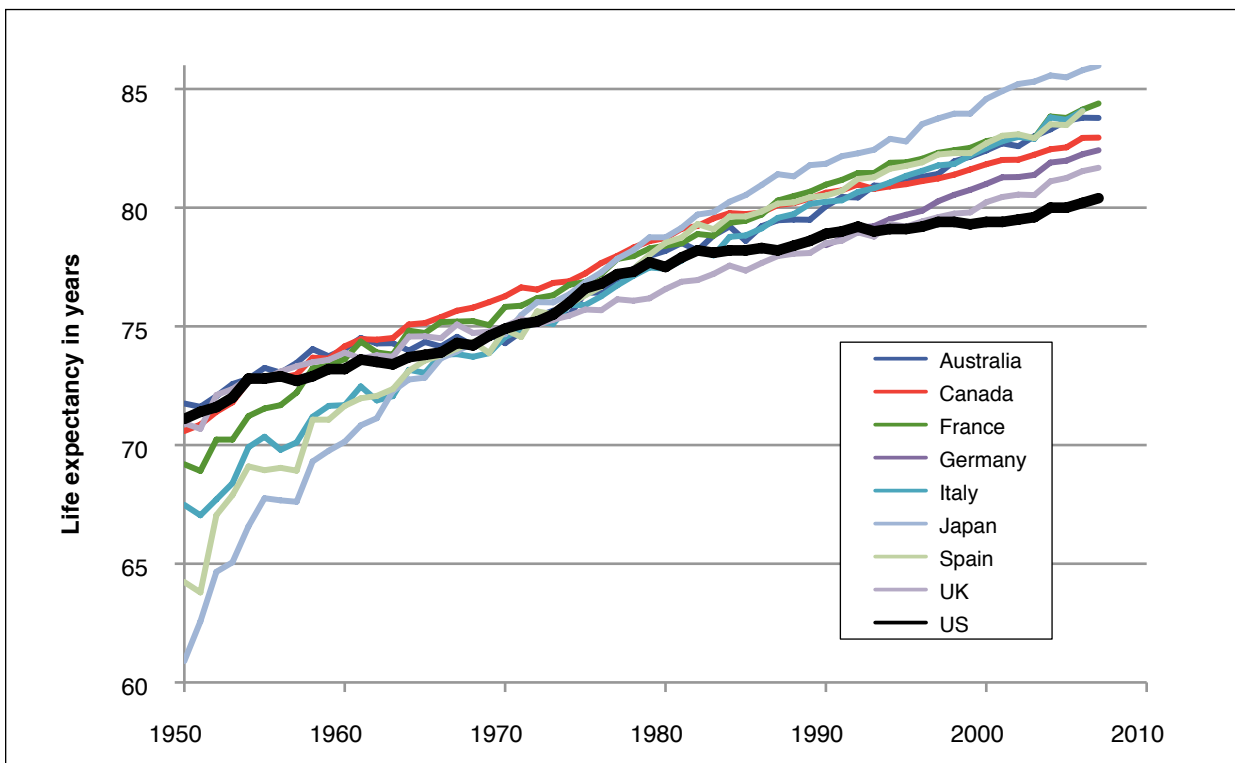
2. Make assumptions about the long-range future rates of decline in death rates by age, sex, and cause. According to the 2011 Trustees Report, “[past] [r]eductions in death rates resulted from many factors, including increased medical knowledge, increased availability of health-care services, and improvements in sanitation and nutrition. Based on consideration of the expected rate of future progress in these and other areas, three alternative sets of ultimate annual percentage reductions in central death rates by age group, sex, and cause of death are assumed for 2034 and later” (Trustees Report 2011, p. 80). For the intermediate scenario, the Trustees make assumptions about 70 rates of decline (5 age groups × 2 sexes × 7 cause categories). Consideration of the low- and high-cost projections increases the total number of parameters to 210. The Trustees Report does not describe the process for arriving at this large number of assumptions.

Figure 28A. International Comparison of Male Life Expectancy Trends: 1950–2007



Source: Human Mortality Database, Trustees Report, 2011.

Figure 28B. International Comparison of Female Life Expectancy Trends: 1950–2007



Source: Human Mortality Database, Trustees Report, 2011.

3. For the period between the last year of the historical data (2006) and the first year in which the ultimate rates of decline apply (2034), a set of formulas is used to produce a smooth transition in rates.

The 2011 Trustees Report expects life expectancy to reach 83 years in 2060 and 85 years in 2085, according to the intermediate set of assumptions.

Explanation of Panel Recommendations

Recommendation P-4

The overview section of the 2011 Trustees Report presents assumptions about future mortality trends in terms of the “[a]verage annual percentage reduction in total age-sex-adjusted death rates from 2010 to 2085.” This variable was first introduced in the 2001 Trustees Report while reports issued before 2001 presented the Trustees’ mortality assumptions in terms of life expectancy at birth. The current Technical Panel believes that the practice of earlier reports is preferable because life expectancy is the most widely used indicator of mortality; further, readers are already familiar with it. In addition, the assumed life expectancy in 2085 captures the impact of assumptions for the transition period 2007–2035, which is not the case for the ultimate rate of decline in the death rate. Recommendation 1 does not change the fact that trends in age-specific death rates are needed to produce estimates of life expectancy.

Recommendation M-8

The current Technical Panel joins the 2007 and 2003 Technical Panels in recommending elimination of the cause-specific component of the Trustees’ methodology. Previous Technical Panels provided a detailed rationale for this recommendation (not repeated here), but their findings include the following (Technical Panel on Assumptions and Methods 2007, 2003):

“A model based on separate projections by cause of death over a long time horizon is both implausible and inconsistent with historical experience.” [2003, p. 38]

“[Moreover],...the empirical basis for cause-specific assumptions seems to be weak [2003, p. 38; 2007, p. 35].”

“There is little written explanation of how these assumptions were developed.” [2003, p. 38]

The process of producing 70 assumptions about ultimate rates of decline by age, sex, and cause of death for each of three cost scenarios is not documented and appears to be informal. Simplifying the mortality assumption will considerably improve the transparency of the Trustees Report.

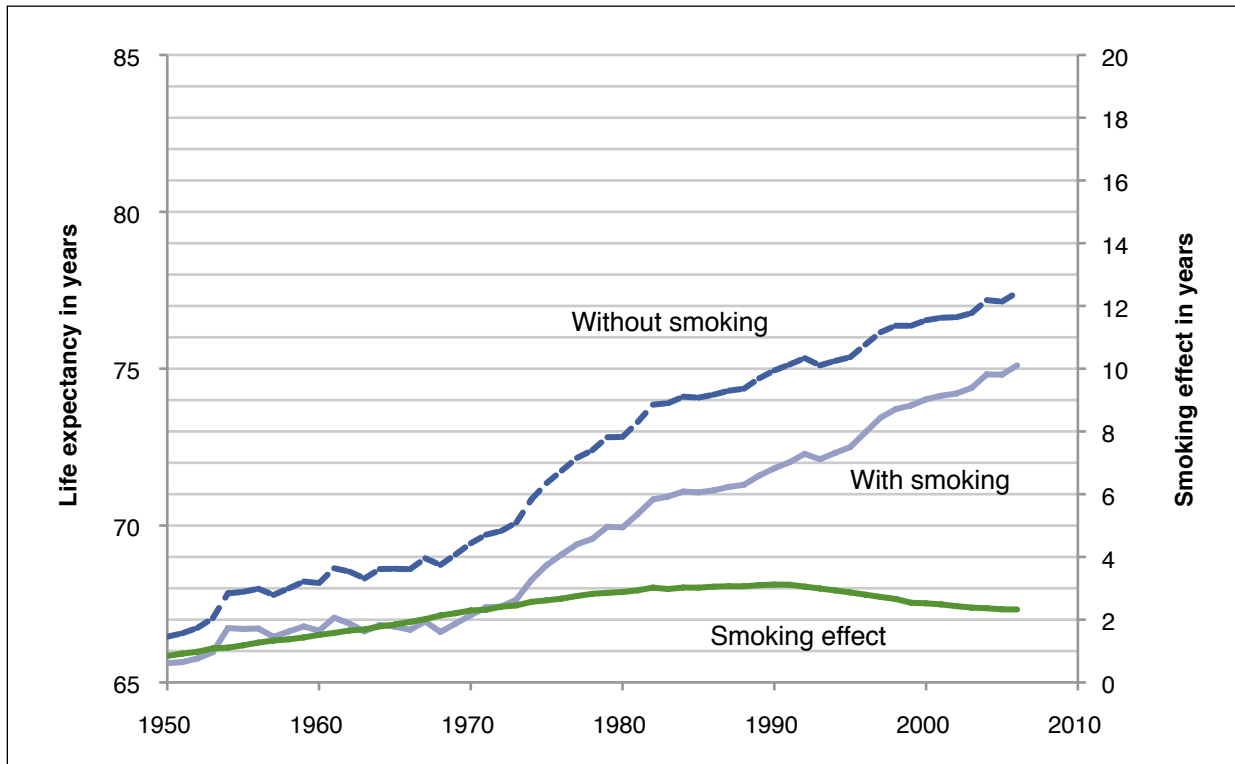
Recommendation A-3

After examining the past and potential future impact of smoking and obesity, the Panel arrived at its recommendation for assuming a more rapid increase in life expectancy. In making this recommendation, we paid particular attention to the impact of smoking and obesity on life expectancy:

Smoking: Past Trends. The NRC report concluded that smoking has had an enormous influence on mortality in recent decades. To measure the impact, observed life expectancy may be compared with a hypothetical life expectancy that would be observed in the absence of smoking mortality (Glei, Preston, and Wilmoth 2010).³⁰ As shown in **Figures 29A** and **29B**, life expectancy without smoking is higher than with smoking for both males and females from 1950–2006, although the trends in smoking impact (bottom lines in **Figure 29A** and **29B**) differ for males and females. For males, the smoking effect rose from 1950–1990, at which time it reached 3.1 years; it subsequently declined by one-fourth. At the peak in 1990, about a quarter of all deaths among males were smoking-related. Among women, the rise in smoking impact on life expectancy occurred later and peaked in 2002 at 2.3 years. For both males and females, smoking behavior affects smoking mortality with a delay of two to three decades (e.g., lung cancer takes many years to develop after exposure to harmful smoke). As a result, the rise and fall of the mortality impact of smoking mirrors the consumption of cigarettes in earlier decades. Male smoking began to decline in the mid-1960s partly in response to warnings about the dangers of tobacco in a U.S. Surgeon General report released in 1964 (U.S. Surgeon General 1964). The resulting decline in smoking led to a decrease in its mortality impact after 1990. Among females, smoking and its mortality peaked more

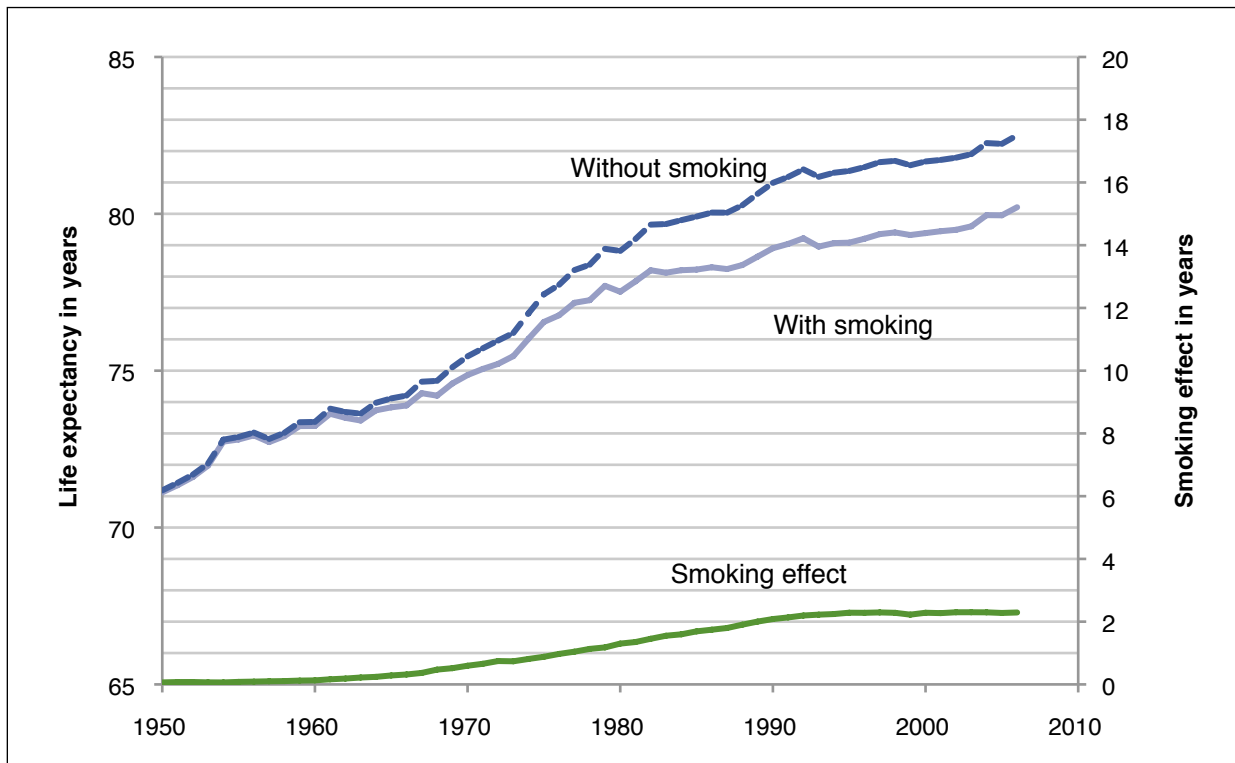
³⁰ Estimates of age- and sex-specific death rates used here and in the NRC report are based on Dana Glei, Samuel Preston, and John Wilmoth, 2010.

Figure 29A. The Effect of Smoking on Male U.S. Life Expectancy: 1950–2006



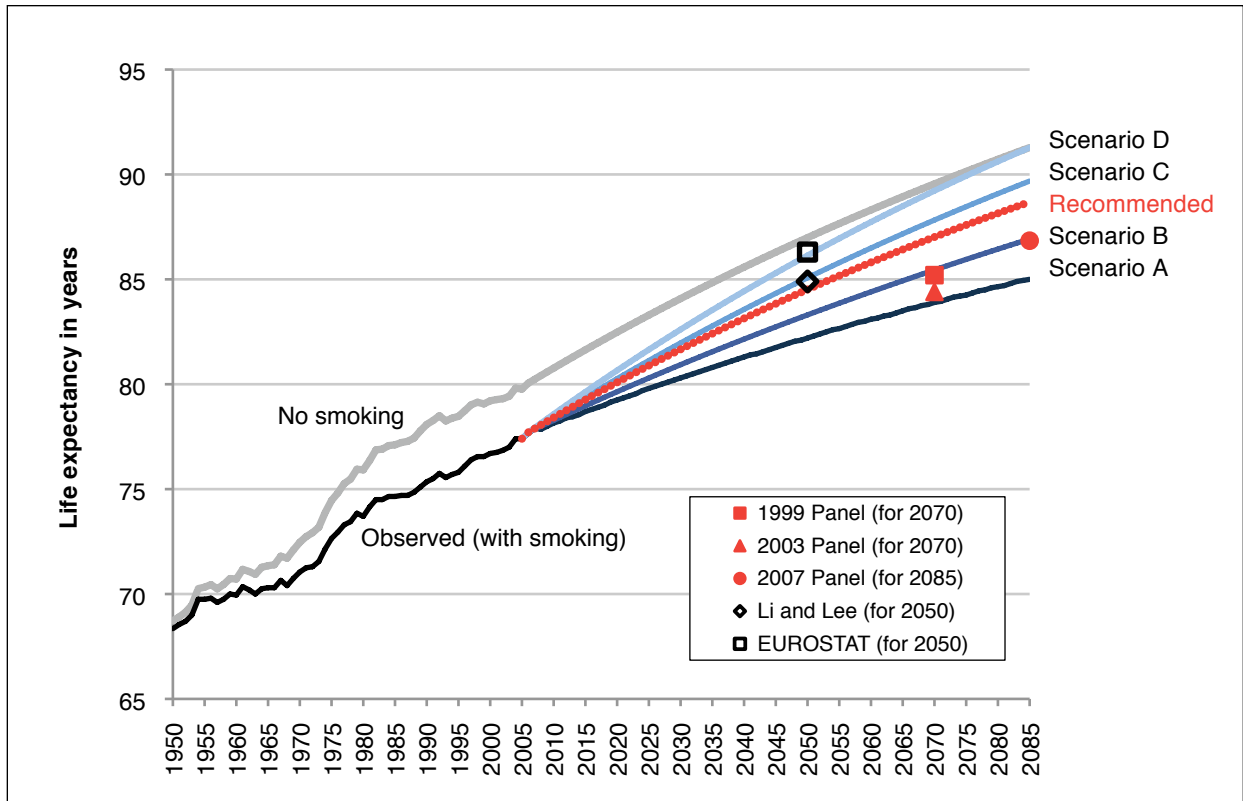
Source: Dana Gleit, Samuel Preston, and John Wilmoth, 2010.

Figure 29B. The Effect of Smoking on Female U.S. Life Expectancy: 1950–2006



Source: Dana Gleit, Samuel Preston, and John Wilmoth, 2010.

Figure 30. Life Expectancy Projections: Alternative Scenarios



Source: Panel calculations; Technical Panel on Assumptions and Methods (1999, 2003, 2007); Li and Lee (2005); EUROSTAT, 2011.

than a decade later than among males, and the peak remained below the level reached by males.

In addition to its substantial impact on the level of life expectancy, smoking influences the rate of improvement in life expectancy. For males, the observed increase in life expectancy since 1950 is 9.5 years instead of the 11.0 years that would have been observed without smoking. For females, the rise in life expectancy with and without smoking is estimated at 9.1 and 11.3 years, respectively. Clearly, the effects of smoking have important implications for mortality projections, as discussed below.

Smoking: Future Impact. The Technical Panel considered four scenarios that differed primarily in the assumed trend associated with the impact of smoking.³¹

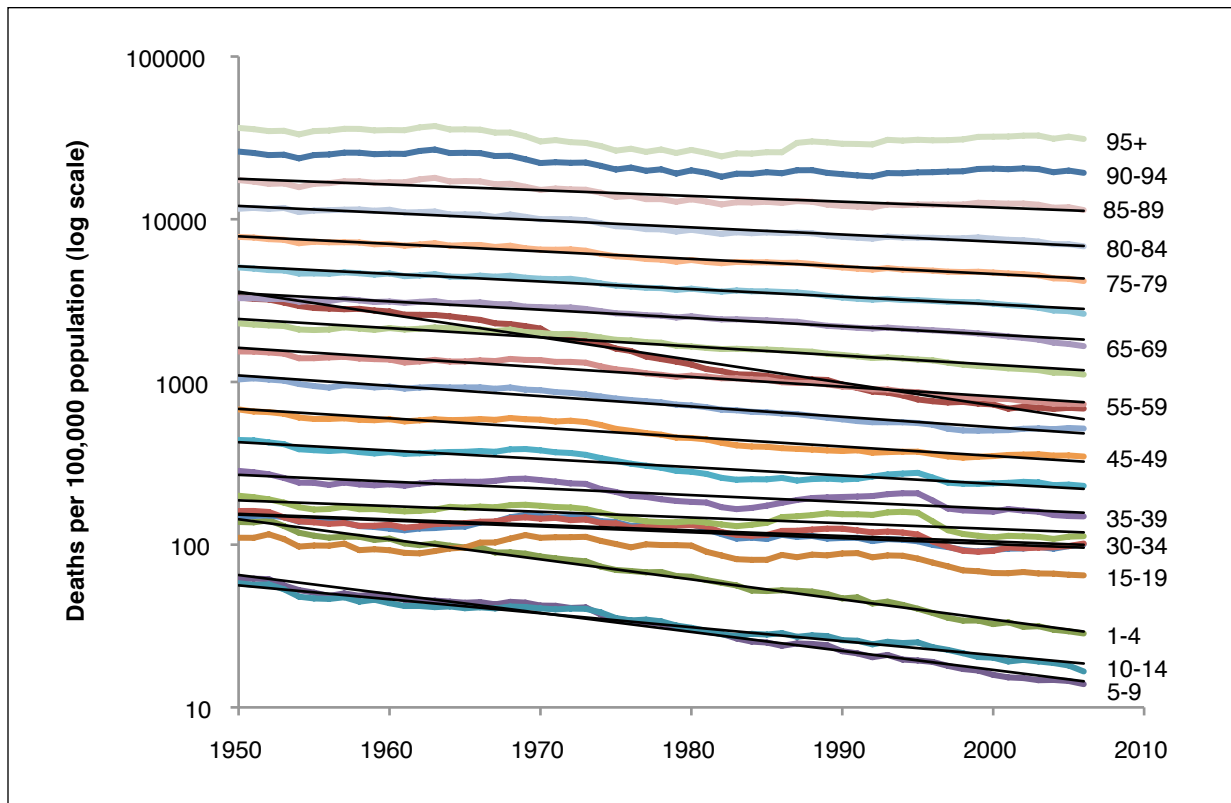
Scenario A. This scenario represents the 2011 Trustees Report’s intermediate projection, which is based on an extrapolation of death rates by age, sex, and cause to 2086. The Technical Panel

considered the projection problematic for two main reasons. First, the use of 70 parameters without a formal procedure raises questions about the reliability of the projection. Second, the projection does not explicitly account for trends in the impact of smoking. As a result, Scenario A implicitly assumes a rise in the impact of smoking in the future and is based on a comparison to a “no smoking” projection (gray line in **Figure 30**) that assumes no smoking during 1950–2085. The difference between the two projections rises over time and represents the implied growing impact of smoking. The Technical Panel believes that it is not plausible to project the continued impact of smoking in future decades because the smoking epidemic has already peaked.

Scenario B. In extrapolating from 1950–2006 with age-specific death rates, Scenario B addresses the first two shortcomings of Scenario A by expanding the historical basis for the projection to 1950 and eliminating cause-specific details. As shown in **Figure 31**, the log of age-specific death rates shows a steady near-linear decline from 1950–2006. A least

³¹ Scenarios B, C, and D are derived by extrapolating age-specific mortality rates for both sexes combined, under conditions specified below.

Figure 31. Age-Specific Death Rates: United States



Source: Office of the Chief Actuary, Social Security Administration, 2011.

squares line fitted to the data for each age group provides a good fit and yields slopes close to those obtained by the widely used Lee-Carter method (Lee and Carter 1992; McNown 1992; Wilmoth 2005; Bell 1997). The advantage of this method is its simplicity and good performance in tests on historical data (Lee and Miller 2001). Only one parameter is required: the duration of the historical period used to estimate the slopes for different age groups. Earlier Technical Panels discussed the appropriate historical period and recommended periods starting around 1950; the current Technical Panel concurs. Scenario B is similar to those recommended by the 1999, 2003, and 2007 Technical Panels such that the resulting future trends in life expectancy are also similar (Figure 30). The only drawback is that Scenario B ignores smoking trends and, as a result, implicitly assumes a rise in the impact of smoking for the same reasons as in Scenario A (Figure 30).

Scenario C. In extrapolating from 1950–2006 with the smoking impact held constant at 2006 levels, Scenario C is similar to Scenario B in that it bases projections on extrapolation of age-specific death rates from 1950–2006. In addition, future

trends in age-specific death rates are assumed to equal trends in historical age-specific death rates without – rather than with – smoking. Scenario C assumes that the smoking impact remains constant at each age from 2006 onward (instead of rising as in Scenarios A and B).

Scenario D. In extrapolating from 1950–2006 with declining smoking impact after 2006, Scenario D assumes that age-specific mortality rates decline from observed 2006 levels to levels projected for 2085 in the “no smoking” scenario, implying that mortality from smoking will disappear by 2085.

Figure 30 plots trajectories of life expectancies for each scenario. Life expectancy rises from 77.7 years in 2006 to 83.0 years, 84.4 years, 86.5 years, and 87.7 years in 2060 and to 85.0 years, 86.9 years, 89.7 years, and 91.3 years in 2085 in Scenarios A, B, C, and D, respectively.

Which of the four scenarios is most plausible? In making its recommendation, the Technical Panel considered two points. First, the choice of scenario depends on likely trends in smoking. As shown in **Figures 29A** and **29B**, smoking-related mortality has leveled off for females and has started to decline

Table 9. Impact of Obesity on Life Expectancy^a

| | Males | Females |
|--|-----------|-----------|
| Olshansky et al. (white population) | 0.33–0.99 | 0.30–0.81 |
| Olshansky et al. (black population) | 0.30–1.08 | 0.21–0.73 |
| NRC based on Adams et al. (2006) | 0.52 | 0.71 |
| NRC based on Metha and Chang (2010) | 0.64 | 0.61 |
| NRC based on Preston and Stokes (2009) | 1.61 | 1.28 |

^a Life expectancy at birth for Olshansky and at age 50 for other three studies.

for males. It is reasonable to assume that smoking mortality will be no higher in the future than it is today, suggesting that the most likely future trajectory will be at least as high as that in Scenario C. Second, it is useful to compare the above scenarios with projections made by earlier Technical Panels and other researchers or organizations. **Figure 30** includes several data points representing the end points of other projections. The three solid red markers indicate the projections recommended by the 1999 (square) and 2003 (triangle) Technical Panels for 2070 and by the 2007 (circle) Technical Panel for 2085. The methodology used by these Technical Panels is very similar to the one used for Scenario B; therefore, it is not surprising that the points are located close to that scenario. The black hollow diamond represents the projection to 2050 of Li and Lee (2005) who relied on a variant of the Lee-Carter method that accounts for mortality trends in other countries. Finally, the black hollow square represents the average 2050 projection made by EUROSTAT for the five largest European countries (EUROSTAT 2011). As noted, the projections from the earlier Technical Panels do not account for smoking trends and are therefore biased downward. The EUROSTAT and Li and Lee projections make no explicit adjustments for smoking, but, given that U.S. men and women smoke more heavily than men and women in most European countries, the two projections implicitly are less distorted by smoking than are Scenarios A and B for the United States. The evidence from these last two alternative projections also argues for a likely trajectory close to Scenario C.

Obesity: Past Impact. The preceding discussion focused on the role of smoking and ignored trends in behavioral factors other than smoking that may

have a detrimental impact on life expectancy trends. The best known of such factors is obesity, which has a well-established adverse impact on health and mortality (Alley, Lloyd, and Shardell 2010). U.S. men and women are among the most obese people in the world, making obesity one of the major reasons that U.S. life expectancy is lower than life expectancy in most other high-income countries.

Olshansky et al. (2005) estimated potential gains in life expectancy from eliminating obesity in the United States at a fraction of a year, with a slightly higher impact among males than among females (two first lines in **Table 9**).

Drawing from three recent studies by Adams et al. (2006), Metha and Chang (2010), and Preston and Stokes (2010), the 2011 NRC report presents additional estimates of the impact of obesity based on risk factors. The effects vary substantially, ranging from 0.52 to 1.61 for males and from 0.71 to 1.28 for females (**Table 9**).

Despite the uncertainty in these studies, the Technical Panel decided – for purposes of making recommendations about future trends – to assume that the current impact of obesity in the United States is one year. The assumed impact is higher than estimated by all but one of the studies listed in **Table 9**.

Obesity: Future Impact. The NRC panel noted that obesity levels have reached a (high) plateau, suggesting that current estimates of life expectancy already reflect much of the impact of obesity on life expectancy. However, it is possible that obesity has delayed effect on mortality that is currently excluded from projections. The Technical Panel considers it likely that obesity has some delayed effect but believes it to be no greater than the current impact of obesity on life expectancy, i.e., the impact of

obesity will at most double from its current level. Given that the current impact on life expectancy is assumed to be one year, the implication is that the additional impact by 2085 will also be one year (for a total of two years).

Conclusion

Based on the preceding findings, the Technical Panel assumed that, without an adjustment for obesity, Scenario C will prevail in the future. To arrive at its intermediate recommendation, the Technical Panel made an adjustment by subtracting one year from Scenario C in 2085. The recommended trajectory thus falls between Scenarios B and C, with life expectancy reaching 84.5 in 2050 and 88.7 in 2085.

In view of the high degree of uncertainty about future mortality trends and the lack of agreement among experts, the Technical Panel decided to increase the range between the high- and low-cost projections to 10 years (i.e., 5 years above and below the intermediate variant). This range is a third wider than that adopted by the 2011 Trustees Report (Table 10) and places the high-cost variant above Scenario D and the low-cost variant below Scenario A.

Table 10. Comparison of Trustees Report’s and Technical Panel’s Recommended Assumptions

| | Projected Life Expectancy in 2085 | |
|----------------|-----------------------------------|----------------------|
| | 2011 Trustees Report | 2011 Technical Panel |
| High-cost | 88.9 | 93.7 |
| Intermediate | 85.0 | 88.7 |
| Low-cost | 81.3 | 83.7 |
| High-low range | 7.7 | 10.0 |

2.3 Immigration

Assumption Recommendation A-4. The Technical Panel recommends that immigration scenarios should tie the level of net immigration to historical evidence on net immigration and population size rather than decreasing or increasing constant numbers of immigrants. The Technical Panel recommends that the Trustees express their ultimate net migration assumptions as rates of the annual number of net migrants divided by population size.

Assumption Recommendation A-5. The Technical Panel recommends making the assumptions regarding future immigration more consistent with long-range historical averages for earlier periods. Specifically, the Technical Panel recommends that the intermediate assumption should ultimately be 3.2 net migrants per 1,000 persons. The Trustees’ current intermediate assumptions about net legal and net other immigrants in 2015 and assumptions about increases for 2015 through 2025 may be appropriate based on current evidence, but the Technical Panel believes that net immigration levels beyond 2025 will not decline as reflected in the ultimate assumption for the remainder of the projection period. The Technical Panel also recommends that the low- and high-cost assumptions should ultimately be 4.2 and 2.2 net migrants, respectively, per 1,000 persons.

Overview

The Technical Panel emphasizes the important role of immigration in increasing the number of young adults and eventually children in the U.S. population and thus immigration’s contribution to a younger and growing population. Immigrants, primarily at younger ages, increase the number of covered workers earlier than the number of retiree-beneficiaries and help improve the long-range actuarial balance. Since 1950, net immigration has increased annually at an average rate of about 4 percent, which is almost three times greater than the overall rate of population growth (1.4 percent), and immigration has long accounted for most U.S. population growth (Gibson 1975; USCB 2009a; Pew Hispanic Center 2006). Recent net migration has reflected an increase in legal immigration and an increase in undocumented or unauthorized migration, both of which remained high from 2001 through 2010 despite the recent economic downturn.

The Technical Panel has evaluated available evidence on net international migration in earlier decades and found that the United States lacks a system for keeping track of international migration, making it difficult both to quantify recent net immigration and project immigration for the coming decades. No single source of information provides data on annual or net immigration to the United States. The most clear-cut component of net immigration, which is annual legal immigration, is not easily predicted, although it is more easily measured than its counterpart of annual other immigration. In the past four decades, the two im-

migration components that are the most difficult to measure – unauthorized migration and return migration/emigration of legal immigrants – have become more important in modeling population change because they may not be assumed to offset the effects of undocumented migration and are not easily estimated. The decennial Census no longer provides a benchmark of net recent immigration or offers a reliable data source for indirect estimation of emigration and net unauthorized migration. Moreover, different estimates of the foreign-born population may be based on analyses of national surveys with varying and unknown coverage. To the extent possible, the Technical Panel has drawn from available statistics and preliminary results for net international migration for 2000 through 2010. Population projections typically assume either that historical patterns will continue or that historical levels will decline because of diminishing unlawful migration in response to national enforcement policies or the termination of special lawful immigration policies.

Changes in legal immigration are associated with major modifications in immigration law since 1952 while the current legal immigration regime is traceable to major legislative changes in 1965, 1976, 1980, 1986, and 1990 followed by the passage of statutes in 1996 and 2001. These changes not only greatly increased the level of legal permanent immigration but also facilitated entry into the U.S. economy of larger nonimmigrant flows of tourists, business persons, and temporary workers, some of whom became long-term residents. As a classic immigration destination, the United States is a liberal welfare state that makes naturalization a relatively straightforward process and conveys rights similar to those enjoyed by native-born citizens (Janoski 2010). The immigration laws reflect the principle of family reunification by specifying numerically limited family preference categories and unlimited immigration of immediate relatives of U.S. citizens. Admissions of immediate relatives averaged slightly more than 500,000 from 2001 to 2010, exceeding numerically limited immigration of about 375,000. For each principal immigrant, “immigration multiplier” effects refer to the total number of accompanying family members and, later, sponsored family members and any of their family members who subsequently immigrate (Jasso and Rosenzweig 1990; Yu 2007).

In the Trustees’ current population projections, net immigration plays a diminishing role in popu-

lation growth over the projection period, averaging 2.7 net migrants per 1,000 population in 2011 through 2085, somewhat lower than the historical net immigration of nearly 3.0 net migrants per 1,000 population from 1900 through 2010. At the beginning of the latter period, the United States placed no quantitative limits on the entry of immigrants. Although the current immigration system and enforcement infrastructure impose some restrictive policies, the historically low immigration levels of the mid-20th Century are unlikely to recur. The broader contexts of globalization of labor demand, market transitions, and evolving social networks have facilitated migration and settlement of both legal and unauthorized migrants. From an international standpoint, the United States is expected to remain the major receiving country of net international migration. Although national policies may affect the magnitude and directionality of international migration, the economic and demographic asymmetries that have primarily generated international migration are likely to result in persistence of recent migration patterns among more or less developed nations (UN DESA 2009).

Until the recent economic downturn, the increasing trend in immigration during the 1980s, 1990s, and 2000s suggested that the post-1980 period would provide a critical basis for projecting immigration into the future, as in the recommendations of earlier Technical Panels. However, the best evidence from 2007 through 2010 indicates that circular migration diminished, inflows dropped, and return migration declined. The level of net immigration in relation to the size of the U.S. population seems to have been lower for the 2000s than for the 1990s (USCB 2010a). With this recent reminder of immigration’s volatility with economic shifts, it is useful to recall the moderate immigration from 1960 through 1980. Therefore, the Technical Panel recommends immigration levels that largely reflect the historical record. It bases the immigration assumptions for its intermediate recommendations on the long-term historical trend of net immigration and legal immigration, with assumptions for the low- and high-cost scenarios also drawn from experience.

Historical Background

Legal immigration to the United States has been very high at times and very low in other periods. The historical peak of U.S. legal immigration occurred between 1905 and 1915, followed by lulls

during the Great Depression and the two World Wars. Beginning in the early 1920s, immigration laws became more restrictive, specifying numeric and geographic limitations. The *Immigration and Nationality Act* (INA) took effect in 1952 and provided the organized structure of statutes governing immigration law. The 1965 amendments to the INA repealed the discriminatory and strict national-origins quotas enacted in 1924, lifted the ban on Asian immigration, established a preference system of family and occupational categories by imposing country-specific limits on visas and an overall Eastern Hemisphere cap, and created exempt categories for immediate relatives of citizens; later amendments limited immigration from both the Western and Eastern hemispheres. Thus, legal immigration increased with greater numbers from the Eastern Hemisphere and under the numerically unlimited categories of immediate relatives of citizens.

Legal immigration levels accelerated from 1950 to 2000, but especially between 1990 and 2000. The *Immigration Reform and Control Act of 1986* (IRCA) legalized undocumented workers and long-term residents, largely affecting Mexican migration and future immigration through family reunification (Woodrow 1995; Durand, Massey, and Parrado 1999; Clark, Hatton, and Williamson 2007). The *Immigration Act of 1990* (IA1990) expanded legal immigration, especially employment categories. The *Personal Responsibility and Work Opportunity Reconciliation Act of 1996* (PRWORA) and the *Illegal Immigration Reform and Immigrant Responsibility Act of 1996* (IIRIRA) restricted immigration by making enforceable the affidavit of support for individuals sponsoring family members for visas and by setting income requirements.

Large-scale unauthorized or illegal immigration emerged in the 1970s and continued with greater demographic and familial diversity over the 1980s and early 1990s despite IRCA measures to prevent employers from hiring illegal immigrants and efforts to intensify border and interior enforcement policies. Unauthorized migration escalated again in the late 1990s, with estimates of net legal and unauthorized migration in the 1980s, 1990s and 2000s based on demographic studies of national surveys. About 50 to 60 percent of unauthorized residents crossed without documents, primarily from Mexico and other Central American countries, with some border-crossers among those originating in non-neighboring countries and others arriving as legal temporary visitors and later becoming unlawful.

Relative to 2000 Census-based unauthorized estimates of between 7.0 and 9.0 million residents (Passel 2002; Bean et al. 2001; INS 2003; Costanza et al. 2001; DHS 2006), extant unauthorized estimates showed an increase to about 11 to 12 million illegal immigrants between 2006 and 2010 (DHS 2011; Passel and Cohn 2011).

From 1987 through 2010, the annual number of legal admissions averaged more than 1 million, which was roughly equal to the previous high from 1900 through 1915. The number of lawful permanent residents between 1987 and 2010 showed considerable variability partly because of changes in U.S. policies, migrant decision making, and various bureaucratic factors, e.g., changes in application fees, application volumes, processing times, and security procedures. In contrast with the period 1905–1915, the majority of immigrants entering the country between 1987 and 2010 were already long-term residents who had arrived as temporary travelers for tourism, business, diplomacy, and education (Massey and Bartley 2005). Several policies eased adjustment from unauthorized status to lawful permanent resident or legal immigrant status. These policies led to high legal admissions in the 1990s and 2000s, e.g., from IRCA legalization provisions (1989 through 1991), the *Legal Immigration Family Equity Act* (LIFE) of 2000 (2001 and 2002), resolution of class-action lawsuits over IRCA amnesty application (before and during 2005 through 2010), the *Chinese Student Protection Act*, and the *Nicaraguan Adjustment and Central American Relief Act* (NACARA) (1997).

Components of Immigration

The Trustees view net immigration as the product of three categories of immigrants: (1) legal immigrants; (2) other immigrants consisting of unauthorized immigrants (i.e., illegal and undocumented migrants) and certain legal nonimmigrants (i.e., temporary legal residents); and (3) emigrants from among native-born persons, other immigrants, or legal immigrants.³² Certain legal nonimmigrants

³² All Social Security projections are based on the Social Security Area population, which comprises (1) residents of the 50 States and the District of Columbia (adjusted for net Census undercount); (2) civilian residents of Puerto Rico, the Virgin Islands, Guam, American Samoa, and the Northern Mariana Islands; (3) federal civilian employees and persons in the U.S. Armed Forces abroad and their dependents; (4) non-citizens living abroad who are insured for Social Security benefits; and (5) all other U.S. citizens abroad. As a result, emigrants are individuals who are no longer within the Social Security Area population, which differs from practices in Census population programs.

are long-term residents with work eligibility who are employed in OASDI-covered jobs; some other immigrants work without authorization and yet may have payroll taxes withheld.

For purposes of perspective, it is useful to note that the U.S. population in 2009 (307.7 million) included about one foreign-born person in every 10 persons (12.5 percent or 38.5 million). Of native-born persons (87.5 percent or 268.5 million), about one in 10 persons was second-generation, with the remainder third- or higher-generation (with two native-born parents) (USCB 2010b). Among foreign-born persons, the large share comprised noncitizens (43.7 percent or 21.7 million, or 7.1 percent of the total) rather than naturalized citizens (56.3 percent or 16.9 million, or 5.5 percent of the total) (Gryn and Larsen 2010). Among post-1980-arrived immigrants in 2010, there were nearly as many noncitizens as naturalized citizens among about 21.1 million legally resident foreign-born persons (DHS, Rytina 2010; DHS, Hoefler, Rytina, and Baker 2011).

The Trustees Reports' historical data for legal immigrants are based on official government counts of admissions for lawful permanent residence (LPR); the U.S. Department of Homeland Security's (DHS) Office of Immigration Statistics (OIS) now compiles those counts.³³ Information on legal immigration is available each year and is representative of admissions to LPR status, including individuals arriving from other countries and individuals already living in the United States and adjusting from nonimmigrant (i.e., foreign student, guest worker, visitor for business or pleasure, refugee, asylee, or parolee) or other status, even illegal status. The data for net legal immigrants incorporate reductions for legal immigrants' and native-born citizens' movements out of the country based on indirect evidence supporting ratios of one emigrant for every three to five immigrants (Warren and Passel 1987; Warren and Kraly 1985; Woodrow 1991a, 1996; Ahmed and Robinson 1994; Hollmann et al. 2000; Mulder et al. 2002). Census population programs regularly update emigration rates derived from a comparison of foreign-born populations over time in order to project emigration levels (Passel and Cohn 2008; USCB 2010a; Grieco 2008).

For net other immigration in the historical data series, measures for net change in legal temporary

migrants and the net or gross flows of unauthorized immigrants are not straightforward. Official statistics on unauthorized migration compiled by DHS-OIS show an estimated 11 million unauthorized immigrants residing in the United States as of January 1, 2010 (DHS, Hoefler, Rytina, and Baker 2011). Residual estimates of unauthorized migration involve greater uncertainty and sensitivity to errors than do estimates of legal immigration. Estimates of unauthorized immigrants are generally overstated because they include some legal temporary residents, such as an unknown population of long-term H-1B visa workers (GAO 2011), although DHS allowed for nearly 2 million nonimmigrant residents. Implicit within DHS and other estimates of unauthorized immigration is emigration of other immigrants and legal immigrants.

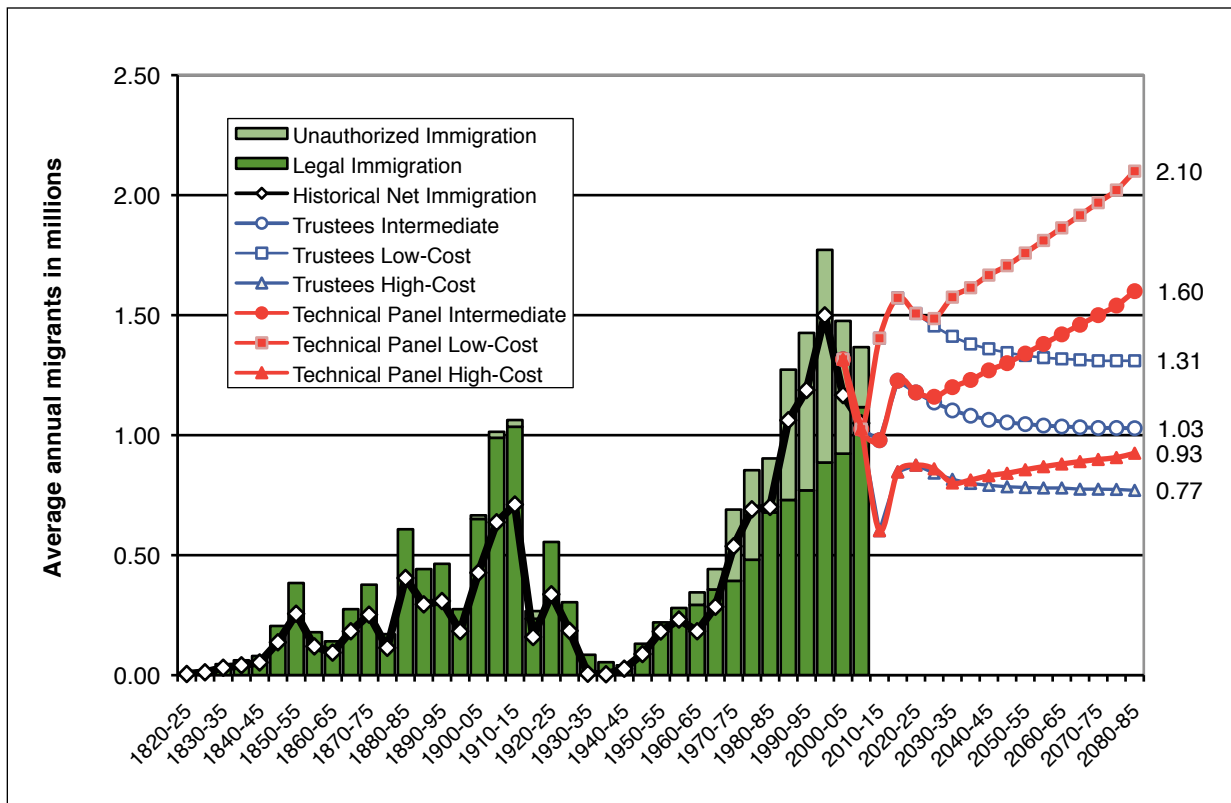
The 2011 Trustees Report's historical data for net other immigration from 2005 through 2010 are largely based on year-to-year comparisons of DHS annual estimates for unauthorized immigrants. In principle, the best annual measures of net unauthorized migration are derived as the average annual change in the size of the unauthorized population at different times, although such an approach relies on comparability in coverage (DHS, Hoefler, Rytina, and Baker 2010, 2011). In fact, national survey estimates for 2007 through 2010 were not completely comparable, and may be contributing to overestimation of change in unauthorized migration (USCB 2009b; Passel and Cohn 2008). For the 1980s, Census demographers developed estimates of unauthorized populations and average annual population change attributable to undocumented migration (Passel and Woodrow 1984, 1987; Woodrow and Passel 1990; Woodrow 1991b; Woodrow-Lafeld 1992) for assumptions in population estimates and used similar assumptions for population estimates in the 1990s. For the 2000s, specific assumptions about net population change attributable to undocumented migration are not made for population estimates, which are derived from net international migration measures from national surveys.

Trends in Net International Migration

A look back to 1820 shows that legal immigration has historically exceeded net migration because emigration or return migration has been greater

³³ The data were previously available from the Immigration and Naturalization Service (INS) in the U.S. Department of Justice and from various other agencies.

Figure 32. Average Annual Migrants in Millions: Net Migration, Legal Immigration, and Unauthorized Migration to the United States, 1820–2010, with Projections of Net Migration to 2085 According to 2011 Trustees Report and Technical Panel Recommendations



Source: Panel estimates; Technical Panel on Assumptions and Methods, 2007.

than unauthorized migration (**Figure 32**).³⁴ By the 1980s, unauthorized migration surpassed legal immigration such that net international migration was greater than legal immigration. In contrast with major declines in immigration levels before 1950 (resulting from the restrictive immigration laws enacted between 1917 and 1924 and from the effects of the Great Depression and World War II), the years after 1970 have seen increased levels of legal immigration and large-scale unauthorized immigration. The number of immigrants reached historic highs by the 1980s, and net international migration in every period from 1980 through 1985 and 2005 through 2010 has exceeded the previous high achieved between 1910 through 1915.

³⁴ These series of estimates of net immigration, legal immigrants, and net unauthorized immigrants are presented according to the 2007 Technical Panel’s more consistent focus by five-year period of arrival in the United States, updated for 2005 through 2010. The earlier report drew on historical projections for 1960 through 2005 (Passel 2004; Passel and Cohn 2008) and 1900 through 1990 (Edmonston and Passel 1994).

Legal immigration, on average, increased in recent decades,³⁵ varying with the policies in effect and the clearance of backlogs.³⁶ The increases in net unauthorized migration were dramatic,³⁷ at average annual levels over 500,000 from 1980 through 2010, or nearly 600,000 per year.³⁸ With declines in the unauthorized population from 2007 through

³⁵ Average legal immigration levels totaled 634,000 in the 1970s, 704,000 in the 1980s, 820,000 in the 1990s, and 1.02 million in the 2000s. From 1980 to 2010, average legal immigration reached 851,000. **Figure 32** overstates the number of legal immigrants for 2005 through 2010 because of inadequate information for allocation to earlier periods of arrival and only partially known transfers from unauthorized to LPR status (cancellations of removal and NACARA adjustments). Better statistics may become available, such as Hollmann (2005).

³⁶ Historical data on legal immigrants typically reflect varying numbers of immigrants owing to unexpected changes in immigration laws, processing delays, or changes in administrative policies.

³⁷ The 2011 Trustees Report’s historical data showed that net other immigration averaged 375,000 per year from 1980 to 1989 and 550,000 per year from 1990 to 1999.

³⁸ For the period 2005 through 2010 in **Figure 32**, the updated number of net other immigration is set at 250,000 annually (DHS 2010), which is slightly higher than the historical data in the 2011 Trustees Report.

2010 (DHS, Hoefler, Rytina, and Baker 2011), the average annual change in the unauthorized population totaled about 250,000 (DHS, Hoefler, Rytina, and Baker 2010), or an average annual increase of about 3.0 percent during the decade (CBO 2011).³⁹ Overall, annual net immigration from 1980 through 2010 averaged 1.1 million, although there were substantially higher levels from 1995 through 2000 and substantially lower levels, from 2005 through 2010.^{40, 41}

Measurements of net immigration in relation to population size show that the net migration rate (NMR) was highly variable before 1920, which is when restrictive and more defined immigration laws took effect. From 1840 through 1915, most of the annualized NMR values fell between 3 and 8 net migrants per 1,000 persons. The average 5.7 net migrants per 1,000 persons was lower than the average rate for legal immigration (8.7) because return migration was substantial.

As shown in **Figure 33**, the net migration rate from 1980 through 2010 averaged about 4.3 per 1,000 population, well below historically high levels. The net migration rate of 2.1 per 1,000 population between 1960 and 1980 was similar to the rates between 1915 and 1930 before two decades of extremely low immigration. For the 2000s, net international migration initially increased, declined after 2001, rose again, and then decreased, resulting in declining net migration rates during the past decade (USCB 2010c). For the 190 years from 1820 through 2010, the average NMR was 3.6. For the 20th Century, the average was 2.7; from 1900 through 2010 and for 1945 through 2010, the NMR averaged about 2.9.

The net migration rate has demonstrated greater stability in the post-1920 period – a period charac-

terized by quantitative limitations on legal immigration – although many factors led to substantial immigration between 1980 and 2010. Apart from the legal immigration framework, policies allowed status adjustments of formerly unauthorized residents and may have accelerated family migration. With Mexico the leading country of origin among both legal immigrants and unauthorized immigrants, three decades of intensified border enforcement have led to alterations in the behavior and settlement of Mexican migrants. Between 1980 and 2005, the likelihood of unauthorized migrants returning to Mexico within a year of entry dropped by more than one-half to record low levels, accounting for the addition of 2 million Mexican settlers in the same period (Massey 2009, 2010). Contrary to expectations, admissions of immediate relatives of U.S. citizens born in Mexico have remained substantially higher than in the early 1990s (Hollmann et al. 2000). For these reasons, net immigration between 1980 and 2010 may have been unusually high. In some respects, the period from 1840 to 1915 has been suggested as an example for understanding contemporary migration (Massey 1999, 2000), although today's immigration restrictions probably make a repeat of historical levels unlikely.

Current Trustees Assumptions

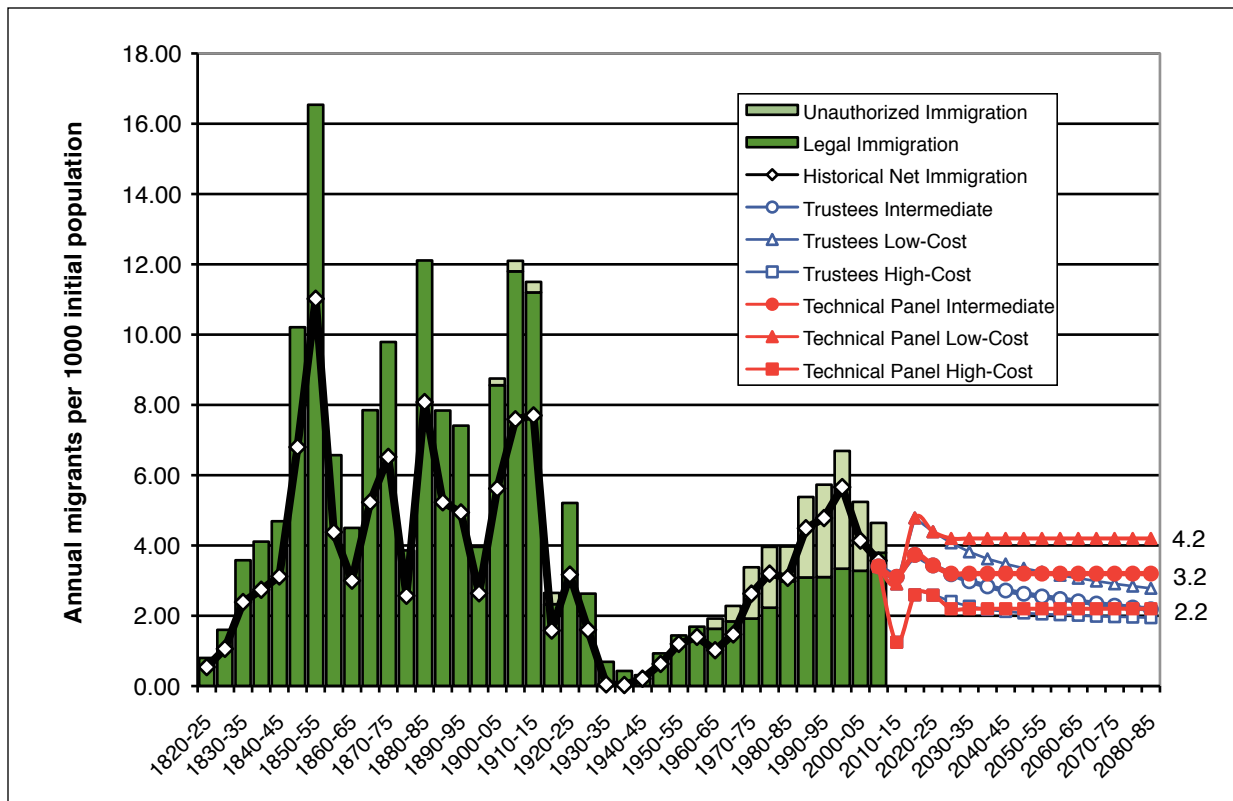
The 2008 through 2011 Trustees Reports treat net legal immigration and net other immigration by considering five sets of annual flows: (1) legal immigration inflows; (2) legal emigration or outflows of legal immigrants; (3) other immigration inflows, including unauthorized migrants and legal temporary workers (not “short-term” temporary admissions); (4) other emigration or outflows of other immigrants; and (5) transfers into legal immigration of other immigrants. As summarized in **Table 11**, the assumptions underpinning the level of net international migration became more complicated in 1988 when the intermediate scenario included an allowance of 200,000 for net other immigrants, as assumed by the Census Bureau. Between 1995 and 2007, the Trustees' intermediate scenario included an ultimate annual net flow of 900,000 persons based, in principle, on 800,000 legal immigrants and 300,000 net other immigrants, minus 200,000 legal emigrants. The assumption of 800,000 legal immigrants per year reflected an allowance of 80,000 for refugee and asylee admissions and about 10 percent in various other categories added to the 675,000 immigrants permitted

³⁹ Omitting the period between 1995 and 2000, net unauthorized immigration averaged 445,000 for the remainder of 1980 through 2010.

⁴⁰ For **Figure 32**, the updated annual average net immigration of 1.05 million between 2005 and 2010 is based on an estimate of 10.5 million for the change in the foreign-born population between 2000 and 2010; an alternative estimate is slightly lower at 10.0 million, as implied by an increase in the foreign-born population between 2000 and 2010 (USCB 2010a).

⁴¹ From Vintage 2009 Census population estimates, annual estimates of net migration dropped from an average 1.0 million between 2000 and 2006 to about 870,000 between 2006 and 2009 (960,000 for 2000 through 2009) (USCB 2010c). Alterations in components when the measurement of net international migration shifted to the residence-one-year-ago method (Grieco 2008) may account for differences in comparison with earlier estimates; Vintage 2006 estimates showed a higher estimate (more than 1.2 million) for average net migration between 2000 and 2006.

Figure 33. Annual Migrants per 1,000 Initial Population: Net Migration, Legal Immigration, and Unauthorized Migration to the United States, 1920–2010, with Projections of Net Migration to 2085, According to 2011 Trustees Report and Technical Panel Recommendations



Source: Panel estimates; SSA's Office of the Chief Actuary projections 2011; Technical Panel on Assumptions and Methods, 2007.

under the *Immigration Act of 1990's* flexible annual world-wide cap. Before 2008, the Trustees' projections considered legal immigration, legal emigration, and net other migration. In refining the last, the modeling accounted for the presence, covered work behavior, and beneficiary entitlement of other immigrants.

For the 2008 through 2011 Trustees Reports, the ultimate assumptions on net immigration are 1.025 million for the intermediate scenario, although changes in the 2008 Trustees Report increased the ultimate assumption of annual legal immigration from 800,000 to 1 million to be consistent with average levels from 2001 through 2006 (about 1.03 million), which proved to be consistent with average levels for 2000 through 2010 (1.05 million) and 1990 through 2000 (980,000). Thus, the Trustees recognized that a strict interpretation of current law is insufficient for specifying annual legal immigration. They therefore allow for slightly higher legal immigration levels of 1.1 million in 2010 and of 1.05 million in 2011 as a consequence of the resolution of visa processing

backlogs. Since the 2008 Trustees Report, the ultimate assumption holds that emigration of legal immigrants is 25 percent of the number of annual legal immigrants,⁴² placing the ultimate level of net legal immigration at 750,000.

The 2008 Trustees Report implemented new methods that separately treat the subcomponents of net other immigration, permitting net other immigration to be calculated as the difference between annual other immigration inflows and the sum of other immigrant emigration⁴³ or outflows and other immigrant transfers to legal immigrant status. Essentially, one-half of annual legal immigration is assumed to be newly arrived and one-half to be adjusting to legal status from other status. The ultimate assumption on inflows of annual other immigrants entering the Social Security Area is 1.5 million, of whom one-third are assumed to be transferring or adjusting to legal status. The Trust-

⁴² Legal emigration is assumed at 20 and 30 percent in the low- and high-cost scenarios, respectively.

⁴³ Values shown for annual emigration of other immigrants are averaged over the period 2011 through 2085.

Table 11. Assumed Ultimate Levels of Net Migration for Three Scenarios, by Entry Status (legal versus other), Trustees Reports: 1981–2011

| Years of Reports | Ultimate Assumption for Net Migration (1000's of persons per year; average across annual reports) | | | | | | | | | Ultimate |
|-----------------------------|--|--------------------|-----------|-------------------|--------------------|-----------|-------------------|--------------------|-----------|-----------|
| | Total | | | Legal Immigration | | | Other Immigration | | | |
| | Low-Cost | Inter-mediate Cost | High-Cost | Low-Cost | Inter-mediate Cost | High-Cost | Low-Cost | Inter-mediate Cost | High-Cost | |
| 1981–1984 | 438 | 400 | 363 | 438 | 400 | 363 | 0 | 0 | 0 | Year 1 |
| 1985–1987 | 667 | 467 | 267 | 667 | 467 | 267 | 0 | 0 | 0 | Year 1 |
| 1988–1990 | 750 | 600 | 450 | 450 | 400 | 350 | 300 | 200 | 100 | Year 1 |
| 1991–1994 | 1,050 | 800 | 650 | 700 | 600 | 550 | 350 | 200 | 100 | Years 1–8 |
| 1995–1999 | 1,150 | 900 | 750 | 710 | 610 | 560 | 440 | 290 | 190 | Years 2–8 |
| 2000–2002 | 1,210 | 900 | 655 | 760 | 600 | 455 | 450 | 300 | 200 | Years 2–3 |
| 2003–2007 | 1,300 | 900 | 673 | 850 | 600 | 473 | 450 | 300 | 200 | Year 21 |
| 2008–2011 | 1,305 | 1,025 | 770 | 960 | 750 | 560 | 350 | 275 | 210 | Year 2 |
| 2011 Trustees Report | | | | | | | | | | |
| Average 2011–2086 | | | | | | | | | | |
| Annual immigrants | | | | 1,200 | 1,000 | 800 | 1,800 | 1,500 | 1,200 | |
| Annual emigrants | | | | -240 | -250 | -240 | -775 | -665 | -575 | |
| Annual transfers | | | | | | | -600 | -500 | -400 | |

Notes: (1) Trustees Reports have been grouped with those of neighboring years having similar sets of net migration assumptions; (2) The “ultimate” date is defined here as the first year of the projection period for which the ultimate assumption was used for all scenarios. Thus, for the projection beginning in 2007, the complete set of ultimate assumptions was used from 2027 onward, corresponding to Year 21 of the projection period. In some cases, the speed of convergence to ultimate values varied across Trustees Reports for neighboring years. (3) For years 2008-2011, net “other” immigration declines over the entire projection period because of constant assumed rates of emigration, and values shown for net other immigration and annual emigrants are average values over the projection period.

ees also changed the method for emigration of other immigrants, assuming that 10 percent of recent new arrivals depart and applying emigration rates to the earlier-arrived other immigrant population. The Trustees detail these rates – and all immigration components – by age and sex. The changes resulted in an increase to the long-range actuarial balance of about 0.30 percent of taxable payroll through an increased number of workers and a decreased number of eventual retirees.

The 2011 Trustees Report calculates net other immigration at 105,000 in 2011. In contrast with 2008, annual other immigration inflows were set at

1.0 million for 2009 through 2010. The 2011 Trustees Report set annual other immigration inflows at 1.1 million in 2011, 1.2 million in 2012, 1.3 million in 2013, 1.4 million in 2014, and 1.5 million in 2015 through 2075. Over the projection period, annual net other immigration declines because of the increasing number of other immigrants residing in the Social Security Area, resulting in an increase in the number emigrating out of the area based on rates of departure. Ranging between 300,000 and 500,000 from 2011 through 2050 and between 275,000 and 295,000 from 2051 through 2085, net

other immigration averages about 325,000 annually between 2011 and 2085.⁴⁴

In combination, all five immigration components show an increase in net immigration of 1.25 million between 2011 and 2015, primarily as a consequence of post-recession increases to net other immigration. Subsequently, net immigration gradually declines to 1.025 million in 2085 largely because of declines in net other immigration. Over the projection period, net immigration averages 1.075 million.⁴⁵ Over time, the Trustees Reports' projections imply ratios of net immigration to the size of the population that decline from 3.4 per 1,000 between 2010 and 2020 to 2.2 per 1,000 between 2075 and 2085. However, the later figures are higher than allowed in UN long-range projections (UN DESA 2011).

Technical Panel's Recommendations and Explanation

For most of the past two decades, the rate of immigration exceeded that portrayed in the Trustees Reports. The Technical Panel acknowledges that future immigration levels are likely to equal or exceed projected levels. The current Technical Panel believes that the Trustees should present policymakers with the most likely projections and formulate assumptions that allow for some changes in immigration law over the next 75 years and beyond. Assuming that current immigration laws remain unchanged, the net legal immigration levels assumed by the Trustees between 2011 and 2025 are consistent with current evidence. However, the trend in future net migration will not necessarily be flat or decrease as assumed by the Trustees. We concur with the two earlier Technical Panels that the ultimate assumption for net immigration should be linked to population size. Such an approach is desirable primarily for simplicity and transparency given the uncertainties surrounding various components of net international migration. While the Technical Panel understands that the Trustees regarded "current law" as a useful convention for developing the intermediate scenario as a baseline against which to measure policy changes, the Technical Panel views more complete assumptions about various immigration scenarios as beneficial in projecting Trust Fund finances for the projection period.

⁴⁴ The averages for net other immigration are 425,000 and 225,000 for the low- and high-cost scenarios, respectively.

⁴⁵ The averages for net immigration are 1.385 million and 785,000 for the low- and high-cost scenarios, respectively.

Rather than an approach based on current law, the Technical Panel recommends that the Trustees derive their net migration assumption from an analysis of historical trends and careful consideration of theories of international migration (Massey et al. 1998). The Technical Panel notes the contrasting viewpoints as to the volume of immigration to the United States in future decades. Factors cited in arguing for less immigration include slow recovery from the recent economic slowdown; deterrence through border enforcement and security measures; changes to immigration policy (e.g., termination of diversity visas or visas for adult sons and daughters (of aliens or citizens) or siblings of citizens); diminishing family reunification as IRCA, NACARA, and LIFE immigrants complete sponsorship; declining labor force entry cohorts in Mexico; smaller, more easily supported family sizes in sending countries; social and economic development in Mexico and other sending countries; and competition from developed countries with aging populations and from developing countries with growing economies, especially China and India. Factors associated with likely increases in future immigration include the continuing demand for high- and low-skilled labor as the U.S. population increases and the economy recovers; perpetuation of immigration through family and social networks; globalization of labor and technology that facilitates international migration; labor surpluses in developing countries; increasing inequality in developing countries and a subsequent "push" on labor migrants; unanticipated effects for settlement and reduced return migration resulting from policies for controlling immigration; and policies that regularize unauthorized residents and workers.

The Technical Panel also notes that data limitations restrict comprehensive modeling approaches for treating various factors in population projections (Cohen 2011; Massey 2007, 2010). However, panel-data analytic studies with demographic, geographic, economic, historical, and policy variables demonstrate the emergence of a nuanced, empirical understanding of how U.S. immigration has been structured and perpetuated through the social and economic conditions inherent in the contemporary global economy (Kim and Cohen 2010; Cohen et al. 2008; Clark, Hatton, and Williamson 2007; Hatton and Williamson 2002; Greenwood et al. 1999; Greenwood and McDowell 1999). For example, distance from the United States has a deterrent effect on U.S. immigration. In addition, the smaller

the U.S. population cohort age 15 to 29 years, the greater is the level of net immigration. English as a common language is positively associated with U.S. immigration. The drivers of world migration may more persistently prove to be income and education, perhaps more so than the “friends and relatives” effect (Clark et al. 2007). Those most responsive to source-country conditions may be new, numerically exempt immigrants, as typified in annual legal immigration (Greenwood et al. 1999).

The Technical Panel supports the linking of immigration assumptions with the size of the U.S. population in the expectation that future immigration trends will be extensions of earlier trends. The demographic and economic asymmetries that drive international migration are likely to persist for several decades. The record of the past century has considerable plausibility for assuming future trends. The Census Bureau 2008 population projections based on stochastic forecasting of historical net international migration implied slight increases in the net migration rate between 2010 and 2050. Those projections contrast with the declining trend in the NMR for the constant immigration scenario (Ortman, Hollmann, and Bhaskar 2010; UN DESA 2011), with which the Trustees’ intermediate scenario most closely corresponds. With respect to world population projections, the United Nations treated one scenario based on zero international migration between 2051 and 2300 but, in response to views that the scenario was neither realistic nor conservative (UN DESA 2003), turned to an alternative scenario that used the same net migration rates in longer-range modeling for 2045 through 2050 (UN DESA 2004a, b).

The United States is a classic country of immigration whose liberal policies support family reunification, employment, diversity, and humanitarian relief. Accordingly, high legal immigration levels under post-1965 immigration laws are likely to persist. The contribution of other immigration to U.S. population growth remains substantial, if difficult to measure. In contrast with the immigration downturn inherent in the Trustees’ assumptions, the Technical Panel supports maintaining the importance of immigration in future population projections. Current provisions in immigration law have led to the presence of many undocumented individuals who may prolong their stays as they await immigration visas through documented family members or resolution of their status through a class-action lawsuit; their respective timetable s

vary. Changes in prosecutorial discretion may reduce deportations or facilitate adjustment of status for unknown numbers of other immigrants seeking hardship relief.

Several indications point to less immigration in the 2000s than in the 1990s, emphasizing the volatility of immigration with respect to the U.S. economy and sending countries’ economies. Since 1990, the United States has seen a sustained decline in the rate of net undocumented migration from Mexico. In fact, Mexican net undocumented migration fell to around 200,000 per year in 2000 and then to zero by 2008 (Massey 2009, 2010) partly as a result of deportations, especially deportations of Mexicans on an historic, massive scale (DHS 2011). However, the number of apprehensions of Mexican migrants at the border were still substantially higher than zero, dropping from 854,000 in 2007 to 428,000 in 2010 (DHS 2010, 2011). A decline in Mexican undocumented migration may be partially explained by the relative labor supplies of Mexico and the United States. A simulation of cohort-level migration from Mexico (Hanson and McIntosh 2009, 2010) showed that the greater U.S. labor supply may account for reduced Mexican emigration after 2000.

Given that conclusive answers about net immigration are lacking, the level of net international migration between 2000 and 2010 may have been as high as 13.5 million based on alternative estimates of and assumptions about coverage and emigration (USCB 2010a). The Technical Panel concurs with the Trustees on likely net immigration between 2011 and 2025. To assess the effect of the recommendation for the long term, the Technical Panel adopted the Trustees’ estimate of 1.15 net migrants in 2025 as a baseline. The crucial recommendation is that the ultimate immigration assumption for the intermediate scenario should be derived from long-run historical averages of the NMR – 2.95 for 1900 through 2010 and 3.55 for 1820 through 2010. The Technical Panel notes that the average of these two averages for the NMR – 3.2 migrants per 1,000 – is consistent with the NMR of 2.9 per 1,000 for the 65-year period 1945 through 2010 and with the NMRs for two periods that exclude recent high immigration – 3.19 for 1870 through 1990 and 3.27 for 1965 through 1995. The high immigration levels between 1990 and 2010 led to an increase in the NMR from 3.4 per 1,000 between 1820 and 1990 to 3.6 per 1,000 between 1820 and 2010. The Technical Panel suggests that the NMR of 3.2 per 1,000

for 2025 through 2030 in the current Trustees' estimates should be maintained throughout the remaining projection period, leading to increases in the assumed number of net migrants during the later decades of the period. The ultimate assumption in the low-cost scenario should be an NMR of 4.2 per 1,000 as more consistent with the recent high NMR of 4.3 per 1,000 between 1980 and 2010 while the high-cost assumption should be an NMR of 2.2 per 1,000, closer to the NMR of 2.1 per 1,000 between 1960 and 1980.

The Technical Panel leaves the methodology for achieving the desired NMRs to the Trustees but notes that current methods may lead to (1) overestimates of emigration of legal immigrants and other immigrants and (2) underestimates of transfers to legal status given survey research identifying the parameters of lawful or unlawful pre-LPR experience (Massey and Malone 2002; Jasso, Massey, Rosenzweig, and Smith 2008), including long visa processing times for adjustees (Jasso et al. 2010). The Technical Panel sees the need for better empirical measures for overall immigrant inflows.

Future net international migration implied by the Technical Panel's recommendations would total about 1.6 million annually by 2085 (**Figure 32**). For each scenario, levels of net migration are higher than those implied by the Trustees' assumptions (**Figure 33**, yet the Technical Panel notes that the levels are not as high as those that would have resulted from the 2007 Technical Panel's recommendations; those recommendations might have overemphasized the particularly high immigration levels between 1990 and 2000. The rationale for these "additional" immigrants need not be specified. Certainly, many or all might be legal under current law, which does not provide for a fixed number of immigrants, and certain policies and administrative procedures have prolonged the processes of adjustment and sponsorship. The differences between the Technical Panel's recommendations and the Trustees' assumptions would significantly affect projections of the total population. The effects in projecting the OASDI Trust Funds and evaluating system finances are more complicated because some of the additional immigrants would be in the other immigrant category and less likely to be in OASDI-covered employment, given their need for immigrant status verification for issuance of Social Security numbers. According to the Trustees, additional immigrants would be likely to improve the long-range actuarial

balance by 0.07 percent of taxable payroll for each 100,000 additional net immigrants.

Conclusion

In making the above recommendations for immigration assumptions in the intermediate scenario, the Technical Panel stresses the recommendations' basis in long-term historical trends; the assumptions for the low- and high-cost scenarios are similarly grounded in long-term patterns. The Technical Panel expects that future immigration will depend critically on the growth of the U.S. economy, the fertility of native-born citizens, the resultant demand for labor, and the availability of labor surpluses in developing countries. Although immigration from Mexico may eventually slow, the worldwide trend in developed and developing countries' labor supplies is likely to result in labor migration to developed countries. The U.S. labor force is likely to grow more than that of other developed countries, and yet continued U.S. demand for international migrants is probable. The Technical Panel commends the Trustees for changes in the 2008 Trustees Report that revised assumptions about immigration levels and that recast the approach for deriving net migration assumptions and implementation in order to clarify the impact of the other immigrant population.

2.4 Disability

Assumption Recommendation A-6. The Technical Panel recommends increasing the age-sex-adjusted disability incidence rate to 5.8 per 1,000 insured workers, with somewhat larger increases for women and smaller increases for men; this is higher than the 5.2 per 1,000 rate assumed in the 2011 Trustees Report. The Technical Panel also recommends low- and high-cost disability incidence rates of, respectively, 4.8 and 6.9.

Assumption Recommendation A-7. The Technical Panel recommends a more rapid decline in DI mortality rates for both men and women from 2020 through 2030 than is currently assumed. The effect of the recommended reduction on the age-adjusted mortality rate for men is a 15.7 percent lower mortality rate from 2030 through 2085; for women, it is a 14.3 percent lower mortality rate during the same period. The recommended intermediate age-adjusted DI mortality rate for men in 2085 is 11.10

per 1,000 DI beneficiaries, which is lower than the currently assumed mortality rate of 13.20. The recommended intermediate age-adjusted DI mortality rate for women in 2085 is 8.20 per 1,000 DI beneficiaries, which is lower than the currently assumed mortality rate of 9.57. The recommended total age-sex-adjusted mortality rate in 2085 is 9.86, which is 13.7 percent lower than the currently assumed 11.42. The Technical Panel also recommends ultimate low- and high-cost total age-sex-adjusted mortality rates of, respectively, 17.10 and 6.30.

Assumption Recommendation A-8. The Technical Panel recommends reducing the assumed DI recovery rate from the currently assumed rate of 10.7 per 1,000 DI beneficiaries to 8.7 per 1,000 DI beneficiaries. The Technical Panel also recommends an increase in the range of uncertainty about the recovery rate, with low- and high-cost values of, respectively, 11.4 and 6.0 relative to the currently assumed low- and high-cost values of, respectively, 12.9 and 8.5.

Method Recommendation M-9. The Technical Panel recommends expanding the discussion of the factors leading to the projected decline in the share of DI-insured men and careful monitoring of the share to see if the recent declines among younger men carry forward to men at older ages. The Technical Panel notes that similar discussion and monitoring are warranted given the projection that the steady rise in the share of DI-insured women will level off in the short term.

Method Recommendation M-10. The Technical Panel recommends exploring in greater depth the effect of diagnoses of DI recipients on program exit rates because of recovery or death. The Technical Panel recommends similar exploration for the projected share exiting DI because of conversion to retired worker benefits.

Presentation Recommendation P-5. The Technical Panel recommends presenting more detail on the programmatic, economic, and health factors that drive DI applications and how the factors are assumed to change in the future.

Overview

When estimating the number of individuals receiving DI benefits in future years, the Trustees account for several factors. First, they project the

number of individuals in each age group, differentiating between men and women. Second, they project the share of men and women in each age group insured for DI benefits. For example, a person must have worked in at least 5 of the 10 most recent years to be potentially eligible for DI benefits. Third, the Trustees project the incidence rate for both men and women in each age group. The incidence rate is equal to the fraction of individuals in each age group insured for DI who are awarded benefits during the year. The fourth factor projected by OACT is the termination rate for men and women in each age group who receive DI. Individuals exit the DI program for three main reasons: conversion to retired worker benefits at full retirement age, death, and recovery.

The projections of the (1) population size, (2) fraction of the population that is DI-insured, (3) incidence rate, and (4) termination rate in each age group drive the projections of DI enrollment among men and women. Changes in any one factor translate directly into changes in the projected size of the program, though the discussion below focuses primarily on the latter three determinants of DI enrollment.

The following equation defines the change in the number of DI recipients from year t-1 to t within age group a and gender g:

$$DDI_{agt} = POP_{agt} * INS_{agt} * INC_{agt} - DI_{ag,t-1} * TERM_{agt}$$

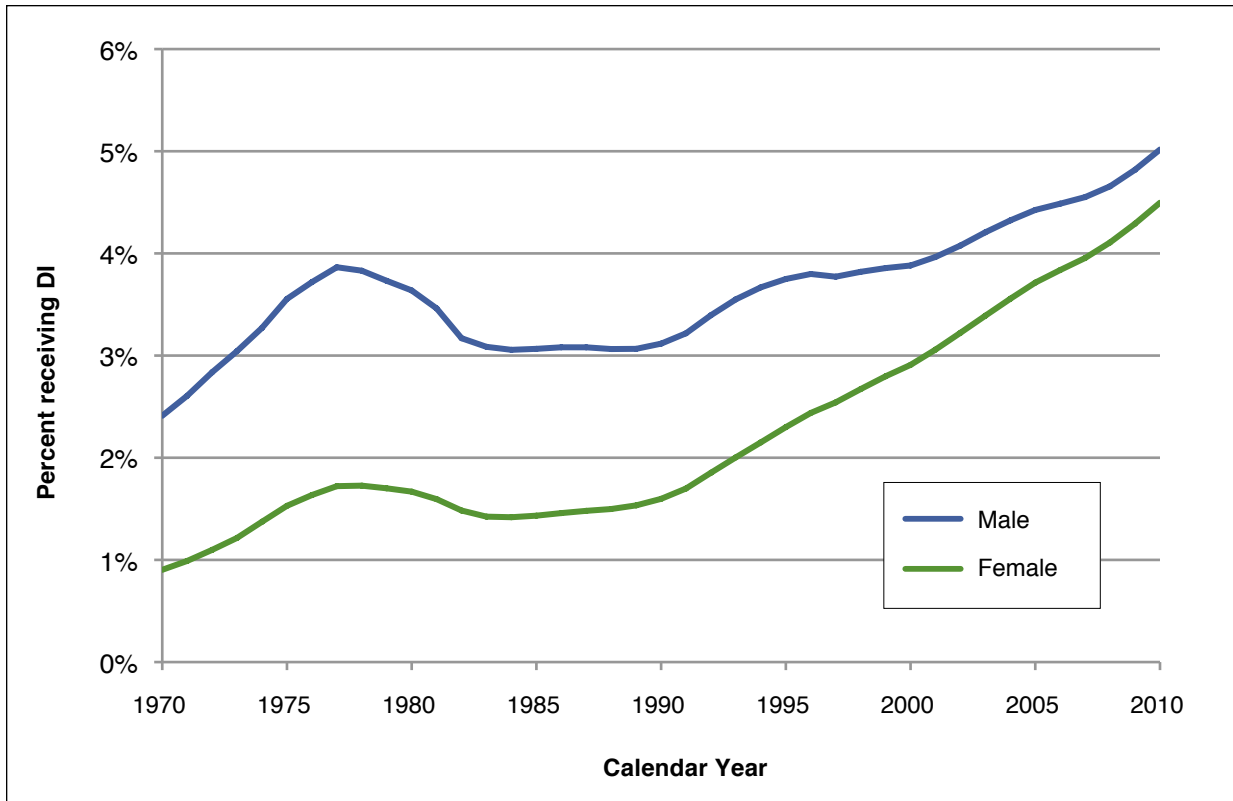
where DDI_{agt} is the change in the number of DI recipients in the given group from the end of year t-1 to the end of year t⁴⁶; POP_{agt} and INS_{agt} represent, respectively, the population in this group and the fraction of that population insured for DI; INC_{agt} is the incidence rate (awards divided by number insured) in this group in period t; and $TERM_{agt}$ is the fraction of DI recipients at the end of period t-1 who exit the program during period t. Thus, the three factors noted above determine the changes in DI enrollment from the baseline year.

Background

Since the late 1980s, the fraction of non-elderly adults between age 25 and 64 years receiving DI benefits has more than doubled, rising steadily from 2.3 percent in 1989 to 4.7 percent by 2010.

⁴⁶ We abstract from the fact that individuals “age out” of the group during the year. For example, individuals who are 54-years-old at the end of year t-1 will age out of the group during the year while those who are 49-years-old at that time will age in to the group.

Figure 34. DI Enrollment among Men and Women Age 25 to 64 years: 1970–2010



Source: SSA, Annual Statistical Supplement to the Social Security Bulletin, various years.

The increase in DI enrollment has been greater among women than among men. More specifically and as shown in **Figure 34**, the fraction of women between age 25 and 64 years receiving DI benefits increased from 0.9 percent in 1970 to 1.6 percent in 1990 and then to 4.5 percent in 2010. Among men in the same age range, the corresponding increase in DI enrollment grew from 2.4 percent in 1970 to 3.1 percent in 1990 to 5.0 percent by 2010.⁴⁷ While DI enrollment increased by a similar amount (0.7 percentage point) among men and women from 1970 to 1990, the growth among women has been much greater during the past two decades.

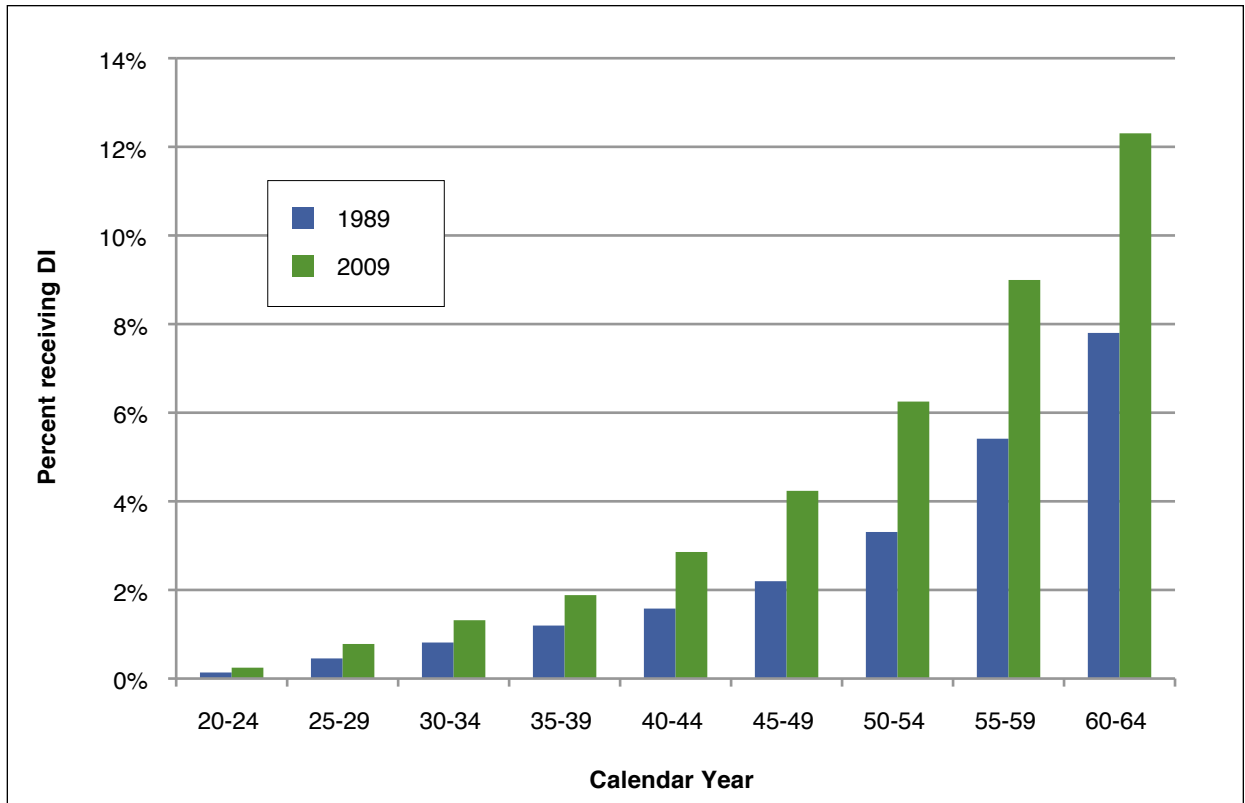
The increase in DI enrollment for both men and women is partly a function of the changing age structure of the U.S. resident population, with most of the Baby Boom generation aging into its 50s and

early 60s over the last 20 years. Analyses of nationally representative survey data (such as the March Supplement to the Current Population Survey issued by the Bureau of Labor Statistics) indicate that the prevalence of self-reported disability rises steadily with age. Consistent with the analyses and as shown in **Figure 35**, rates of DI enrollment are substantially higher among these age groups than among adults at younger ages; therefore, it is reasonable to expect overall rates of DI enrollment to increase even if age-specific rates of DI enrollment do not change.

But, as the same figure shows, the increase in DI enrollment within each age group has been significant. For example, in 1989, the fraction of U.S. residents in their late 40s receiving DI disabled worker benefits was 2.2 percent. Twenty years later, the fraction had almost doubled to 4.2 percent. With the substantial growth in DI enrollment within age groups and as shown by Duggan and Imberman (2009), the changing age structure of the U.S.

⁴⁷ The decline in DI enrollment during the late 1970s and early 1980s per the figure was driven by a tightening of the program's medical eligibility criteria and a sharp increase in the number of Continuing Disability Reviews (CDR) conducted on existing DI recipients. The 1984 law subsequently reversed the changes and liberalized the medical eligibility criteria beyond those in place before the clampdown on the program.

Figure 35. Percent of Adults Receiving DI by Age Group: 1989 and 2009



Source: SSA, Annual Statistical Report on SSDI, various years.

population explains less than one-fifth of the rise in DI enrollment from 1989 to 2010.⁴⁸ Stated differently, if age-specific rates of DI enrollment had not changed during the 20-year period, DI enrollment would have increased from 2.3 to just 2.7 percent versus the actual increase of 2.3 to 4.7 percent.

The increase in DI enrollment has coincided with a steady rise in the share of Social Security expenditures paid out to DI recipients. From 1989 to 2010, that share increased from 10 to 18 percent but significantly understates the importance of DI to the overall Social Security program for at least two reasons. First, the results from earlier research suggest that the work incentives created by the DI program reduce labor force participation among those both applying for and receiving DI benefits.⁴⁹ Thus, pay-

roll tax revenue for the Social Security program is lower. Second, DI recipients receive a monthly benefit equal to their full Primary Insurance Amount (PIA) and continue to receive the benefit after converting to retired worker benefits at full retirement age. Accordingly, many former DI recipients receive higher retired worker benefits than if they had not enrolled in DI.⁵⁰

OACT Assumptions and Technical Panel Recommendations

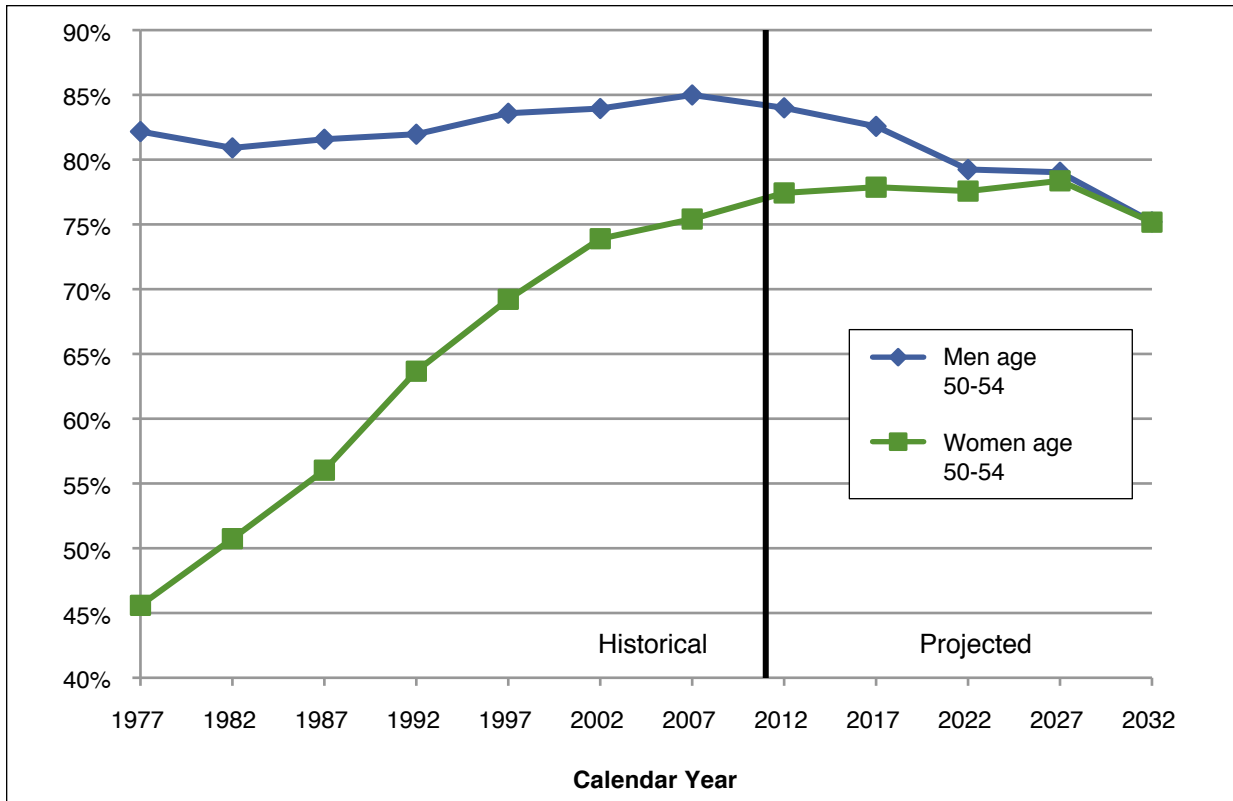
Fraction Insured for DI Benefits. To be insured for DI benefits, an adult must have worked in at least 5 of the 10 most recent years and must be less than full retirement age.⁵¹ The fraction of in-

⁴⁸ Following the methodology used by Duggan and Imberman (2009) and updating it to use 2009 as the final year.

⁴⁹ See Parsons 1980; Bound 1989; Parsons 1991; Bound and Waidmann 1992; Gruber and Kubik 1997; Bound and Burkhauser 1999; Burkhauser and Daly 2002; Stapleton and Burkhauser 2003; Autor and Duggan 2003; Chen and van der Klaauw 2007; von Wachter, Song, and Manchester 2011.

⁵⁰ Consider a DI recipient born between 1943 and 1954 who would have claimed retired worker benefits at age 62 if he had not qualified for DI. Monthly DI benefits are 100 percent of the Primary Insurance Amount (PIA) while retired worker benefits would be just 75 percent of PIA. Thus, monthly retired worker benefits for this individual would be 33.3 percent greater if he enrolled in DI before receiving retired worker benefits. The exact difference might vary somewhat depending on the person's age at the time of DI award, as age determines the number of years of earnings used to calculate the DI benefit.

Figure 36. Percentage of DI-Insured Men and Women Age 50 to 54 years: 1977–2032



Source: Office of the Chief Actuary, Social Security Administration, 2011.

dividuals meeting these criteria varies by both age and gender and has changed over time. Most notably, the increase in female labor force participation in recent decades has led to a steady rise in the fraction of women insured for DI. For example, the fraction of women age 50 to 54 years insured for DI increased from 56.0 percent in 1987 to 75.4 percent by 2007 (**Figure 36**). However, the increase was not nearly sufficient to “explain” the increase in DI enrollment among women during the same period. More specifically, the fraction of women in their early 50s receiving DI benefits increased by 160 percent (from 2.3 to 5.9 percent) from 1989 to 2009 versus an increase of just 35 percent in the share of DI-insured women during the same period.

Figure 36 presents the share of women in their early 50s insured for DI at five-year intervals through 2007 and the projections at five-year intervals through 2032. After accounting for the steady rise through 2007, the share of women who are DI-insured is projected to level off over the next 25 years, with the projected 2032 fraction of 75.2 percent almost identical to the actual 75.4 per-

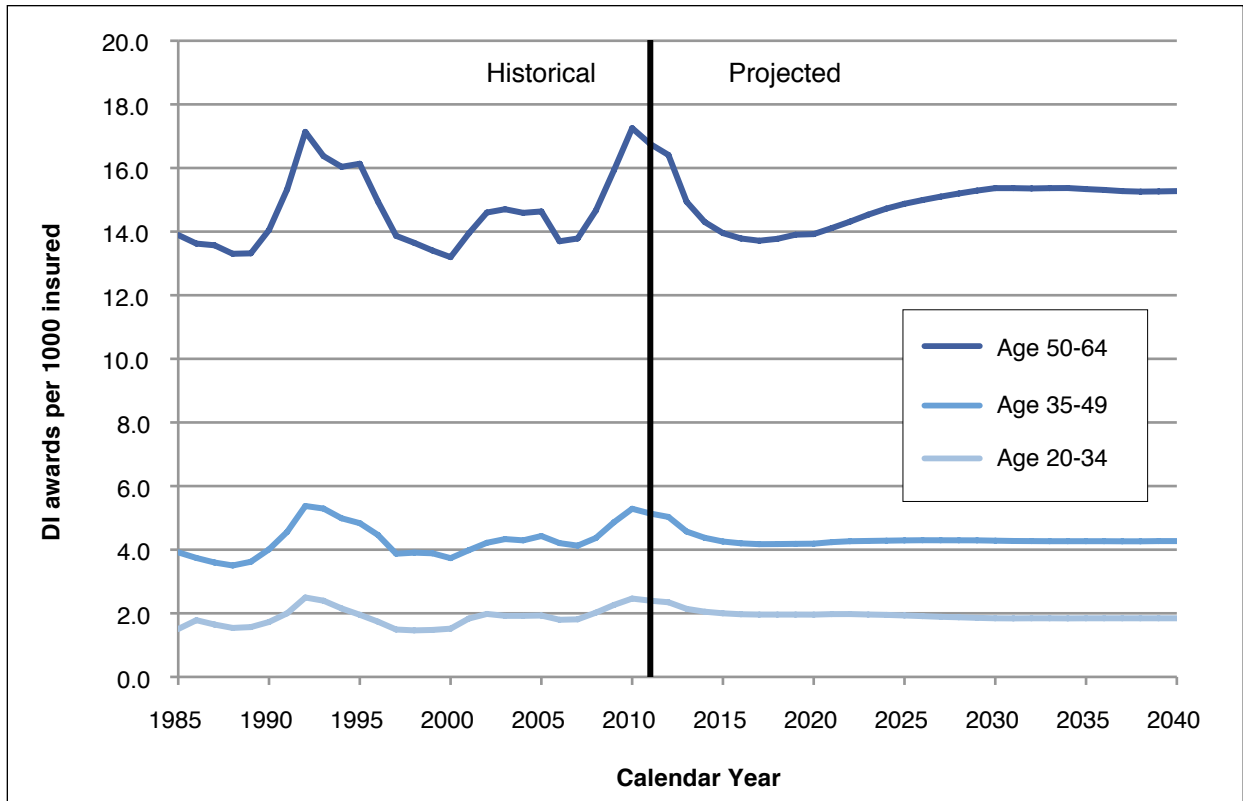
cent share in 2007. The projection partly reflects the Trustees’ assumptions that expansion of the female labor force will not grow much larger in the years ahead, but it may also reflect an increase in the projected share of other-than-legal immigrants in this group.⁵²

Figure 36 also permits a comparison of the share of DI-insured men and DI-insured women age 50 to 54 years. The Trustees assume that the share of men insured for DI – which has gradually though steadily increased since the 1980s – will fall substantially in the coming decades. While just 15.0 percent of men in their early 50s are not currently insured for DI benefits, that share is projected to increase to 24.8 percent by 2032. The Trustees Report does not discuss this substantial change, along with similar changes for many other groups.

The projections for other age groups among both men and women are qualitatively similar, with a leveling off projected for women and substantial declines projected for men. For example, among

⁵² Undocumented immigrants are not insured for DI benefits even if they have worked a sufficient number of years.

Figure 37. DI Incidence (per 1,000 insured) among Men: 1985–2040



Source: Office of the Chief Actuary, Social Security Administration, 2011.

women between age 40 and 44 years, the DI-insured share is projected to fall from 74.0 to 72.8 percent from 2007 to 2032 while, among men in the same age group, the projected decline is much greater – from 85.3 to 76.8 percent.

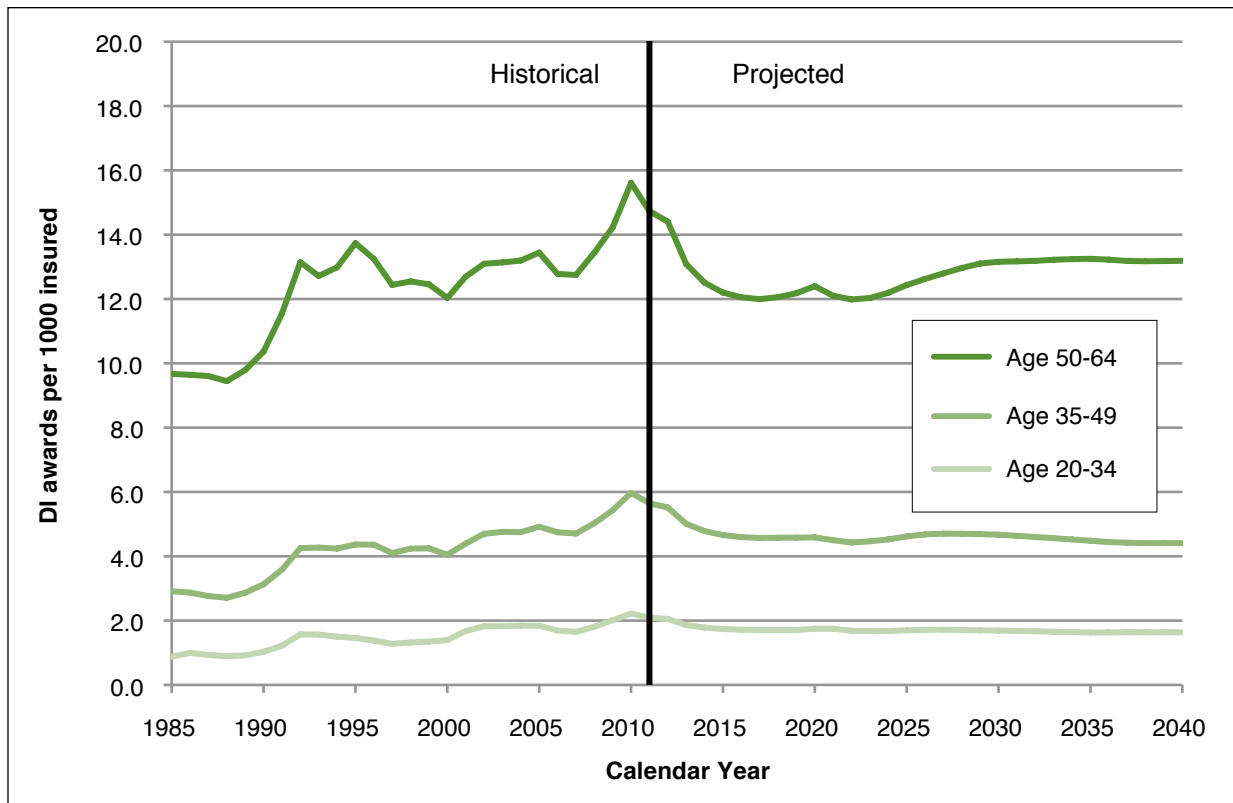
Given OACT’s methodology, the assumed declines in the share of DI-insured reduce the number of individuals projected to receive DI benefits. More careful discussion and scrutiny of the projections and the factors responsible for them (e.g., declining employment, rising shares of other-than-legal immigrants, and so forth) are warranted in view of the sharp departure from recent experience and the importance of the DI-insured shares to the medium- and long-run size of the DI program.⁵³ This forms the basis for the Technical Panel’s first method recommendation M-9 above.

⁵³ It is worth noting that the share of men insured for DI has been falling at younger ages. For example, among men between age 30 and 34 years, the fraction insured for DI fell from 85.6 percent in 1997 to 79.3 percent in 2007. The Trustees assume that the declines will carry forward to successive age groups, though the projected magnitude of the decline is even greater than observed among men at younger ages.

Incidence Rates. In future years, an important determinant of projected DI enrollment is the incidence rate, which is the ratio of DI awards to the number insured for DI benefits in each year. Incidence rates have steadily increased in recent years, partially reflecting the effect of the aging of the Baby Boom generation and the link between incidence rates and age. **Figures 37** and **38** depict DI incidence rates for men and women, respectively, in three age groups: 20 to 34 years, 35 to 49 years, and 50 to 64 years.⁵⁴ Recognizing the significant changes in the medical eligibility criteria for the DI program that took effect in 1984, we focus on the period since 1985. The data from 1985 to 2009 present actual incidence rates while the data from 2010 to 2040 are projected incidence rates. Given that projected incidence rates remained largely un-

⁵⁴ Incidence for these 15-year age groups is the unweighted average of the incidence in each of the three component 5-year age groups. For example, to calculate incidence among men age 35 to 49 years, we take the average of the incidence for men age 35 to 39, 40 to 44, and 45 to 49 years in order to reduce the effects of any changes in the age structure within these 15-year age groups.

Figure 38. DI Incidence (per 1,000 insured) among Women: 1985–2040



Source: Office of the Chief Actuary, Social Security Administration, 2011.

changed between 2040 and 2085, we focus on the first 30 projection years rather than on all 75.

An examination of data in the two figures reveals that, consistent with previous research (Black, Daniel, and Sanders 2002; Autor and Duggan 2003; Duggan and Imberman 2009), DI incidence rates increase during economic downturns. For example, the incidence rate for all three age groups for both men and women rose substantially from 1989 to 1992, a period encompassing the 1991 recession. Similar increases were apparent in the early 2000s, and DI incidence rates rose substantially again from 2007 to 2009 during the most recent recession (the 2010 and later data in **Figures 37** and **38** are projections).

The data demonstrate that it is important to control for economic conditions when exploring how age-specific DI incidence rates for both men and women have evolved in recent years and whether they are relatively stable. Indeed, the Trustees assume that age-specific DI-incidence rates for both men and women will stabilize at levels close to those of just before the recent economic downturn.

This can be seen in **Table 12**, which compares the actual age-specific incidence rates in 2007 for both men and women with the projected rates in 2037. The 50-to-59- and 60-to-64-year age groups are listed separately given the somewhat different patterns for these two subgroups.

An examination of the data in **Table 12** reveals a larger projected increase in incidence for men than for women over the long run. For example, while incidence for men age 35 to 49 years is projected to increase by 3.3 percent from 2007 to 2037, incidence for women in the same age range is projected to decline by 6.1 percent. With the exception of those age 60 to 64 years,⁵⁵ the projections

⁵⁵ The Trustees assume that incidence for both men and women in their early 60s will increase by about 25 percent from 2020 to 2030 (after falling somewhat from 2007 to 2020) and then stabilize. The increase may reflect the projected effect of the increase in Social Security's full retirement age, which will enhance the relative financial attractiveness of DI benefits for cohorts born in 1955 and later relative to those born from 1943 to 1954. See Duggan, Singleton, and Song (2007) for an examination of the effect of the full retirement age on DI enrollment.

Table 12. DI Incidence by Gender and Age: 2007 and 2037

| Age Group | Female Incidence | | | Male Incidence | | |
|-----------|------------------|----------------|----------------|----------------|----------------|----------------|
| | Actual 2007 | Projected 2037 | Percent Change | Actual 2007 | Projected 2037 | Percent Change |
| 20–34 | 1.65 | 1.64 | -0.6% | 1.81 | 1.84 | +1.8% |
| 35–49 | 4.71 | 4.42 | -6.1% | 4.13 | 4.26 | +3.3% |
| 50–59 | 11.45 | 11.39 | -0.5% | 11.89 | 12.02 | +1.1% |
| 60–64 | 15.35 | 16.78 | +9.3% | 17.57 | 21.78 | +24.0% |

of long-run age-specific incidence are highly similar to 2007 values.

To determine the appropriateness of the assumptions, an empirical investigation can determine whether there is a significant time trend in DI incidence for either men or women by estimating models of the following type for each age group depicted in **Figures 37** and **38**:

$$\text{Incidence}_t = g + b * (\text{Year}-1985)_t + g_1 * \text{UnempRate}_t + g_2 * \text{UnempRate}_{t-1} + e_{at}$$

The model controls for both the current year's and previous year's unemployment rate given that economic downturns may have a delayed effect on DI application and award. The model includes the 25 most recent years (1985 through 2009) (subtracting 1985 from the calendar year variable so that the variable ranges from 0 to 24).⁵⁶ The coefficient *b* captures the average annual change in incidence for each age group after controlling for the effects of the unemployment rate.

The results reveal that, for all six age*gender groups considered in **Figures 37** and **38**, there is a statistically significant positive trend in DI incidence.⁵⁷ **Table 13** summarizes the results, listing the estimate for *b* along with its corresponding

p-value.⁵⁸ It also lists the 2007 incidence for each group in order to facilitate a comparison with the estimated annual rates of change.

To gauge the implied magnitude of the estimates, it is useful to consider an example. The estimate of 0.1143 for *b* in the model for women age 35 to 49 years suggests that incidence rose by an average of 0.1143 per 1,000 each year from 1985 to 2009. If this trend were to continue for just another 10 years and then stabilize, it would represent an increase of approximately 1.14 per 1,000 insured in DI incidence for the same group, a 24 percent increase over the 2007 value of 4.71 per 1,000.

For all six groups, DI incidence is trending up over time – and especially rapidly for women. Relative to baseline DI incidence, the increases are larger for the younger age groups.⁵⁹ For example, if the trends were to continue for another 10 years, incidence for women age 20 to 34 years would increase by 31 percent (equal to 0.51 divided by 1.65) versus 15 percent for women age 50 to 64 years. The corresponding implied changes for men in the same two age ranges would be 12 and 5 percent, respectively.

From the perspective of the DI program specifically and Social Security generally, the relatively rapid increase in award rates at younger ages is particularly important for two reasons. First, potential time spent in the DI program (and thus the present

⁵⁶ There are two possible concerns with the selection of this time period. First, DI incidence was relatively low in the mid-1980s, even after the change in DI's medical eligibility criteria. Second, the effects of the most recent economic downturn have not yet been fully felt. Our results are, however, almost identical if we shorten our time frame by restricting attention to the 20-year period from 1988 to 2007 inclusive, which would exclude both the mid-1980s and the years since the start of the most recent recession.

⁵⁷ All 12 estimates for *g*₁ and *g*₂ in the six models are positive, reflecting the increase in DI award rates that tends to occur as the unemployment rate rises. In five of the six models, either *g*₁ or *g*₂ is statistically significant at the 5 or 10 percent level. The one exception is the female group age 50 to 64 years.

⁵⁸ Lower p-values represent greater statistical precision. A p-value of less than 0.10 (0.05) implies that the estimate is statistically significant at the 10 (5) percent level.

⁵⁹ It is not surprising that DI incidence is growing more slowly at older ages when one considers that today's counterparts to individuals who, in previous years, qualified for DI in their late 50s and early 60s may qualify for the program at much younger ages.

Table 13. Annual Rate of Change in DI Incidence: 1985–2009

| Gender | Age Group | 2007 Incidence | b | p-value |
|--------|-----------|----------------|-------|---------|
| Men | 20–34 | 1.81 | 0.022 | 0.001 |
| | 35–49 | 4.13 | 0.042 | 0.003 |
| | 50–64 | 13.78 | 0.063 | 0.018 |
| Women | 20–34 | 1.65 | 0.051 | 0.000 |
| | 35–49 | 4.71 | 0.114 | 0.000 |
| | 50–64 | 12.75 | 0.193 | 0.000 |

value of potential DI benefits⁶⁰) is much greater for a young or middle-age adult than for a near-elderly adult. Second, to the extent that DI reduces labor force participation, it translates into a corresponding decrease in tax revenue. Unfortunately, the single age-sex-adjusted incidence reported in the Trustees Report essentially treats an award at age 40 no differently than an award at age 60 even though the implications for the DI Trust Fund vary dramatically.

In light of the empirical results reported above, the Trustees' assumption that DI incidence will remain stable throughout the 75-year projection period seems implausible. Absent a significant change in DI policy, such as a tightening of the program's medical eligibility criteria, a much more likely scenario is that the trend toward increasing DI incidence will continue for some time. Even the assumption that the trend will continue for just 10 more years means that incidence among men and women, respectively, for the three age groups noted earlier would increase by an average 1.2 and 0.4 per 1,000.

This analysis forms the basis for Recommendation A-6, an increase in the long-run age-sex-adjusted incidence rate from 5.2 to 5.8 per 1,000 insured workers (and identical increases of 0.6 per 1,000 for the low- and high-cost scenarios), with variation in the magnitude of the adjustment by gender and age group. The recommended adjustments to DI incidence rates are intentionally conservative in two important respects. First, the trend for each age group is assumed to continue

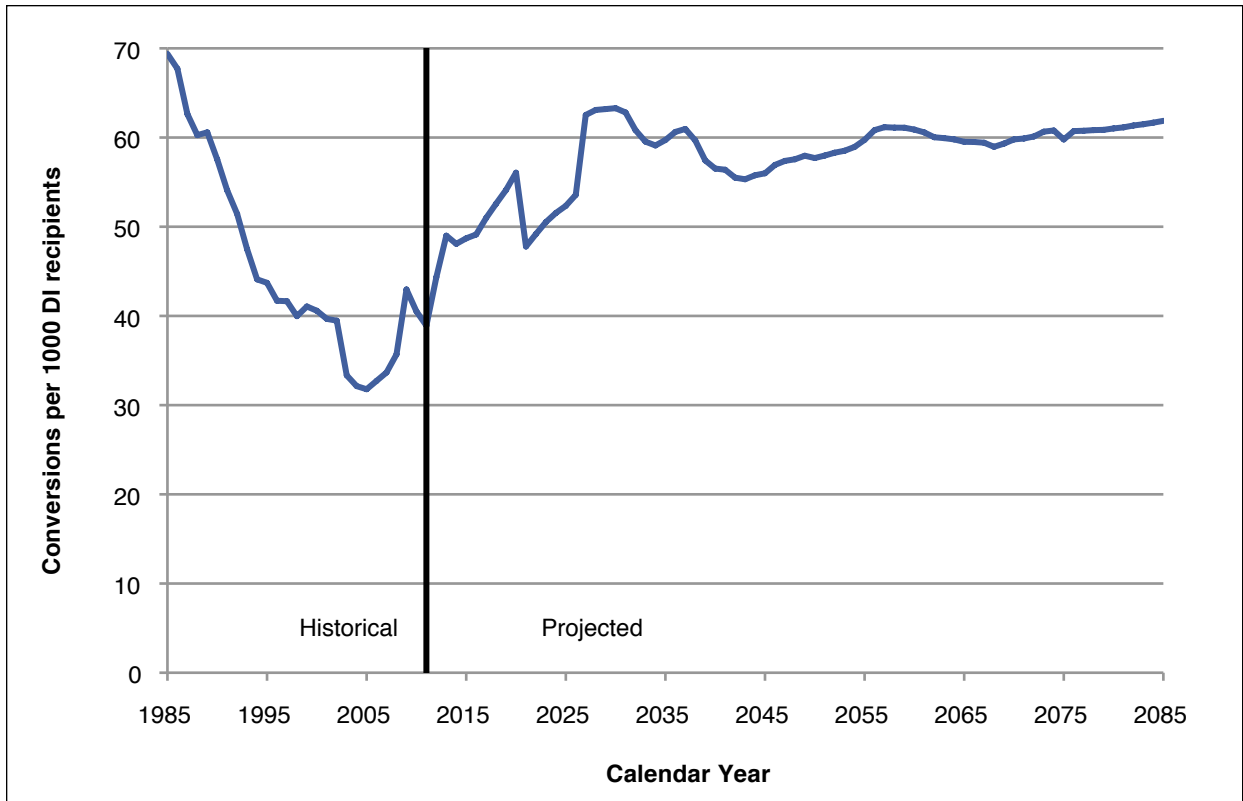
for only 10 more years. Second, the recommended increases are somewhat smaller than the increases implied by the 10-year trend projections.

Termination Rates. From 1985 to 2009, the annual exit rate from DI fell from 12.0 to 7.7 percent. The average person awarded DI benefits now remains in the program for much longer than his or her counterparts of earlier years. Individuals may exit the DI program for one of three reasons: (1) conversion to retired worker benefits at full retirement age (FRA), (2) death, or (3) recovery. Of the 617,587 DI recipients exiting the program in 2009, 55.1 percent exited by converting to retired worker benefits, 36.2 percent because of death, and 8.6 percent because either their earnings exceeded the substantial gainful activity level set by SSA or they no longer met the program's medical eligibility criteria.

Conversion to Retired Worker Benefits. DI recipients who reach the FRA (age 66 for those born from 1943 to 1954) convert to retired worker benefits; thus, changes in the exit rate associated with the FRA are entirely a function of the DI population's age distribution. As shown in **Figure 39**, the FRA exit rate trended down during the late 1980s and through the late 1990s as DI enrollment rates increased especially rapidly among younger adults (and a decreasing share of DI recipients was just under the FRA). The rate was fairly stable in the early 2000s and artificially low from 2003 through 2008

⁶⁰ Given that earnings tend to rise with age, at least through the 20s and 30s, the average monthly benefit for younger individuals awarded DI benefits is smaller than for those awarded benefits later. This reality is, however, not nearly sufficient to offset the effect of a larger number of potential years in the program on the present value of benefits.

Figure 39. DI Recipients Converting to Retired Worker Benefits (per 1000 recipients): 1985–2085



Source: Trustees Report, Figure V.C5.

because of the increase in the FRA that occurred during that period.⁶¹

As shown in **Figure 39**, the FRA exit rate will soon increase as the oldest members of the Baby Boom generation (born in 1946) reach their FRA beginning in 2012. OACT projects substantial increases in the exit rate in subsequent years, with eventual stabilization at around 60 per 1,000, a rate not seen since the 1980s. OACT projects that an increasing share of DI recipients will be in their 60s, a prediction clearly at odds with the evidence above that DI enrollment is increasing more rapidly among younger age groups. Indeed, given the absence of 65- and 66-year-old DI recipients in the late 1980s and throughout the 1990s, the increase

in the FRA will lower the exit rate associated with the FRA by increasing the number of DI recipients.

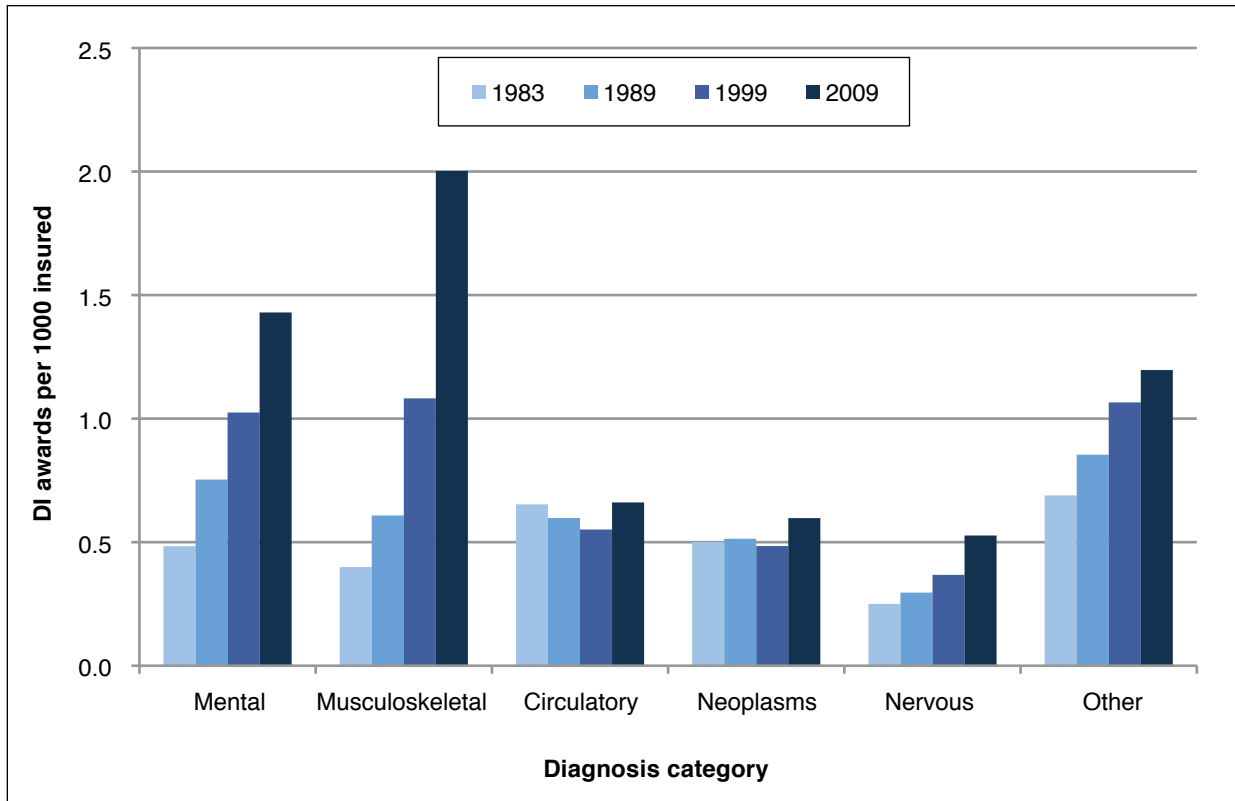
A detailed exploration and discussion of the factors producing the increase in the projected rate at which DI recipients will convert to retired worker benefits is warranted, as it substantially affects OACT’s projections of DI enrollment. This forms the basis for the recommendation P-5 above.

Mortality. The mortality rate of DI recipients has declined steadily and rapidly in recent years. The age-sex-adjusted mortality rate fell from 4.70 percent in 1985 to 2.63 percent by 2010. This 44 percent decline was substantially greater than for all non-elderly adults during the same period.⁶² To some extent, the decline in the mortality rate since 1985 reflects the increase in the share of female DI recipients whose mortality rates are much lower than those of comparably aged males. In 1985, just 33 percent of DI recipients were women versus 47 percent by 2010.

⁶¹ Only DI recipients born from January 1938 through October 1938 would have converted to retired worker benefits in 2003 because the full retirement age for the group had increased by two months to 65 years and two months. Similarly, only DI recipients born from November 1938 through August 1939 would have converted to retired worker benefits in 2004. In other words, from 2003 through 2008, the size of the cohorts converting to retired worker benefits were about one-sixth smaller because of the policy change, thereby explaining the substantial increase in the exit rate from 2008 to 2009 per the figure.

⁶² The unadjusted change in the mortality rate was almost identical over this same period, falling from 4.88 percent in 1985 to 2.80 percent by 2009 (a 43 percent decline).

Figure 40. DI Awards by Diagnosis per 1,000 DI-Insured: 1983, 1989, 1999, 2009



Source: SSA, Annual Statistical Report on SSDI, various years.

An even more important factor, however, is the shift in program-qualifying conditions. In the early 1980s, the most common conditions among DI recipients were cancer and heart disorders. Following a liberalization of the program’s medical eligibility criteria in 1984, individuals with more subjective conditions could more easily qualify for the program, resulting in a steady shift to low-mortality conditions such as mental disorders and musculoskeletal conditions such as back pain.⁶³ The shift is evident in **Figure 40**, which plots the award rate in selected years for the four most common diagnoses among DI recipients. The figure shows that award rates have risen only slightly since 1983 for cancer and heart conditions but dramatically for mental disorders and musculoskeletal conditions. The award rate for mental disorders in 2009 was three times greater than in 1983 (1.43 per 1,000 in 2009

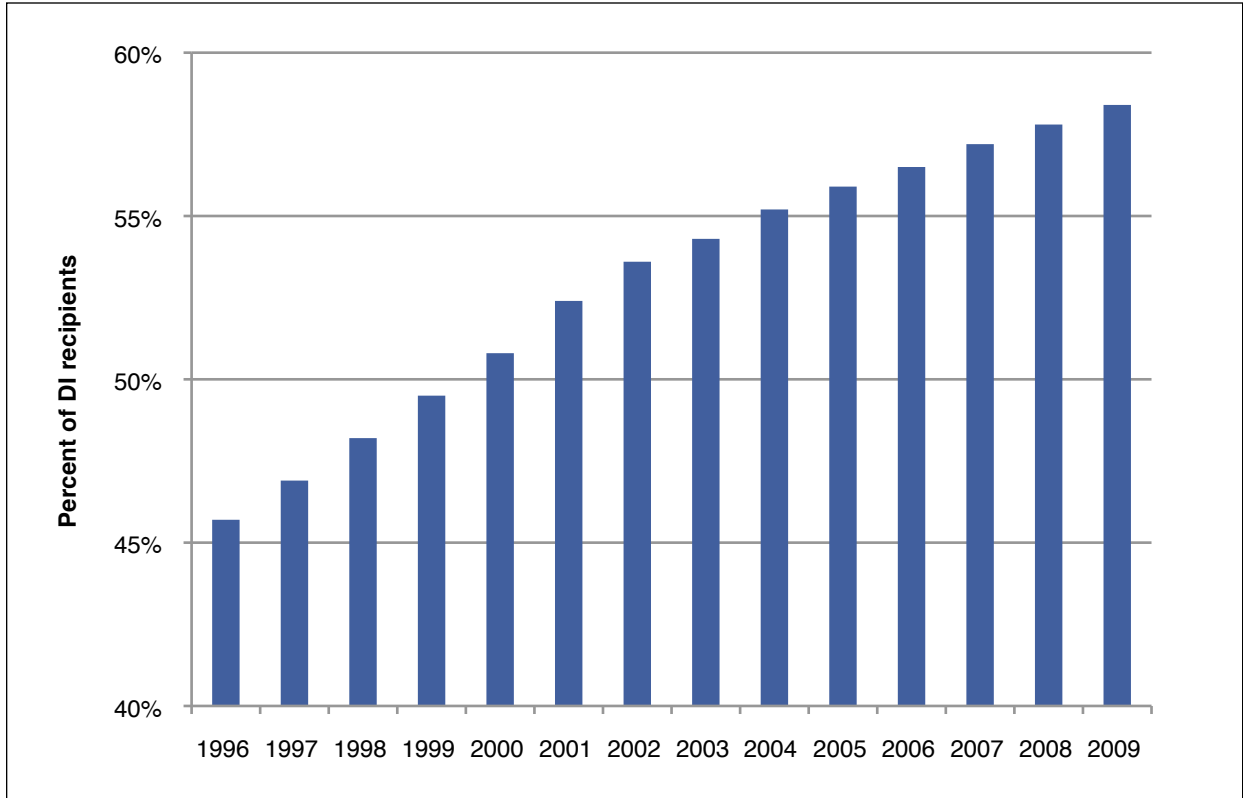
versus 0.48 per 1,000 in 1983) while the rate for musculoskeletal conditions in 2009 was five times greater (2.00 versus 0.40).

As a result of steady changes in award rates, the DI program is to some extent “out of equilibrium” as the share of DI recipients with a mental disorder or musculoskeletal condition increases. For example and as shown in **Figure 41**, the share of DI recipients age 50 years or older who qualified because of a mental disorder or musculoskeletal condition has steadily risen from 45.7 to 58.4 percent since 1996. A similar trend holds for DI recipients under age 50. The increase in the share of DI recipients with low-mortality conditions seems likely to continue in the years ahead, causing mortality rates for this group to decline more rapidly than for the general population. The Technical Panel recommends further investigation of the relationship between mortality and diagnosis, something that OACT does not explicitly consider at present.

Figure 42 plots the age-sex-adjusted mortality rate of both male and female DI recipients since 1985 and displays the Trustees’ projections of

⁶³ Rupp and Scott (1996) demonstrate that mortality rates vary substantially by diagnosis. DI recipients with mental disorders and musculoskeletal conditions as their qualifying conditions have much lower mortality rates than the average DI recipient while DI recipients with cancer and heart conditions have much higher mortality rates.

Figure 41. Percent of DI Recipients Age 50 years and Older with Mental Disorder or Musculoskeletal Condition: 1996–2009



Source: SSA, Annual Statistical Report on SSDI, various years.

these rates as well as the Technical Panel’s recommendations through 2085. To facilitate interpretation of the changes over time, the figure presents the changes converted to a log scale so that a constant rate of decline in the mortality rate is linear.⁶⁴

An examination of the data in **Figure 42** reveals that, from 1985 to 2010, age-adjusted mortality rates among male DI recipients fell by an average 2.20 percent per year versus an average annual decline of 2.46 percent for women.⁶⁵ The Trustees project that the rates will continue to decline at a similar rate for both men and women during the next 10 years. More specifically, in each year during this period, the Trustees assume a 2.35 percent an-

nual decline for male mortality rates and a 2.44 percent decline for female mortality rates.

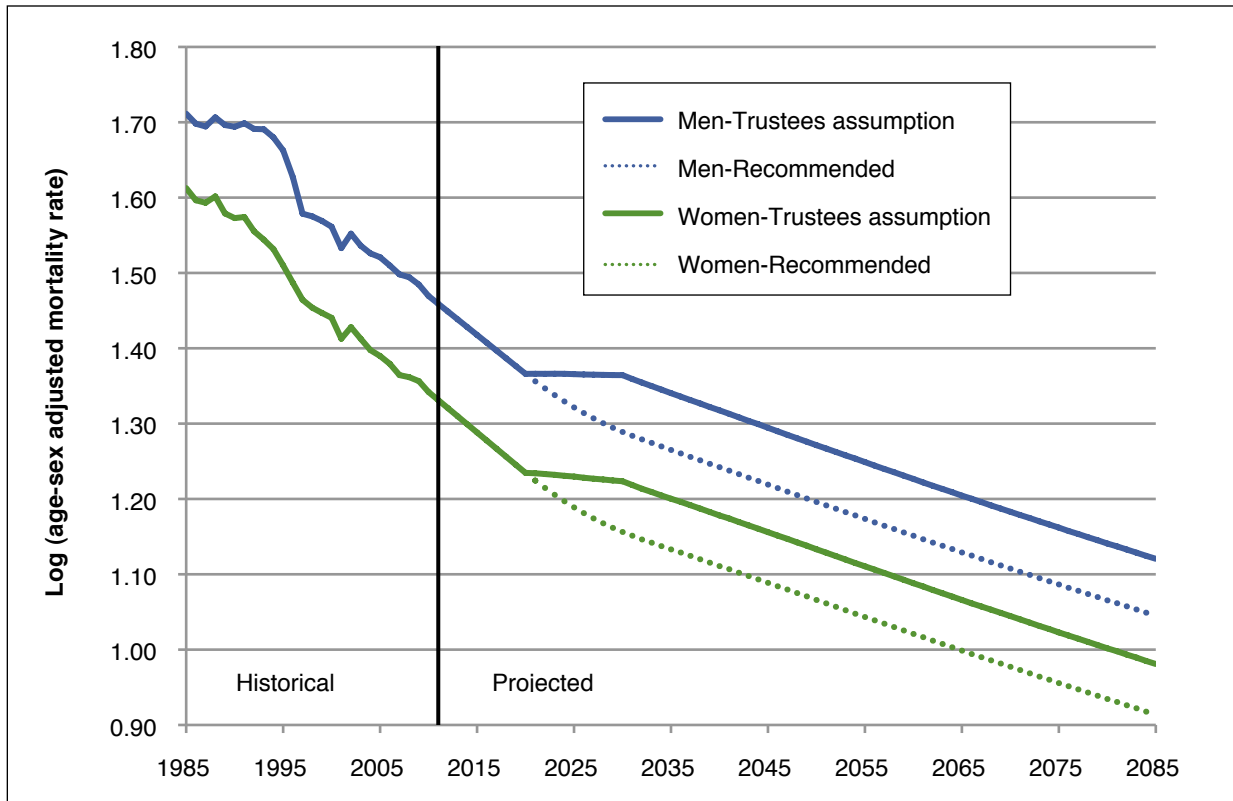
However, the assumed annual declines change abruptly beginning in 2021, so that from 2020 to 2030, the average annual decline in the male and female mortality rates plummets to just 0.04 and 0.26 percent, respectively. This substantial change in the assumed mortality rate trends may be seen in **Figure 42**. Beginning in 2031, the assumed mortality rates decline by an average of about 1.1 percent per year through 2050 and by about 1.0 percent per year thereafter, which is comparable to the decline assumed for the general population during the same period.

The assumption that mortality rates will essentially remain flat during the 10-year period from 2020 to 2030 seems implausible given the ongoing increase in the share of DI recipients with low-mortality conditions such as mental disorders and back pain. Thus, the Technical Panel recommends (A-7) a more gradual change in the annual rate of decline in the mortality rate after 2020, trending steadily from the average annual decline assumed

⁶⁴ The increase in the rates above in the late 1980s and early 1990s largely reflects the effects of the HIV/AIDS epidemic; DI recipients with HIV/AIDS had very high mortality rates. However, the introduction and diffusion of more effective drugs from 1995 to 1997 induced a substantial reduction in mortality rates such that mortality rates for DI recipients declined steeply during this period.

⁶⁵ The age-adjusted mortality rate for DI-recipient males fell from 51.45 to 29.47 per 1,000 during this 25-year period versus a decline from 40.99 to 21.98 per 1,000 for DI-recipient females during the same period.

Figure 42. Log (Age/Sex-adjusted Mortality Rate) for Male and Female DI Recipients, 1985–2085: Current Trustees Assumption versus Technical Panel Recommendation



Source: Office of the Chief Actuary, Social Security Administration, 2011; Panel calculations.

from 2010 to 2020 (2.35 percent for men and 2.44 percent for women) to the average annual decline assumed after 2030.⁶⁶ With this revision, projected mortality rates would be a constant 15.7 percent lower for men from 2030 through 2085 and a constant 14.3 percent lower for women during the same period. The corresponding reductions would be somewhat smaller in 2021 through 2029. For example, in 2025, the mortality rates would be lower for men by 9.7 percent and for women by 9.0 percent.

Recovery. The third channel through which DI recipients exit the program is recovery, which may occur if the DI recipient returns to the workforce and his or her earnings exceed the substantial gainful activity level set by SSA or if SSA conducts a Continuing Disability Review (CDR) and deter-

mines that the recipient's condition has improved to a level that he or she no longer meets the program's medical eligibility criteria.⁶⁷ Returns to the workforce are likely to increase in response to improving economic conditions while the number of CDRs conducted by SSA will largely determine involuntary medical recovery exits.⁶⁸

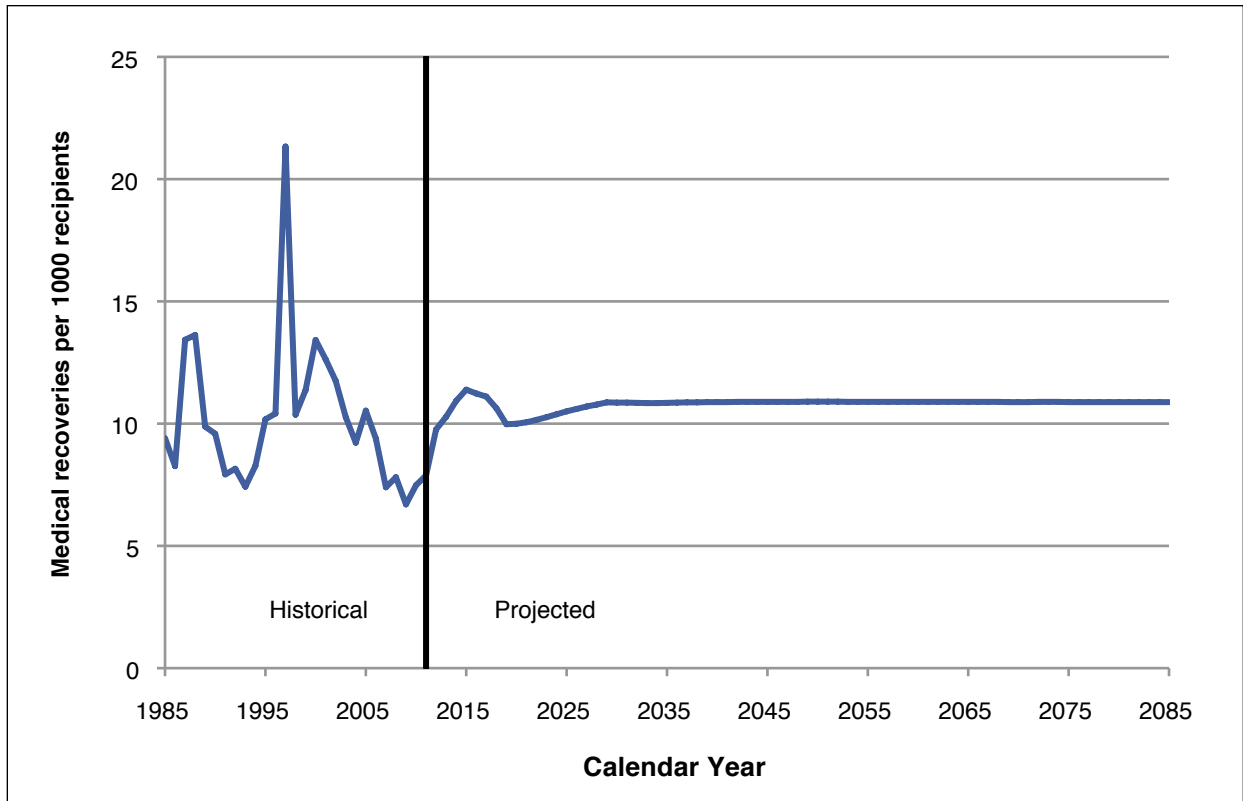
Figure 43 presents the age-sex-adjusted recovery rate for the DI program from 1985 through 2009 and the Trustees' projections of the rate from

⁶⁶ Thus, for example, the assumed male age-adjusted DI recipient mortality rate would fall by 2.35 percent in 2020 (from its 2019 value), 2.24 percent in 2021 (from its 2020 value), 2.14 percent in 2022 (from its 2021 value), and so forth, until falling by 1.27 percent in 2030 from its 2029 value. The assumed reduction in 2031 (of 1.17 percent from the 2030 value) and in all subsequent years would remain unchanged.

⁶⁷ In addition to liberalizing the medical eligibility criteria for the DI program, the 1984 changes described above made it substantially more difficult for SSA to use CDRs to terminate benefits for DI recipients. Before the changes, the person conducting the CDR asked, Does this recipient meet the program's medical eligibility criteria? After 1984, the person conducting the CDR also had to demonstrate that the condition that made the person eligible for DI had improved. If, for example, the initial decision was clearly incorrect such that the person could engage in substantial gainful activity, but the condition had not improved, then SSA could not use the CDR to terminate benefits.

⁶⁸ We focus on medical CDRs rather than on CDR mailings given that the former are much more likely to result in program exit. The mailings sent to DI recipients ask questions such as, Has your condition improved? Perhaps not surprisingly, a very small share leads to benefit termination.

Figure 43. DI Recovery Rate (per 1,000 DI recipients): 1985–2085



Source: Office of the Chief Actuary, Social Security Administration. Data presented to Technical Panel on January 28, 2011 and transmitted to the Technical Panel May 27, 2011.

2010 through 2085.⁶⁹ The recovery rate was particularly high in 1997, exceeding 2.1 percent, and resulted from a federal policy change (part of the 1996 welfare reform law) that terminated benefits for tens of thousands of DI recipients who previously qualified for the program because of drug or alcohol addiction. Excluding the 1997 data, the average recovery rate from 1985 through 2009 is 9.9 per 1,000 DI recipients. In a typical year, approximately 1 percent of DI recipients exit the program because they voluntarily return to the workforce or SSA determines that their condition has improved to a level that no longer meets DI’s medical eligibility criteria.

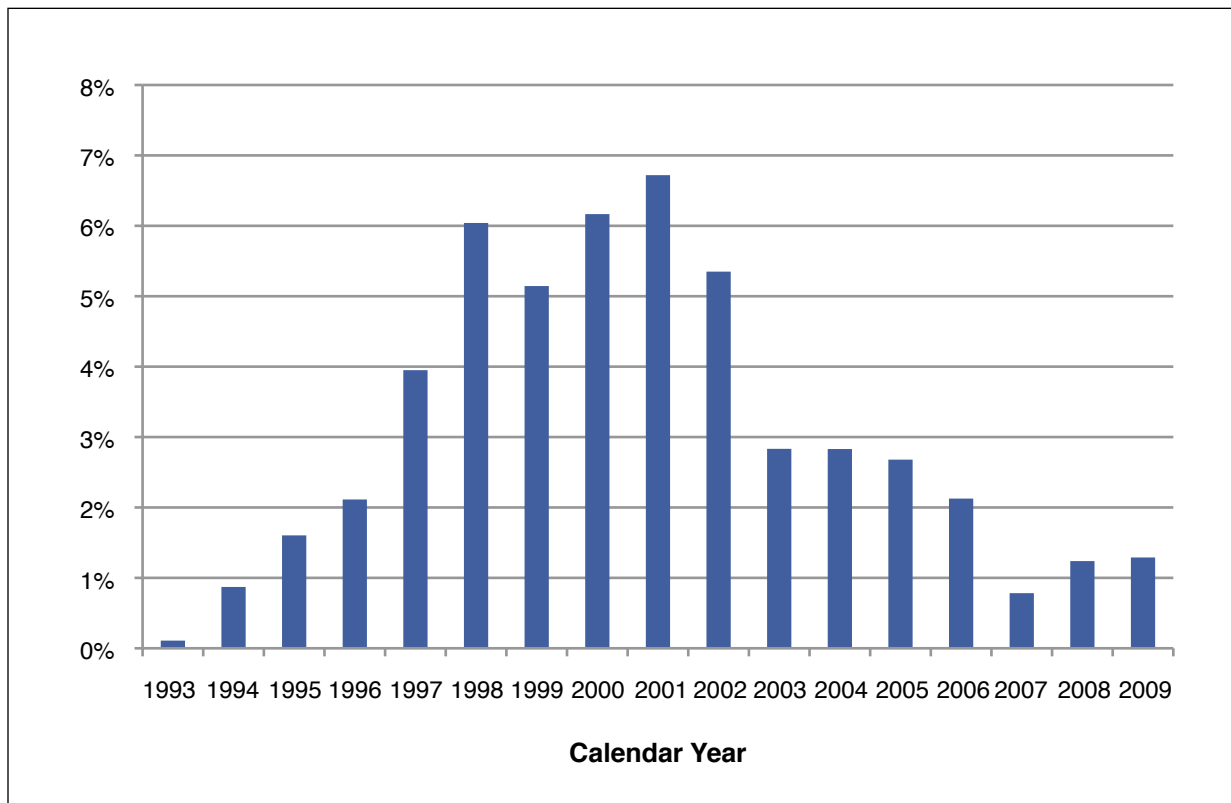
An examination of the data in **Figure 43** reveals some striking trends in the recovery rate. For example, from 1993 to 2000, the rate steadily increased from 7.4 to 13.4 per 1,000 DI recipients. Given the

discussion above, the increase was likely linked somewhat to improving economic conditions, as the unemployment rate fell throughout the period. However, the trends in **Figure 44** demonstrate that changes in the number of CDRs also played an important role. From 1993 to 2000, the share of DI recipients receiving a medical CDR increased from 0.1 to 6.2 percent. Interestingly, both trends reversed in the next several years, with the share receiving a medical CDR falling to just 1.3 percent in 2009 and the fraction exiting due to recovery falling by 50 percent during the same period, from 13.4 per 1,000 in 2000 to 6.7 per 1,000 in 2009. It therefore seems that the rate at which medical CDRs are performed is a significant determinant of the recovery rate.

The data in **Figure 43** reveal that the Trustees project a substantial increase in the recovery rate in the next several years. For example, from 2009 to 2015, the Trustees project an increase from 6.7 to 11.4 per 1,000 DI recipients. The figures then fluctuate somewhat during the next several years before settling into a long-run rate of 10.9 per 1,000

⁶⁹ The data for Figure 43 and the following section on recovery rates are based on the 2010 Trustees assumptions and were presented to the Panel on January 28, 2011, and transmitted to the Panel on May 27, 2011. Changes in the assumed recovery rate from 2010 to 2011 assumptions were very small.

Figure 44. Percentage of DI Recipients Receiving Medical Continuing Disability Review : 1993–2009



Source: Annual Report of Continuing Disability Reviews, Fiscal Year 2009, Social Security Administration, 2010.

DI recipients, with the long-run low- and high-cost values at 13.2 and 8.7 per 1,000, respectively (In 2011, the intermediate value is 10.7 with the low- and high-cost range at 12.9 and 8.5).

The intermediate-cost projection for the long-run recovery rate is substantially greater than the average recovery rate in recent years and represents a sharp departure from the trends in **Figure 43**. The explanation is that SSA’s CDRs are currently at temporarily low levels (page 128 of the 2010 Trustees Report) and will soon return to higher levels.

Given the recent trends in DI recipients’ recovery rates, the assumption of a sharp increase sustained over the long term seems highly optimistic and rests on a substantial increase in SSA’s ability to process more CDRs while garnering an increasing share of the federal government’s resources. But, given that unprecedented numbers of DI applications are straining SSA’s resources amid backlogged DI decisions and increasing Baby Boomer claims for retired worker benefits, the assumption may not come to pass. In addition, the likelihood of large spending

cuts throughout most of the federal government puts this assumption in further jeopardy.⁷⁰

Analysis of the data in **Figures 43** and **44** forms the basis for the Technical Panel’s recommendation A-8, which is a lower assumed recovery rate over the short, medium, and long terms. The recommendation is for an almost 20 percent reduction in the intermediate-case assumption from the 2011 assumption of 10.7 to 8.7 per 1,000. Somewhat lower than the average from 1985 to 2009, the recommendation reflects the trend’s steady decline during the past decade, yet the rate is substantially greater than its recent level. The Technical Panel also recommends a significantly larger gap between the intermediate-cost projection and both the high- and low-cost projections given the uncertainty surrounding the resources allocated for CDRs; the Technical Panel calls for high- and low-cost recovery rates of 6.0 and 11.4 (from 8.5 and 12.9 in the 2011 assumptions) per 1,000 DI recipients, respectively.

⁷⁰ It is worth noting that funds invested in CDRs yield a high “bang for the buck,” with estimates suggesting that \$1 spent on CDRs yields more than \$10 in reduced program outlays.

Conclusion

The Technical Panel's three assumption recommendations will increase the projected size of the DI program. Given the magnitude of the recommended changes, the cumulative effect on long-run DI enrollment is substantial. From 1989 to 2010, the fraction of adults age 25 to 64 years receiving DI benefits increased from 2.3 to 4.7 percent. The Trustees assume the share will increase to just 4.9 percent by 2032. Consistent with that projection, a slowdown is likely given that the aging of the Baby Boom generation has to some extent "run its course" with respect to its effect on DI enrollment rates, especially as the fraction of women insured for DI will not increase as rapidly in the years ahead.

However, recent research (Autor and Duggan 2006; Duggan and Imberman 2009; von Wachter et al. 2011; Autor and Duggan 2010) shows that many more forces have driven the rapid rise in DI enrollment during the past two decades and will likely affect it in the years ahead. For example, the rise in wage inequality along with the progressive benefit formula used by SSA to calculate monthly DI benefits has led to an increase in "replacement rates" (the ratio of potential benefits to potential earnings) for a large share of U.S. workers. Similarly, rising unemployment can induce large numbers of individuals, who would choose to work in better times, to withdraw from the labor force and apply for the DI program. Furthermore, the reduction in the generosity of retired worker benefits as a consequence of the 1983 Social Security Amendments has increased the relative attractiveness of applying for DI benefits.

The most important factor influencing growth of the DI program, however, is the change in its medical eligibility criteria. DI is now a realistic option for many individuals with subjective conditions such as mental disorders and back pain. Whether and to what extent the criteria (and those used for CDRs) will change in the years ahead represents the primary source of uncertainty about long-run program enrollment.

There are, however, many other important sources of uncertainty about the long-run size of the program. For example, whether and to what extent job opportunities will improve, especially for lower-skilled workers, will have a first-order impact on the number of individuals applying for DI. In addition, improvements in medical care will increase life expectancy for individuals with cancer, heart conditions, and other conditions common among DI recipients. While the health of non-elderly adults has

improved substantially according to virtually every measure, the recent rise in obesity (and any further increases in obesity) could increase the demand for DI benefits. The new health reform law may increase the number of individuals who "retire early," perhaps leading to growth in the number applying for DI benefits.

Finally, further reductions in the generosity of retired worker benefits resulting from the 1983 Social Security Amendments imply that, for anyone born in 1960 or later, DI benefits will be 43 percent more generous than retired worker benefits claimed at the early retirement age of 62 (the most common age for claiming retired worker benefits). It is reasonable to think that, with further increases in DI enrollment, the stigma of applying for the program will decline such that a much larger number of individuals will apply in the future.

Given all of these factors, the uncertainty about the long-run size of the DI program is substantial. In recommendation P-5, the Technical Panel suggests that OACT provide more discussion of the economic, programmatic, and demographic factors that influence DI enrollment. Trends in incidence rates, termination rates, and related variables strongly suggest the Trustees' long-run assumptions significantly understate the DI program's future size.

Chapter 3: Economic Assumptions and Methods

3.1 Labor Force Participation Rate

Method Recommendation M-11. Consistent with Recommendation P-1, the Technical Panel recommends characterizing labor force participation rates as a basic assumption with a meaningful range of uncertainty. Labor force participation rates should also be part of the formal sensitivity analyses currently presented in Appendix D.

Assumption Recommendation A-9. The Technical Panel recommends increasing the assumed labor force participation rates with intermediate values of 75.0 for men and 61.9 percent for women in 2085; these rates are higher than the currently assumed values of 72.9 percent for men and 60.8 percent for women. Together, the recommended values would raise the age-sex-adjusted labor force participation rate from 66.6 to 68.2 percent. The Technical Panel also recommends a substantial increase in the range of uncertainty about labor force participation, with low- and high-cost age-sex-adjusted participation rates of, respectively, 70.3 and 64.8 percent in 2085.

Method Recommendation M-12. The Technical Panel recommends moving toward a heuristic life-cycle approach for projecting labor force participation by age and sex. Ultimately, labor force participation should be driven by life-cycle-specific labor supply measures such as typical age of first entry, percentage of the working-age population in the labor force, age of primary job exit, and fraction of the retired population still working. The Technical Panel's recommended intermediate-, low-, and high-cost values above are based on consideration of labor force participation across eight age/sex groups and thus represent a move in the desired direction.

The Current Labor Force Participation Model

The 2003 and 2007 Technical Panels recommended a review and restructuring of the model used to project the labor force participation assumptions used in the Trustees Report. We reiterate the need for fundamental change. Our suggestions might be considered a refinement of our earlier recommendations. We acknowledge that the philosophy behind the current approach has some merit, but believe that the fundamentally time-series based modeling strategy fails to generate meaningful projections of either future labor force participation rates of the uncertainty about these projections.

In the ideal process of time-series model development, the process identifies all relevant causal (or independent) variables affecting the variable of interest (the dependent variable) and then uses historical data to estimate the relationship between them. The estimated model then generates forecasts for the dependent variable by substituting expected future values for the independent variables. The current labor force participation model begins with this ideal framework, but its failure to properly distinguish causation from correlation leads to an inappropriate level of confidence about how well the model explains historical experience.

Any discussion of the shortcomings of the current labor force participation model should be preceded by a description of the model's strong points. In its first phase, the "model" is a collection of 153 separate time-series equations, each for a particular demographic group characterized by some combination of age, sex, marital status, and pres-

ence/absence of children under age 6.⁷¹ This initial breakdown is important because the various demographic groups are the first-order determinants of labor force participation. Thus, disaggregation of the population into 153 groups introduces the most important independent variables and allows the key explanatory variables to have different effects on each of these different groups.

In its second phase, the labor force participation model subjects each of the 153 groups to the following questions: Is there a trend in the labor force participation rate of that group? If so, does some other set of independent variables explain the trend? If the answer is “no trend” or “explainable trend,” then the model is deemed appropriate for the given group. More often than not, the conclusion is simply “no trend” and that the result is flat labor force participation rates. Yet, the conclusion often depends on the exact time period chosen and therefore may miss emerging trends.

In addition, in the second phase of the modeling process, OACT introduces into the projections potentially serious errors and miscommunication. For example, the key explanatory variable in the equation for labor force participation of males age 62 is the labor force participation rate of females age 60. Why? Research has shown that couples tend to retire together. However, that does not mean that changes in female labor force participation *cause* changes in male labor force participation; it means that the changes are *correlated*. In the current framework, causality leads to seriously flawed conclusions. Since the mid-1990s, the (cohort-driven) increase in labor force participation of females age 60 has been used to “explain” the increase in labor force participation of males age 62 during the same period. Applying the “explained trend” criteria suggests that the problem has been solved, when it more accurately increases false confidence.

In this case, the current approach leads to predictions that are probably biased and, at the very least, highly susceptible to great uncertainty. The labor

force participation rate of 60-year-old females has been rising for the last two decades. The cohort-level shifts in life-time participation that began with younger and middle-age women in the 1970s are now working their way through the age distribution. As those cohort effects are fully realized over the next few years, the current model projects that 60-year-old female labor force participation rates will stabilize. When that occurs, the time-series equation for 62-year-old male labor force participation also predicts stabilized labor force participation rates (although, in this case, a few other effects continue the upward trend but at a greatly reduced pace; most important, the main driver has been neutralized in the projections).

What are the real drivers of labor force participation of 62-year-old males? Why not build those into the model? The vast literature on determinants of retirement from life-time jobs indicates that many factors, such as the nature and generosity of public and private pensions, household wealth holdings, health of the worker and/or spouse, and availability of health insurance, all affect the retirement decision. It is not feasible to introduce these factors into a time-series econometric model estimated on a handful of data points. However, the factors can and should be an important part of the conversation about labor force participation projections, suggesting that a heuristic life-cycle analysis is indeed preferable.

A Heuristic Life-Cycle Approach

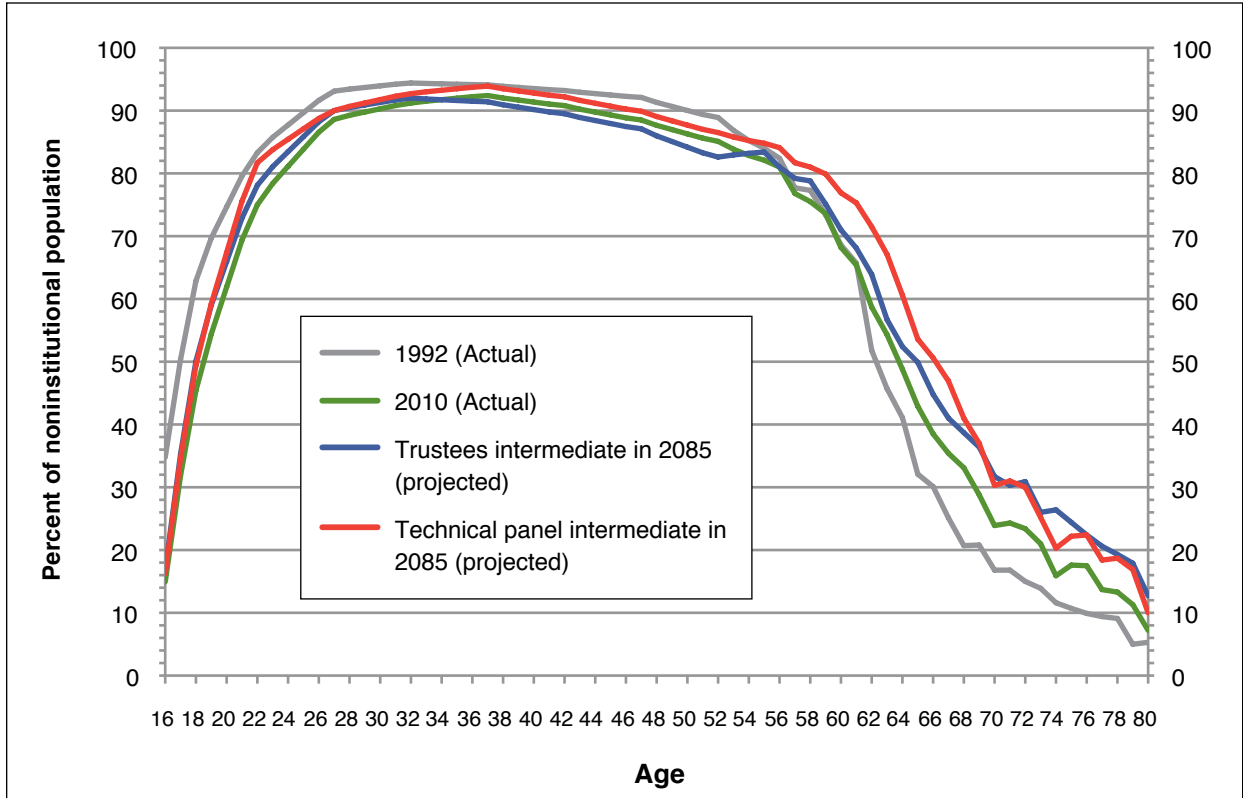
Labor force participation across age groups and over time may be portrayed visually by relying on at least two distinct approaches. The first approach looks at the life-cycle profile of labor force participation at various time points (**Figures 45** and **46**).⁷² The second approach looks at some measure of group-level participation rates over time (**Figures 47** and **48**).⁷³ The two approaches require the simplification of decisions in order to limit the amount of information the reader must process,

⁷¹ The 153 groups are constructed as follows: age groups include 16 to 17 years (i.e., 16–17), 18–19, 20–24, 25–29, 30–34, 35–39, 40–44, 45–49, 50–54, 55, 56, ... 99, 100, and over. For age groups between 20 and 54, male and female labor force participation rates (LFPR) are further disaggregated by marital status, categories of which include never married, married with spouse present, and married with spouse absent (which includes separated, widowed, and divorced). Female LFPRs disaggregated by age (between 20 and 44) and by marital status are further disaggregated by presence of own child. The groups for presence of own child are females with at least one child under age 6 and females without a child under age 6. Thus, there are 69 equations for males and 84 for females.

⁷² OACT provided the data used in this section, aggregated into 70 age-sex groups (16–17, 18–19, 20–24, 25–29, 30–34, 35–39, 40–44, 45–49, 50–54, and 55 to 80 and above by single years). **Figures 45** and **46** were generated by interpolating between midpoints of the groups under age 55.

⁷³ The measures in **Figures 47** and **48** are age-adjusted; that is, the weights within each age group are fixed at their base year (2009) value both forward and backward in time. Age-adjusting (or age-sex-adjusting when aggregating over sex as well) is important because changes in the population distribution affect the group average even in the absence of any meaningful behavior changes.

Figure 45. Male Labor Force Participation by Age: 1992, 2010, Trustees Projection and Technical Panel Recommendation for 2085



Source: Office of the Chief Actuary, Social Security Administration, 2011; Panel calculations.

but they also complement each other insofar as they suggest how best to simplify decisions.

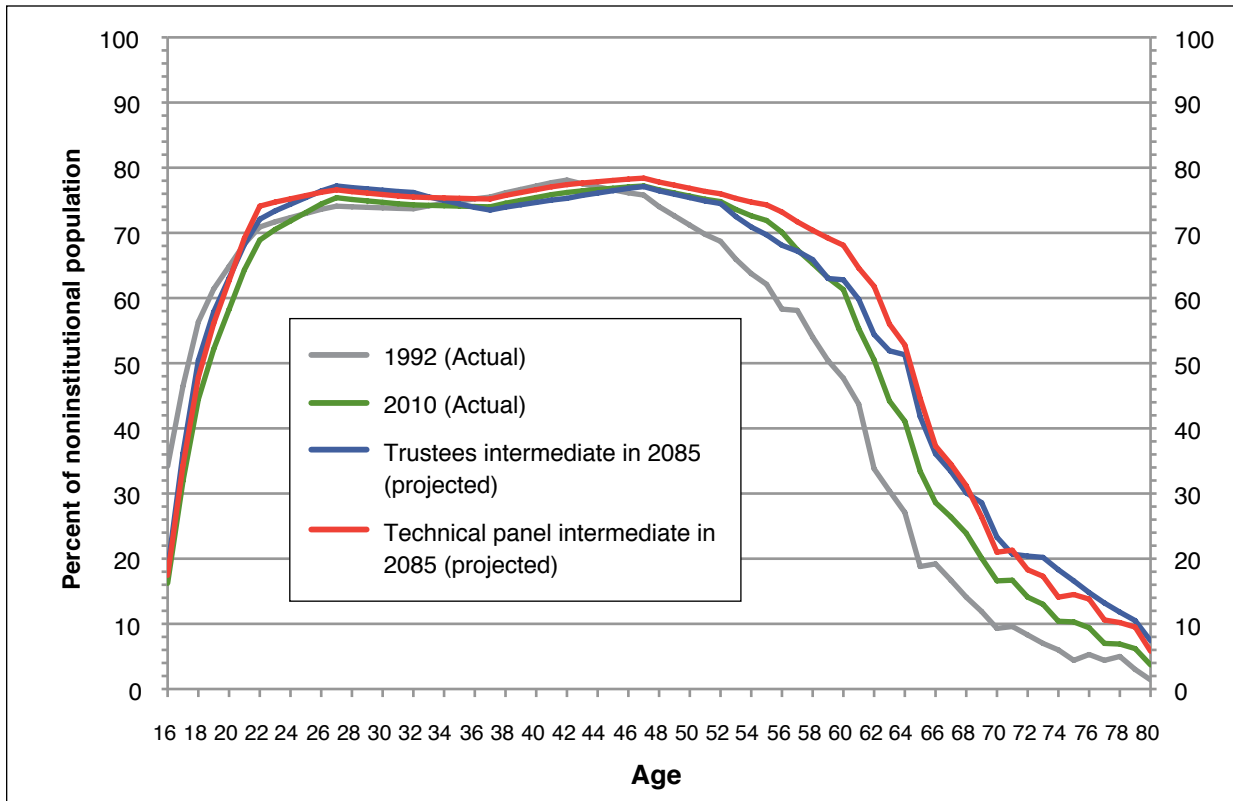
The life-cycle labor force participation profiles (**Figures 45** and **46**) clearly show the four phases of participation that are the focus of the heuristic analysis. The first phase encompasses schooling (age 16 to 24). The second phase covers prime working age (age 25 to 54). The third phase is early retirement (age 55 to 61), and the final phase is general retirement (age 62 and beyond). The two life-cycle profile figures show how participation differs dramatically across the four phases; the gaps between the two historical time points (1992 and 2010) demonstrate the changes across the four groups during the most recent two decades.

The age-adjusted labor force participation rates over time (**Figures 47** and **48**) provide significantly more information about trends, but at the cost of within-group detail. However, the complementarity between the two visual approaches is useful. The life-cycle profiles (**Figures 45** and **46**) indicate that any of the four age groups (schooling, prime-age, early and general retirement) experienced the

changes associated with each of the detailed groups (for example, participation rates fell for all ages in the schooling group and rose for all ages in the general retirement group). In addition, the trends in age-adjusted participation (**Figures 47** and **48**) show that the choice of 1992 as a base year for the heuristic analysis is appropriate because that is when significant changes in (especially) young and old participation rates began to emerge.

In an important connection between the heuristic approach suggested here and the current time-series econometric model, the latter tries to explain the changes in labor force participation at detailed ages and then use the explanations as the basis for its projections. From the perspective of the life-cycle profiles (**Figures 45** and **46**), the current model explains the vertical distances at any given age. Clearly, dramatically different forces act on different groups; moreover, there are several ways to rationalize what amounts to a handful of data points for each group. Worse yet, some groups (for example, early-retiree males) registered little change between 1992 and 2010, but such an outcome does

Figure 46. Female Labor Force Participation by Age: 1992, 2010, Trustees Projection and Technical Panel Recommendation for 2085



Source: Office of the Chief Actuary, Social Security Administration, 2011; Panel calculations.

not mean that important economic factors have not affected labor force participation behavior. It simply means that those forces have canceled out one another in the recent past and that the absence of recent trends is an unacceptable basis for predicting no change in the future. Current economic pressures and policy changes will likely produce significant impacts on the early retirement group in the coming years such that expected behavioral reactions must be built into the projections.

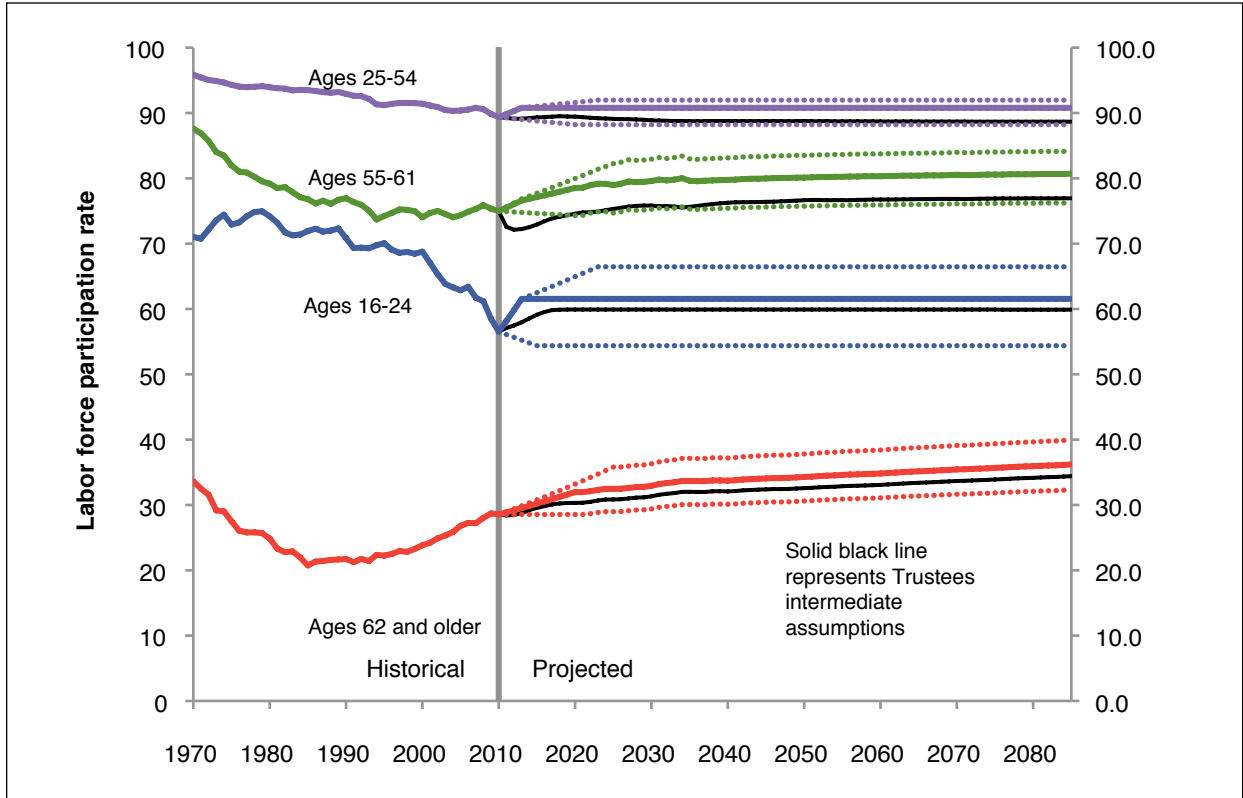
Alternative Scenarios

Based on the heuristic approach, the Technical Panel proposes labor force participation rates that are generally equal to or higher than those in the Trustees Report's intermediate projections. The proposed values are based on consideration of recent trends and incorporate expectations about the economic and policy factors known to affect the decision to work. Obviously, those trends and factors differ across the four age groups, and some of the expectations about influences and/or behavioral reactions are uncertain. The expectations and uncer-

tainty are quantified here in simple ways by extending/reversing trends and for various periods.

School-age males and females (age 24 and younger) have experienced dramatic reductions in labor force participation in the past two decades. Some of the decrease is attributable to higher rates of school attendance, but participation has also fallen for those not attending school. Another factor at work is a significant cyclical component as the steady erosion in labor force participation between the early 1990s and 2007 became a precipitous drop between 2007 and 2010. The Trustees Report's intermediate projection incorporates some recovery for young males and females (**Figures 47 and 48**), but not back to 2007 levels. The Technical Panel's intermediate projection assumes more recovery – back to about 2004 levels – based on the belief that significant economic pressures on young people and their parents will lead to increased work effort. The range of uncertainty extends from even more recovery (back to about 2001 levels, which is at the end of the second most recent recession) to absolutely no change from the new lows observed in 2010.

Figure 47. Age-Adjusted Male Labor Force Participation Rates: Historical (1970–2010) and Projected (2011–2085), Trustees versus Technical Panel



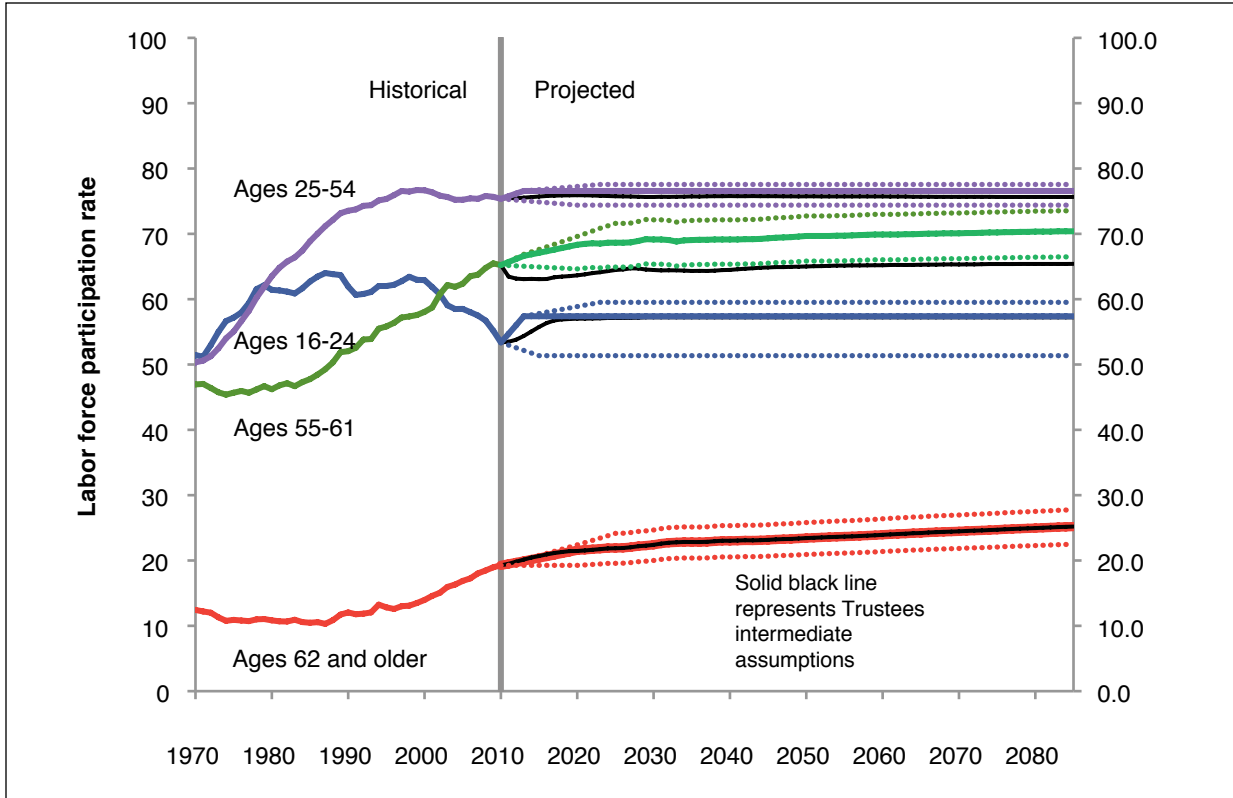
Source: Office of the Chief Actuary, Social Security Administration, 2011; Panel calculations.

Labor force participation rates among prime-age males and females (age 25 to 54) differ in recent years but are nevertheless related because females have substituted for males as primary breadwinners in some households. The Technical Panel’s proposed intermediate levels are noticeably higher for males and slightly higher for females. The levels reflect more recovery from the recent recession as participation rates for males age 25 to 54 plummeted between 2007 and 2010, whereas the current projections show only partial recovery. Although increased disability prevalence and health care reform may exert downward pressure on future participation, a return to and maintenance of the 2007 labor force participation rate is a reasonable intermediate trajectory given the effect of the business cycle, the economic pressures associated with lower income growth, and the collapse of housing prices. The range of uncertainty for prime-age workers is given by a plausible high cost (recent declines in participation continue for a few more years) and low cost (not only does participation return to 2007 levels, but some of the ground lost between 1992 and 2007 is regained) values.

Early retirees are a crucial group to consider when analyzing Social Security and other aging-related policy questions. Participation rates among 55- to 61-year-old males have remained stable for the past 20 years while participation rates among females in the same age group have increased dramatically. The Technical Panel believes that both trends will change. Economic forces and policy shifts are likely to cause more males and females to delay exit from the labor force at young ages, but the cohort effect that has raised female participation is likely to moderate.

Despite little in the way of discernible patterns in labor force participation among early-retiree males even as cohort effects continue to drive the upward trend for females, the Technical Panel believes that it is reasonable to raise the intermediate projections above current values. Not surprisingly, it is the intermediate projections for early retirees that spell the largest divergence between the Technical Panel’s and Trustees’ projections, which are based on how the current economic and policy environment has changed and the likely effects of those changes on future behavior. Factors such as the collapse of

Figure 48. Age-Adjusted Female Labor Force Participation Rates: Historical (1970–2010) and Projected (2011–2085), Trustees versus Technical Panel



Source: Office of the Chief Actuary, Social Security Administration, 2011; Panel calculations.

housing prices, changes in private sector pensions, cost pressures on state and local retirement plans, decreased generosity of Social Security because of the rising FRA, and increasing health care costs all point to longer work lives. It is also not surprising – for the same reasons – that the uncertainty ranges for early-retiree males are particularly wide.

The time-series approach to analyzing labor force participation obviously does not capture the effects on behavior that have not yet been realized. The ideal approach would be to look at retirement behavior in micro-level panel data and consider how the various factors above will likely affect future cohorts of retirees.⁷⁴ Discerning and quantifying the factors is difficult, suggesting the advisability of another approach to tracking changes in retirement expectations over time. For example, data from the Health and Retirement Study show that the period from 1992 to 2004 witnessed a roughly 10 percentage point increase in the fraction of

51- to 54-year-olds who expected to be working full-time at age 65 (National Institutes of Health 2010). In addition, a 2010 Pew Research Center study found that the recent economic recession has led many near-retirees to delay their expected retirement; 60 percent of working people age 51 to 60 said that they are likely to delay retirement in response to recent economic events (Pew Research Center 2010). The evidence points to the types of reductions in early retirement that underlie the Technical Panel’s alternative projections.

The Technical Panel generally agrees with the Trustees’ projections for the general retirement group (age 62 and older), but it expects slightly greater increases in labor force participation for younger members of the group. As with the early retirees, the chief factor is economic reality. People exit the labor force because they have to (for health reasons) or are able to do so. For two decades, economic reality has been affecting the participation of would-be retirees and is likely to continue to do so (or to intensify) in the coming years. Again, as with the early-retiree group, the Technical Panel acknowledges the tremendous uncertainty about

⁷⁴ One recent study finds, for example, that the recent increase in the Social Security full retirement age has had a significant effect on both labor force participation and benefit claiming. See Giovanni Mastrobuoni (2009).

post-retirement labor force participation, underscoring the importance of constantly monitoring, reviewing, and evaluating participation from a heuristic perspective. If the Technical Panel is correct and labor force participation is higher than specified in the Trustees Report, a higher level of labor force participation will improve the trajectory of Social Security finances and alleviate some of the need for painful benefit cuts or tax increases.

3.2 Real Wage Growth Rate

To project future income and cost rates, the Trustees must combine assumptions about the number of workers with assumptions about the wages those workers will earn and thus the benefits they will receive. The methodology used in the Trustees Report to project real wage growth begins with the productivity growth rate and sequentially considers steps that link productivity growth to real wage growth.

Productivity is defined as the ratio of real GDP to total hours worked in the economy as a whole. The growth rate of productivity is a major determinant of the economy’s ability to sustain a higher standard of living and, similarly, Social Security’s ability to generate revenue to support benefit payments. The rate of productivity growth is a chief determinant of the rate of growth of average real annual earnings per employed person. The relationship between productivity and the real wage is expressed as follows:

$$\frac{\text{Earnings/CPI}}{\text{Employment}} = \frac{\text{GDP/PGDP}}{\text{Hours}} * \frac{\text{Compensation}}{\text{GDP}} *$$

$$\frac{\text{Earnings}}{\text{Compensation}} * \frac{\text{Hours}}{\text{Employment}} * \frac{\text{PGDP}}{\text{CPI}}$$

where Earnings are the wage, salary, and proprietors’ income as reported in the National Income and Product Accounts (NIPA); CPI is the Consumer Price Index for Urban Wage Earners and Clerical Workers (CPI-W) as reported by the Bureau of Labor Statistics (BLS); Employment refers to total employment in all sectors of the economy; PGDP is the implicit price deflator for gross domestic product; Compensation is total labor compensation as reported in NIPA; and Hours are total hours worked in the economy as tracked by BLS.

The left-hand side of the equation is average real earnings per employed person, or the real wage. The first term on the right-hand side is productivity. The four terms that post-multiply productivity are referred to as the “linkages” between productivity and the real wage. They are, in order, the compensation share of GDP, the earnings ratio to compensation, average hours worked, and the ratio of the GDP price deflator to the CPI.

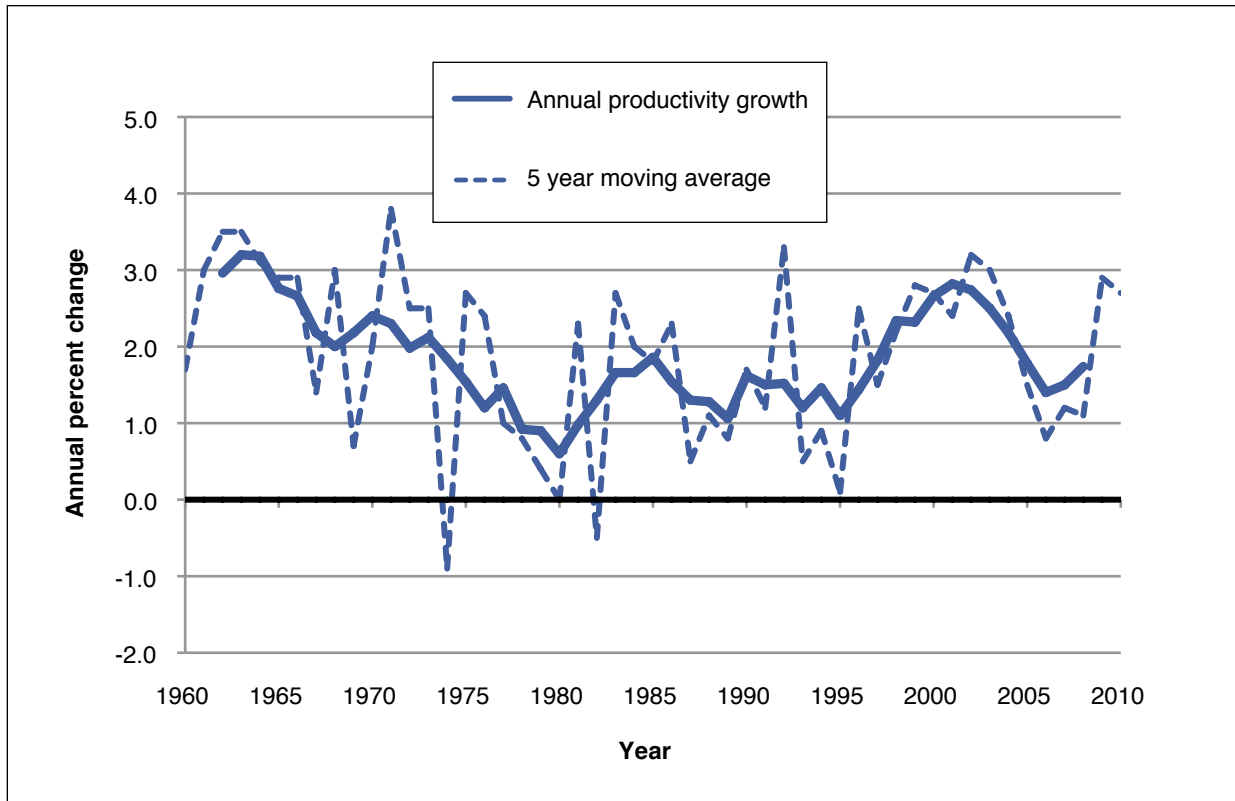
As the equation is multiplicative in levels, the growth rate of the real wage – the input to the OACT model – is equal to the sum of the growth rates of the five terms on the right-hand side of the equation. OACT’s methodology is to make assumptions about each growth rate separately in order to derive the assumed growth rate of real wages. For example, the 2011 Trustees Report (Table V.B1) arrived at the growth rates depicted in **Table 14**.

This section discusses each of the assumptions that links productivity and the real wage. The following sections discuss three other economic assumptions – the unemployment rate, the real interest rate, and the rate of inflation.

Table 14. Real Wage Assumptions in Trustees Report: 2011

| Scenario | Real Wage | Productivity Growth | Compensation Share | Earnings Ratio | Average Hours | Price Differential |
|-------------------|-----------|---------------------|--------------------|----------------|---------------|--------------------|
| Low-Cost | 1.8 | 2.0 | 0.0 | 0.0 | 0.1 | -0.3 |
| Intermediate-Cost | 1.2 | 1.7 | 0.0 | -0.1 | 0.0 | -0.4 |
| High-Cost | 0.6 | 1.4 | 0.0 | -0.2 | -0.1 | -0.5 |

Figure 49. Annual Productivity Growth and Five-Year Moving Average: 1960–2010



Source: Trustees Report, Table V.B1, 2011.

3.2.1 Productivity

Assumption Recommendation A-10. The Technical Panel recommends retaining the productivity growth rate of 1.7 percent per year assumed in the 2011 Trustees Report. The Technical Panel also recommends retaining the currently assumed low- and high-cost values of 2.0 and 1.4 percent, respectively.

This recommendation matches the recommendations of the past two Technical Panels (2003, 2007) and keeps the productivity growth rate assumptions at the same levels since the 2006 Trustees Report. The concept of productivity used by the Trustees pertains to the entire economy, whereas the measure of productivity most commonly discussed in the academic and business communities pertains only to the non-farm business sector. The latter excludes the agricultural sector, along with governments, households, and non-profits. The non-farm business sector is the largest sector of the economy, and its productivity growth is typically higher by a few tenths of a percentage point than

productivity growth in the economy as a whole. The documentation of the differences across sectors provided by OACT is sound and contains a detailed explanation of the assumptions for each component (OACT 2010).

Figure 49 presents the time-series of productivity growth rates since 1960, with the dashed line showing annual values and the solid line showing a five-year moving average of annual values. The intermediate assumption of 1.7 percent is close to the annual average productivity growth of the last 40 years as shown in the figure.

The five-year moving average reached its lowest point in 1980, during a period that extended from 1973 to 1995 and that economists regarded as a productivity slowdown. The slowdown is bracketed by the first oil shock of the 1970s and the emergence of the technology boom in the mid-1990s. During the slowdown, productivity growth averaged 1.3 percent per year. The high-cost scenario is analogous to assuming that, in the future, productivity growth will only slightly exceed that achieved between 1973 and 1995.

Table 15. Compensation Share of GDP, by Decade

| 1950–1959 | 1960–1969 | 1970–1979 | 1980–1989 | 1990–1999 | 2000–2010 |
|-----------|-----------|-----------|-----------|-----------|-----------|
| 54.9% | 56.5% | 58.5% | 57.8% | 56.8% | 56.4% |

Source: National Income and Product Accounts, Tables 1.1.5 and 2.1, June 24, 2011.

The five-year moving average later peaked between 2000 and 2002 as the technology boom drew to a close. Productivity growth averaged 2.5 percent from 1996 to 2004 and 2.2 percent from 1996 to 2010. The most important question facing productivity forecasters is whether the recent upturn in productivity will be sustained over the long term, boosting the rate assumed in long-range projections, such as those in the Trustees Report.

A standard explanation for the productivity slowdown between 1973 and 1995 is the employment shift from high-productivity manufacturing employment to lower-productivity service sector employment (Kozicki 1997). According to this explanation, the slowing of the employment shift has allowed the productivity growth rate to increase. Recent evidence on the links between demographics and productivity suggest that at least some of the time-series changes in productivity growth rates are attributable to the entry of the large cohort of young, unskilled Baby Boomers into the workforce during the 1970s and their subsequent evolution into a large, skilled cohort in the 1990s (Feyrer, 2007). It is likely that the secular increase in female labor force participation during the same period amplified these effects. Thus, productivity growth in the most recent period has been elevated temporarily by demographic factors and should not unduly influence the ultimate value assumed in the intermediate-cost projections.

3.2.2 Compensation Share of GDP

Assumption Recommendation A-11. The Technical Panel recommends retaining the intermediate assumption of a 0.0 percent annual growth rate for the compensation share of GDP. The Technical Panel further recommends introducing uncertainty about this parameter. Specifically, starting from a current value of 54.5 percent for the compensation ratio, the Technical Panel recommends low- and high-cost values of, respectively, 56 and 53 percent over the projection period. Growth rates of, respectively, 0.1

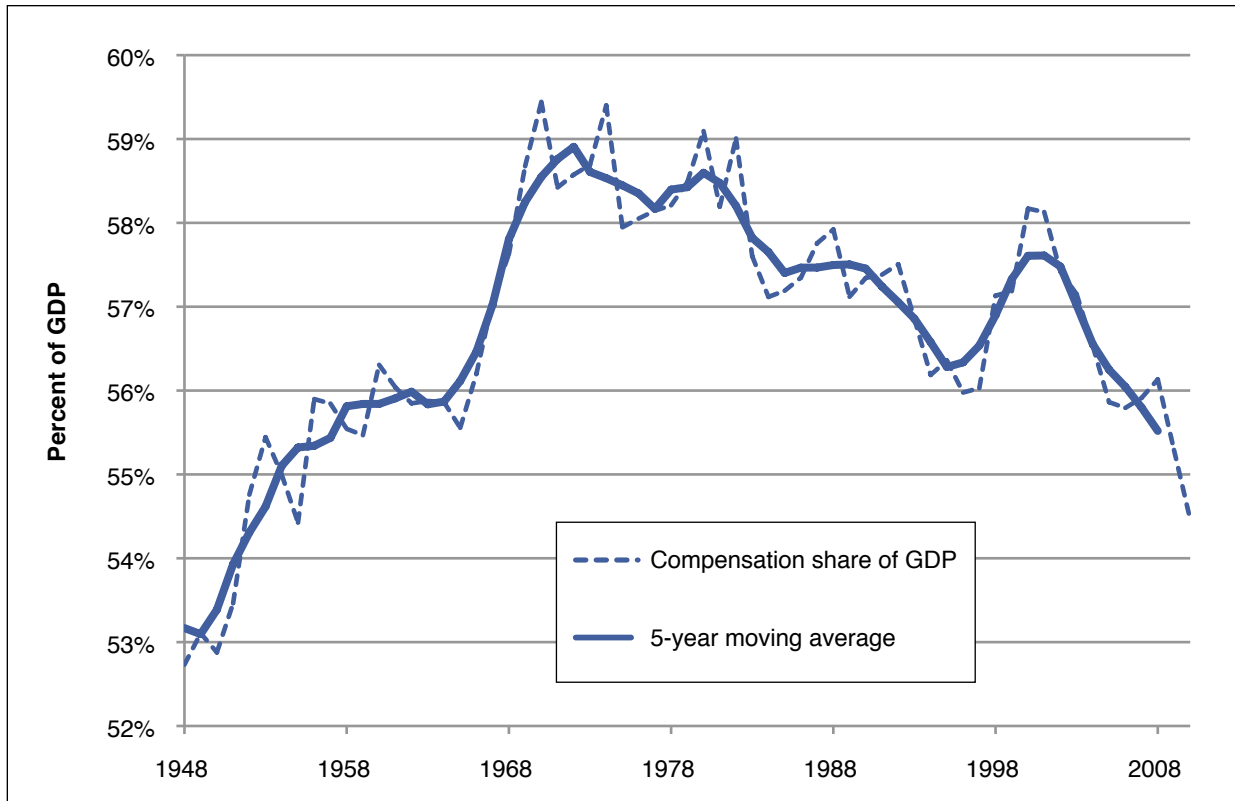
and -0.1 percent per year for 25 years in the low- and high-cost scenarios would generate the suggested range in the compensation ratio.

The compensation share of GDP is the ratio of employee compensation (wage and salary accruals plus supplements to wages) to GDP. **Table 15** shows the value of the ratio by decade since the 1950s.

The last four decades show a steady decline from the peak of 58.5 percent in the 1970s. **Figure 50** shows the decline clearly, with both the series and its five-year moving average. Whether starting from the 1970s or 1980s, the rate of decline per decade through the most recent decade has been approximately 0.7 percentage point. The most recent value in 2010 is 54.5 percent.

Given the declines in the series, the assumption of a zero percent projected growth rate should be justified not on the stability of the series historically, as in Trustees Reports and earlier Technical Panels, but rather on the basis of the presumption that the factors causing the decline will not continue. Compensation is just one component of personal income, which is itself a subset of gross domestic income (GDI). **Figure 51** shows the components of GDI as a share of GDP. After compensation, the next largest component is the net operating surplus of private enterprises, which includes net interest to domestic industries, net business transfer payments, proprietors' income, rental income, and corporate profits of domestic industries. The other three components are net taxes (defined here as taxes on production and imports plus the current surplus of government entities less subsidies), the consumption of fixed capital, and the statistical discrepancy between GDI and GDP. **Figure 51** shows that, over the last four decades, the increase in the net operating surplus of private enterprises has more than offset the decrease in compensation. The shifts largely negate the jump in compensation relative to private enterprises that occurred between the 1960s and 1970s.

Figure 50. Compensation Share of Gross Domestic Product: 1948–2010



Source: National Income and Product Accounts, Tables 1.1.5 and 2.1, June 24, 2011.

Table 16 shows the components of the net operating surplus of private enterprises by decade, presented as a percentage of GDP.

Every income component in the table was the same or higher in the most recent decade than in the 1970s, when the compensation share peaked. That every component increased as the compensation ratio fell suggests that the shift in income was permanent. Net interest and business transfers have been on average higher since the 1970s than before the 1970s while proprietors' income, rental income, and corporate profits are on average lower in the latest period versus the earlier period. It is conceivable that the overall downward trend will continue, with the compensation share continuing to fall toward its 1950s and 1960s values. It is also possible that the compensation share will stabilize at values seen in the more recent past.

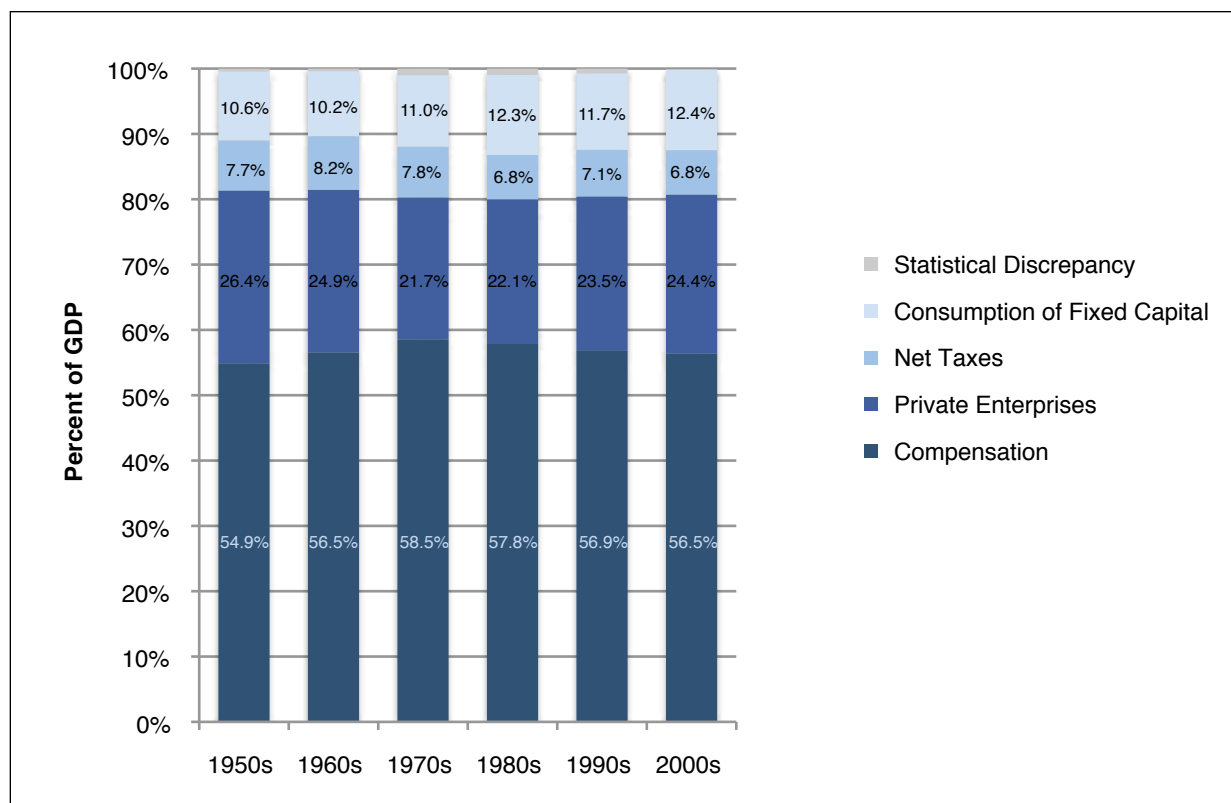
To reflect those possibilities, the Technical Panel considers a range of 53 to 56 percent after 25 years as a reasonable projection, starting from a current value in 2010 of 54.5 percent. The range assumes growth rates of 0.1, 0.0, and -0.1 percent per year

for 25 years in the low-, intermediate-, and high-cost scenarios, respectively.

3.2.3 Earnings to Compensation Ratio

Assumption Recommendation A-12. The Technical Panel recommends setting the annual growth rate for the earnings to compensation ratio at 0.0 percent in the intermediate-cost scenario, an increase from the current assumption of -0.1 percent. The Technical Panel also recommends low- and high-cost annual growth rates of, respectively, 0.1 and -0.1 percent per year, which yield an ultimate range for the earnings to compensation ratio of 77 to 89 percent relative to a starting value of 83 percent. The adjustment for the effects of health care reform made in the 2010 Trustees Report (+0.1 percent per year) is reasonable and should be maintained, pending direct observation of the law's impact in the coming years. The Technical Panel's recommendation of an intermediate-cost assumption of 0.0 percent incorporates such adjustment.

Figure 51. Components of Gross Domestic Income as a Share of GDP: 1950s–2000s



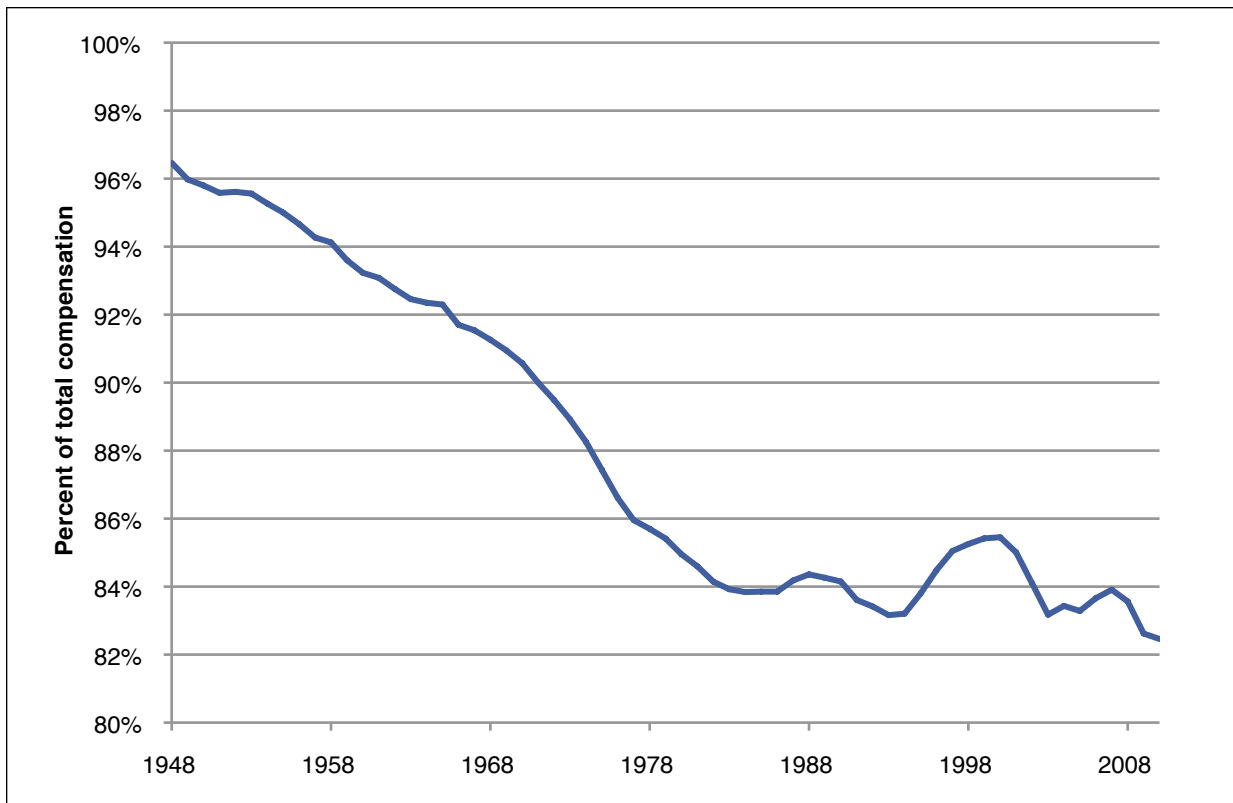
Source: National Income and Product Accounts, Table 1.10, June 24, 2011.

Table 16. Components of Net Operating Surplus of Private Enterprises, by Decade

| Decade | Net Interest | Business Transfers | Proprietors' Income | Rental Income | Corporate Profits |
|-----------|--------------|--------------------|---------------------|---------------|-------------------|
| 2000–2010 | 6.1% | 0.8% | 8.1% | 1.7% | 7.7% |
| 1990–1999 | 6.4% | 0.7% | 7.0% | 1.8% | 7.7% |
| 1980–1989 | 8.1% | 0.7% | 6.0% | 0.9% | 6.5% |
| 1970–1979 | 4.6% | 0.5% | 7.5% | 1.5% | 7.7% |
| 1960–1969 | 2.6% | 0.4% | 8.9% | 2.8% | 10.2% |
| 1950–1959 | 1.4% | 0.3% | 11.2% | 3.2% | 10.3% |

Source: National Income and Product Accounts, Tables 1.10 and 1.1.5, June 24, 2011.

Figure 52. Earnings to Compensation Ratio: 1948–2010



Source: National Income and Product Accounts, Table 2.1, June 24, 2011.

The earnings to compensation ratio is the ratio of total labor earnings, including wages and self-employed income, to total labor compensation. **Figure 52** shows the decline in the ratio over the last six decades.⁷⁵ The decline was rapid in the three decades leading up to 1980, as employer contributions for pensions, government social insurance, and group health insurance increased. **Figure 53** shows these components, as a share of total compensation, individually. Much of the initial growth and its subsequent persistence have been attributed to the tax advantages of fringe benefits relative to wages and salaries. Indeed, the sharp trend came to an end in the early 1980s, just as tax reform lowered marginal tax rates and reduced the incentive for firms and workers to shift compensation out of earnings.

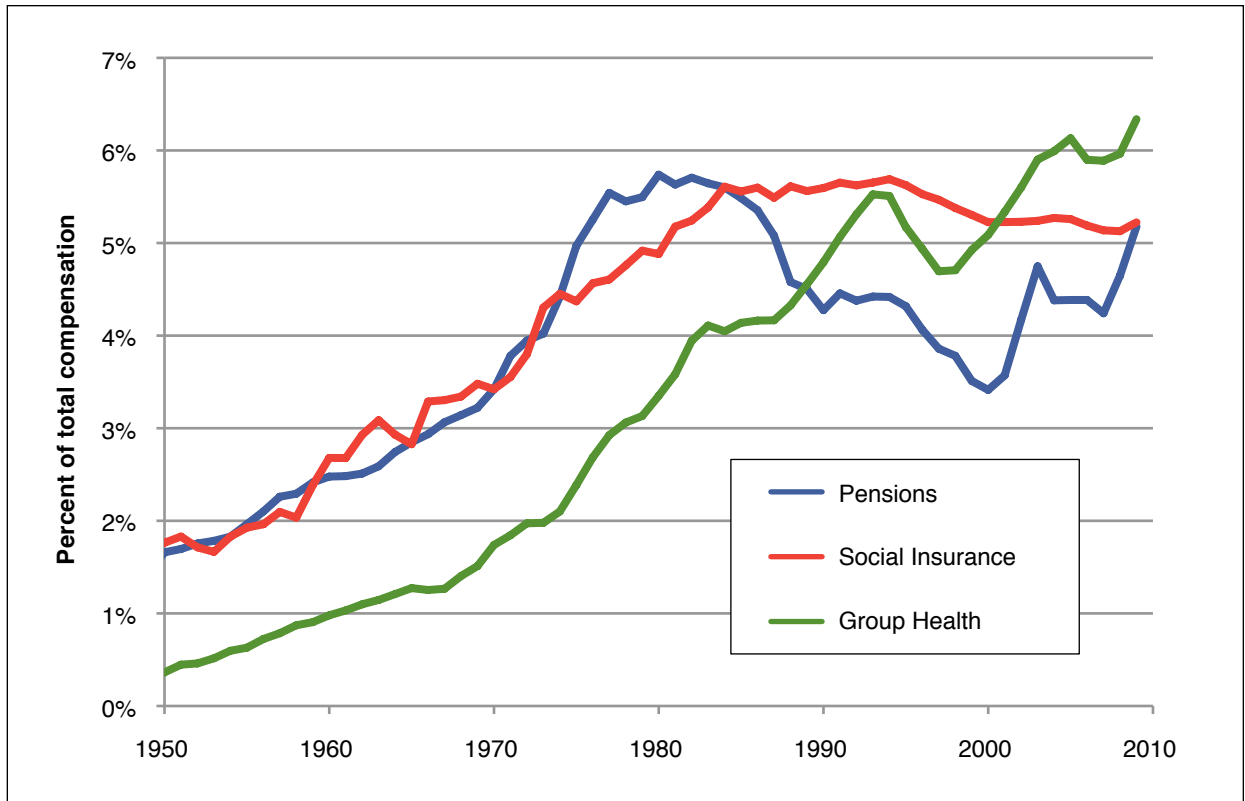
As **Figure 53** shows, employer contributions to pension plans stopped increasing in the early 1980s, as many employers switched to defined contribution plans that may have required lower

contributions. The generally positive growth of the stock market in the 1980s and 1990s, particularly as evidenced by the stock market bubble that emerged during the mid- to late 1990s, improved funding ratios in defined benefit pension plans, making it possible for employers sponsoring such plans to reduce their required contributions. In the wake of the bubble's bursting and with stepped-up funding requirements under the *Pension Protection Act of 2006*, larger pension contributions will likely exert moderately downward pressure on the earnings ratio in the next few decades.

Employer contributions to government social insurance stabilized as a share of total compensation in the early 1980s as ad hoc increases in the Social Security maximum taxable earnings and the payroll tax rate gave way to the present configuration of tax rates and wage indexing under the 1983 Social Security Amendments. In addition, much of the growth in total earnings over this period occurred above the Social Security maximum taxable earnings level, which tends to reduce the ratio of

⁷⁵ The earnings ratio as presented here includes proprietors' income in both the numerator and denominator.

Figure 53: Employer Contributions for Earnings Supplements: 1950–2009



Source: National Income and Product Accounts, Tables 2.1 and 7.8, June 24, 2011.

government contributions for social insurance as a share of total compensation.

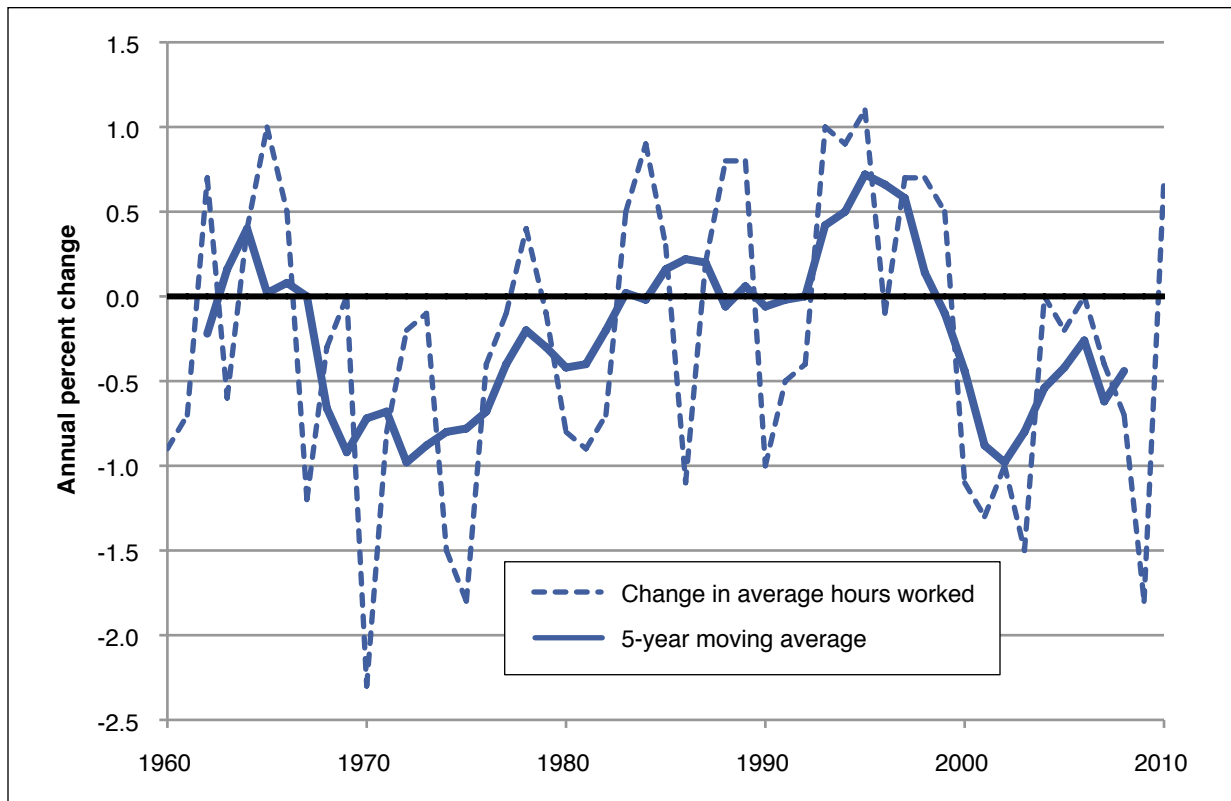
With termination of the strongest tax incentives for shifting compensation out of earnings, the secular increase in health care costs relative to GDP has mechanically caused the tax-advantaged part of compensation to grow rapidly. At the same time, wage and salary growth has been tempered by the funding of health care through the employment contract. The only period that did not experience a decline in the earnings ratio was the boom years of the mid- to late 1990s. This temporary decline in the share of compensation contributed by employers to group health insurance is clear in **Figure 53** as well. In addition to the weaker pension funding needs noted above, that period saw the initial diffusion of Health Maintenance Organizations (HMO), which succeeded briefly in arresting health care cost inflation. The sharp return to the upward trend in employer costs for group health insurance after the end of the technology boom indicates the temporary nature of the HMO as an innovation to control health care costs. However, as health expenditures

continue to increase relative to GDP, there will be greater financial incentives to develop market innovations that reduce health care costs and thus the share of compensation paid as fringe benefits rather than as earnings.

Trustees Reports issued before 2010 set the decline in the earnings ratio to a value of -0.2 percent per year, corresponding roughly to its average over the entire period in **Figure 52**. Combining the assumption that higher health care costs will lead to a greater focus on cost containment with the observation that the annual rate of decline slowed markedly after 1980, both the 2003 and 2007 Technical Panels recommended that the Trustees modify the assumption to a rate of decline of 0.1 percent per year or less. Earlier Technical Panels were particularly concerned about assumptions that would push the earnings ratio below 75 percent of compensation relative to its recent values, which are now about 83 percent.

The 2010 Trustees Report lowered the rate of decline in the earnings ratio to 0.1 percent per year, justifying the decision on the passage of the *Patient*

Figure 54. Average Hours Worked: Annual Percent Change, 1960–2010



Source: Social Security Trustees Report, Table V.B1, 2011.

Protection and Affordable Care Act of 2010 (ACA). The law’s major provision regarding the earnings ratio is an excise tax on employer-sponsored group health insurance, which is to be phased in later in the current decade. With the excise tax initially designed to apply only to extremely generous health plans, the threshold for premiums subject to the tax grows with the overall rate of inflation, which is expected to lag behind the growth per capita in health care costs. Over time, the excise tax will affect more health plans and pressure firms and workers to shift compensation out of health insurance and into earnings. As a specific change to account for the ACA, the Technical Panel finds this adjustment for the ACA to be reasonable, at least as an initial step until evidence on the law’s impacts can be examined.

However, the above adjustment does not address the underlying change in the earnings ratio evident in **Figure 52** based on factors unrelated to the ACA. The Technical Panel recommends a reduction in the rate of decline in the earnings ratio. In the intermediate-cost scenario, the rate of decline should

be zero. For the low-cost scenario, the Technical Panel recommends that the earnings ratio should increase by 0.1 percent per year. For the high-cost scenario, the Technical Panel recommends that the earnings ratio should decrease by 0.1 percent per year. These assumptions generate a range of 77 to 89 percent at the end of 75 years.

3.2.4 Hours Worked

Assumption Recommendation A-13. The Technical Panel recommends retaining the intermediate-cost assumption of 0.0 percent for the annual change in hours worked. For the low-cost scenario, the Technical Panel recommends a slight increase of 0.05 percent per year in hours worked over the 75-year period. Recognizing a greater risk of a decline in hours worked, the Technical Panel recommends a reduction in annual hours of -0.15 percent per year for the 75-year period in the high-cost scenario.

Figure 54 shows the time-series of annual percentage changes in average hours worked per week

by using a series from BLS corresponding to the entire economy. While the annual changes fluctuate considerably, the five-year moving average shows only one period in the 1990s with sustained positive values. The trend in the last five decades has been negative at an average annual rate of -0.25 percent. Over the past two decades, the average decline has been somewhat smaller.

As with other labor market outcomes, OACT has considered how changes in the composition of the labor force might affect both historical trends and future projections of hours worked. For example, “Workers with higher education tend to work more hours than their less-educated counterparts, and males and prime-age workers tend to work more hours than females, the very young, and the very old” (OACT 2010). The Technical Panel agrees with the above observation but draws conclusions that differ from those of the Office of the Chief Actuary, which notes:

For the future, the OACT [Office of the Chief Actuary] still believes that there are factors that, by themselves, suggest that the annual rate of change in average hours worked will be negative. As in the past, the assumed steady increases in productivity will allow workers to gradually increase leisure time while still maintaining increases in weekly and annual earnings. Furthermore, the average projected changes in the education and age-sex distributions of the workforce are not expected to significantly affect the average annual growth rate in the AHW [Average Hours Worked] in the future. However, the OACT also believes that the assumed future increases in life expectancy will raise labor force participation rates for older workers and may also raise AHW, holding other factors constant (OACT 2010).

The Technical Panel agrees with the first statement and with the assertion that continued productivity growth will have a weak, negative impact on hours worked. The Technical Panel also agrees with the claim that possible changes in the labor force’s educational and sex composition may have no further impact on hours worked. These factors justify an assumption of 0.0 percent change in hours worked in the intermediate-cost scenario.

The Technical Panel does not agree with the claims about the impact of either the changing age

composition or changes by age in labor force participation. The main impact of older workers as an increasing percentage of the labor force is that average hours worked will decrease, as older workers will be more likely to work part-time during a given week or fewer weeks per year. Consistent with the Technical Panel’s recommendations regarding the labor supply of older workers, the Technical Panel recommends a slight increase in the magnitude of decline in average hours worked in the high-cost scenario to an annual rate of -0.15 percent. Further, the Technical Panel recommends a reduction in the increase in average hours worked in the low-cost scenario to a rate of 0.05 percent per year.

3.2.5 Price Differential

Assumption Recommendation A-14. The Technical Panel recommends reducing the magnitude of the intermediate-cost assumed GDP-CPI price differential to -0.2 percent per year, relative to the currently assumed -0.4 percent price differential. The Technical Panel also recommends low- and high-cost price differentials of -0.1 and -0.3 percent, respectively.

The final link between the productivity growth rate and real wage growth is the differential in growth rates between the GDP price deflator (PGDP) and the CPI-W. In the formula above, PGDP scales productivity, and CPI-W scales the real wage. If CPI-W increases more rapidly than PGDP, real wages grow less rapidly than productivity. The differences between the price indexes come from two sources. First, PGDP covers the entire economy, whereas CPI-W pertains only to the bundle of goods and services consumed by urban wage earners and clerical workers. Second, construction of the two indexes rests on different methodological approaches.

The consequences of differences in coverage between the entire economy and consumption may be measured by comparing the GDP price deflator to the price deflator for the Personal Consumption Expenditures (PCE) component of GDP. Both use the same methodology as part of the National Income and Product Accounts collected by the Bureau of Economic Analysis. The second and third columns of **Table 17** show the geometric average inflation rates by decade for the two indexes.

Table 17 shows that, in the 1950s and 1960s, the GDP deflator grew faster than the PCE deflator

Table 17. Comparison of Inflation for Different Price Indexes, by Decade

| Decade | GDP Deflator | PCE Deflator | CPI-W | CPI-W-RS | PGDP Minus CPI-W-RS |
|-----------|--------------|--------------|-------|----------|------------------------|
| 2000–2010 | 2.24 | 2.16 | 2.40 | 2.39 | -0.15 |
| 1990–2000 | 2.07 | 2.21 | 2.73 | 2.41 | -0.34 |
| 1980–1990 | 4.22 | 4.46 | 4.53 | 4.34 | -0.12 |
| 1970–1980 | 6.98 | 7.02 | 7.82 | 7.12 | -0.13 |
| 1960–1970 | 2.72 | 2.44 | 2.75 | 2.56 | 0.16 |
| 1950–1960 | 2.44 | 2.19 | 2.09 | 2.08 | 0.36 |

by 0.25 to 0.28 percentage points per year. In the 1970s, 1980s, and 1990s, the pattern was reversed, with the PCE deflator growing faster than the GDP deflator by 0.04, 0.24, and 0.14 percentage points per year, respectively. Since 2000, the comparison flipped again, with growth in the GDP deflator exceeding growth in the PCE deflator by 0.08 percentage points per year. The comparisons show that, by itself, the difference in inflation between consumption and the rest of the economy is not systematically positive or negative.

The Bureau of Labor Statistics publishes the Consumer Price Index series monthly. The most comprehensive measure is CPI-U, which is representative of all urban consumers. Social Security indexes benefits to CPI-W, which covers a subset of urban wage earners and clerical workers. The differences between the two indexes are reflected in the weights applied to each consumption category, consistent with their importance to the respective populations of consumers. CPI-W places relatively more weight on energy and commodities and less on services. Over the past six decades, CPI-W has averaged 0.04 percentage points less growth per year than CPI-U.

The fourth column of **Table 17** shows the average annual percentage changes in CPI-W in each decade. With the exception of the 1950s, CPI-W inflation exceeded the inflation rate of the PCE deflator by an average 0.24 percentage points since 2000 and by as much as 0.80 percentage points in the 1970s. A long line of studies has documented the reasons for the differences between the CPI and PCE deflator. The principal reasons are differences in formulas, weights, and scope (Bosworth 2010).

Periodically, the methods used to estimate each price index undergo revision. For the PCE deflator,

the revisions are incorporated into the published index as the National Income and Product Accounts are systematically revised. The published CPI indexes are never revised because they are frequently the basis for contracts. Any improvements made to the series occur only prospectively. Instead, BLS formulated a research series for CPI-U beginning in 1999 and has provided updates since then (Stewart and Reed 1999). The series, CPI-U-RS, shows what the CPI-U would have been since 1977 if the current methodology had been in place over the entire period. To obtain values for CPI-U-RS before 1977, a reasonable approach takes the ratio of CPI-U-RS to CPI-U in 1977 and multiplies earlier values of CPI-U by that ratio. Given the similarity of CPI-U and CPI-W, a hypothetical CPI-W-RS series, whose annual changes are summarized in the fifth column of **Table 17**, is generated by multiplying CPI-W by the ratio of CPI-U-RS to CPI-U in each year.

For the last decade, the published series CPI-W and the hypothetical research series CPI-W-RS have been identical (the 0.01 disparity in **Table 17** reflects a rounding error). In the 1990s, however, annual inflation in the research series averaged 0.32 percentage points lower than that in the published series. In earlier decades, the annual inflation in the research series averaged between 0.01 and 0.70 percentage points below that in the published series. The final column of **Table 17** shows the differences by decade in the GDP deflator and the CPI-W-RS series. The differences in the most recent four decades were -0.15, -0.34, -0.12, and -0.13 percentage points. The differences in earlier decades were positive. Based on these differences, the Technical Panel recommends incorporating a price differential of -0.2 percentage points into the intermediate-cost scenario and retaining the 0.1 percentage point dif-

Table 18. Technical Panel Recommendations for Real Wage Assumptions

| Scenario | Real Wage | Productivity Growth | Compensation Share | Earnings Ratio | Average Hours | Price Differential |
|--------------------|-----------|---------------------|--------------------|----------------|---------------|--------------------|
| Years 1–25 | | | | | | |
| Low-Cost | 2.15 | 2.0 | 0.1 | 0.1 | 0.05 | -0.1 |
| Intermediate | 1.50 | 1.7 | 0.0 | 0.0 | 0.0 | -0.2 |
| High-Cost | 0.75 | 1.4 | -0.1 | -0.1 | -0.15 | -0.3 |
| Years 25–75 | | | | | | |
| Low-Cost | 2.05 | 2.0 | 0.0 | 0.1 | 0.05 | -0.1 |
| Intermediate | 1.50 | 1.7 | 0.0 | 0.0 | 0.0 | -0.2 |
| High-Cost | 0.85 | 1.4 | 0.0 | -0.1 | -0.15 | -0.3 |

ferentials in the low- and high-cost scenarios relative to the intermediate scenario.

3.2.6 Real Wage Differential

Assumption Recommendation A-15. Taken together, the Technical Panel’s recommendations A-10 through A-14 for productivity growth and the four linkages generate an intermediate real wage growth rate of 1.5 percent per year in years 25 through 75, with low- and high-cost values of, respectively, 2.05 and 0.85 percent. Over the first 25 years, our recommendations also generate an intermediate real wage growth rate of 1.5 percent, but with low- and high-cost values of, respectively, 2.15 and 0.75 percent per year.

The recommendations for the real wage and its various components are summarized in **Table 18**.

3.3 Unemployment Rate

Assumption Recommendation A-16. The Technical Panel recommends retaining the assumed ultimate long-run unemployment rate of 5.5 percent from the 2011 Trustees Report. The Technical Panel also recommends retaining the low- and high-cost assumed unemployment rates of, respectively, 4.5 and 6.5 percent.

Figure 55 shows the civilian unemployment rate over the last five decades, when it averaged 5.9 percent. Before the sharp rise in the unemployment

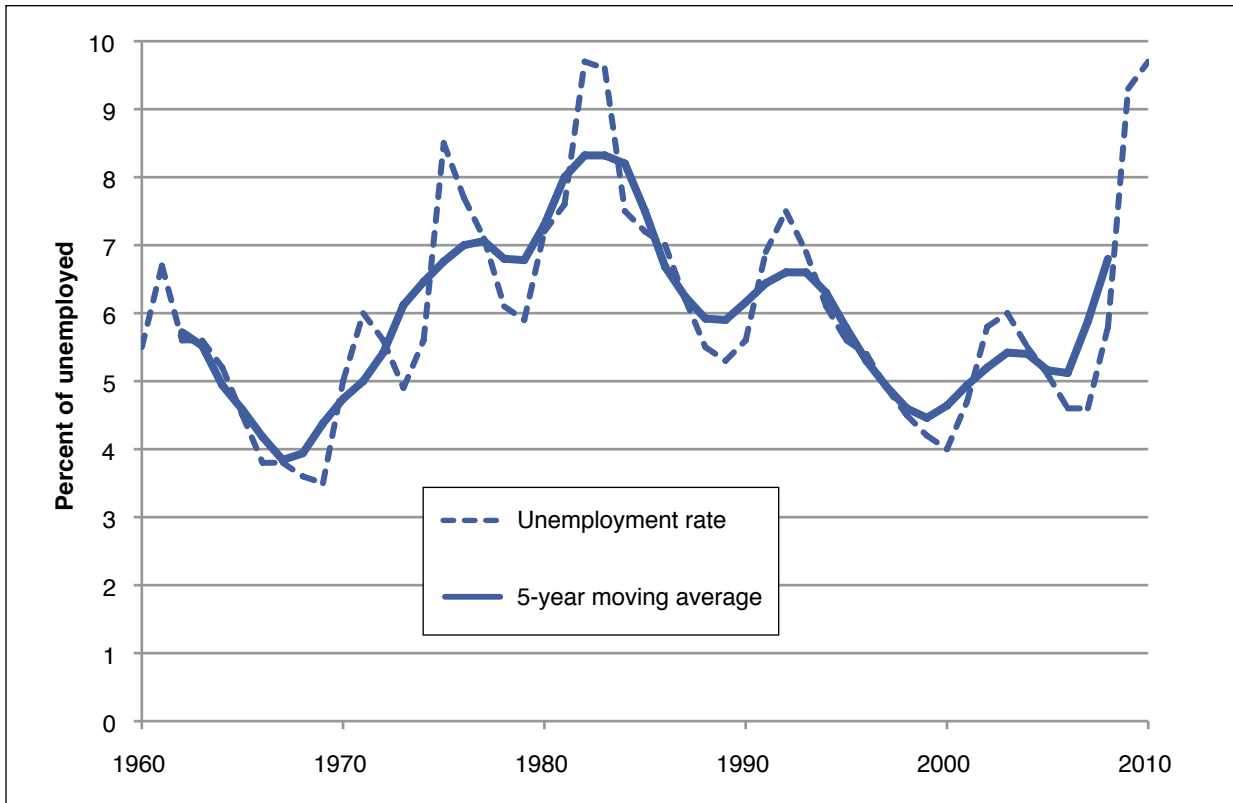
rate during the recent recession, unemployment had been trending down from its peak in the early 1980s, which was the last time the Federal Reserve intervened with sharply higher interest rates to curb inflation and inflationary expectations. Such interventions come at the cost of a dramatic increase in unemployment.

As with other labor market outcomes, it is sensible to filter out predictable co-movements of the unemployment rate with demographic factors such as the age-sex composition of the potential labor force. OACT’s documentation of its economic assumptions discusses the filtering procedure and notes that “[t]he aggregate civilian unemployment rate, adjusted for changes in the age-sex distribution of the labor force, averaged about 5.6 percent over the last four complete economic cycles from 1973 to 2007” (OACT 2010). OACT’s adjustment strengthens the case for an intermediate assumption of 5.5 percent, assuming that the age-sex adjustments are carried forward into the projections.

3.4 Interest Rates

Assumption Recommendation A-17. The Technical Panel recommends reducing the assumed long-run real interest rate to 2.7 percent. The rate is lower than the 2.9 percent long-run real interest rate assumed in the 2011 Trustees Report and more in line with market-based forecasts derived from current yields on inflation-protected Treasury securities. The Technical Panel recommends retaining the

Figure 55. Civilian Unemployment Rate: 1960-2010



Source: Social Security Trustees Report, Table V.B2, 2011.

low- and high-cost values of, respectively, 3.6 and 2.1 percent for the real interest rate.

The interest rate credited to the special public debt obligations is equal to the average market yield on all marketable fixed-rate Treasury securities that are not callable and that do not mature within the next four years. **Figure 56** shows the historical interest rates, net of inflation, since 1960. The peak in **Figure 56** for the 1980s reflects a period of extremely tight monetary policy, when the Federal Reserve intervened in money markets to reduce inflation and inflationary expectations. Since that episode, inflation expectations have fallen and, with them, real interest rates have continued to decline. All three subsequent recessions have been induced by asset price deflations rather than by the Federal Reserve’s implementation of contractionary monetary policy. Over the past two decades, the real interest rate has averaged 3.2 percent and declined fairly steadily until the price deflation associated with the 2008–2009 financial crisis caused real interest rates to jump.

An examination of current rates indicates that the rise in real interest rates was temporary; market expectations for future rates continue to remain below the historical average. **Figure 57** shows the eight-year history of weekly yields on portfolios of Treasury Inflation-Protected Securities that are adjusted to preserve a constant maturity of 5, 7, 10, 20, or 30 years. The yields are consistently below 2.5 percent, except for the very short period of extreme deflationary concerns during the 2008–2009 financial crisis.⁷⁶

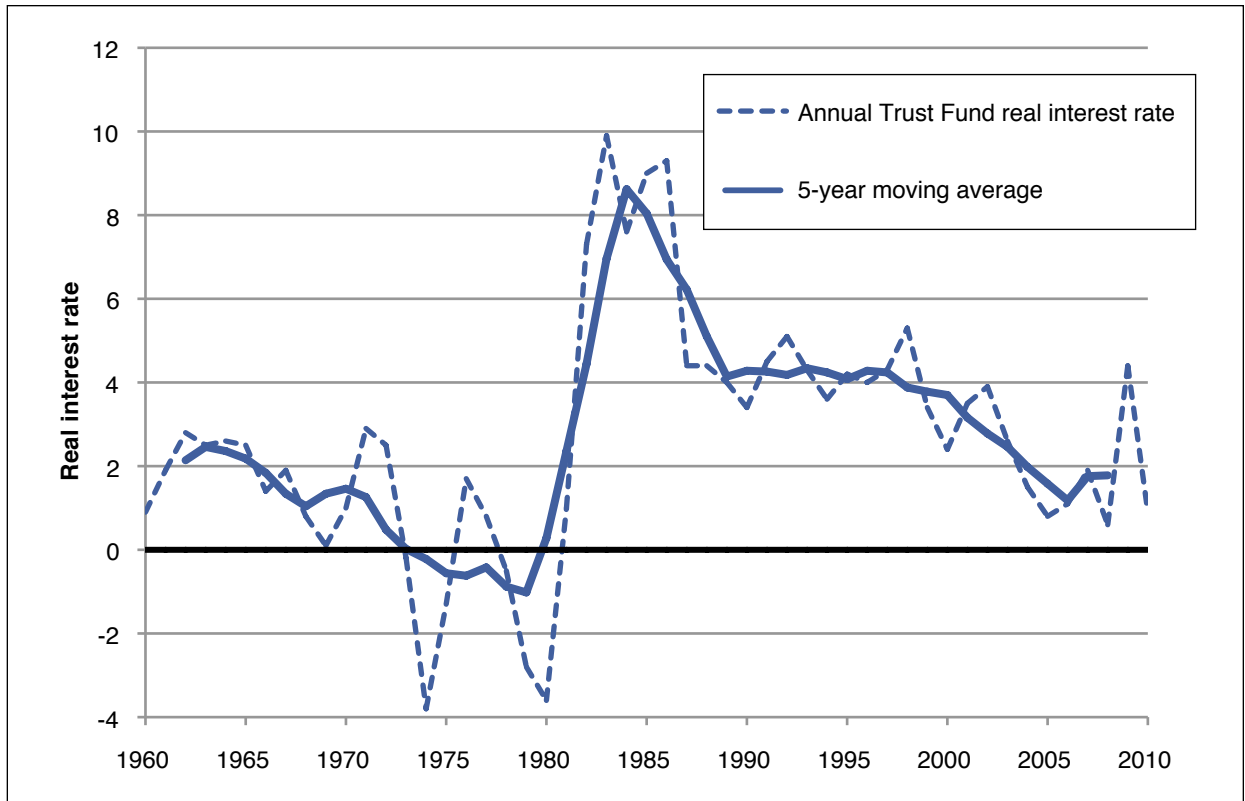
Table 19 presents the values for each of the portfolio yields for the week ending July 2, 2011.

Table 19. TIPS Yield Curve Using Constant-Maturity Portfolios

| 5-Year | 7-Year | 10-Year | 20-Year | 30-Year |
|--------|--------|---------|---------|---------|
| -0.28% | 0.26% | 0.73% | 1.46% | 1.75% |

⁷⁶ Given that the TIPS market is smaller than the market for nominal Treasuries, the yields may already factor in an illiquidity premium. As such, they likely *overstate* the real interest rate based on the difference between nominal yields and inflation expectations.

Figure 56. Annual Trust Fund Real Interest Rates: 1960–2010



Source: Social Security Trustees Report, Table V.B2, 2011.

Each yield is equal to the geometric average annual interest rate over the years from the present to the portfolio’s maturity. We calculate the average annual interest rate that is expected to prevail between any two time points, T_1 and T_2 , by applying the following formula for $r_{1,2}$:

$$(1 + r_{1,2})^{T_2 - T_1} = \frac{(1 + r_2)^{T_2}}{(1 + r_1)^{T_1}}$$

Based on the formula, **Table 20** presents the expected average annual interest rates over the full 30-year period.

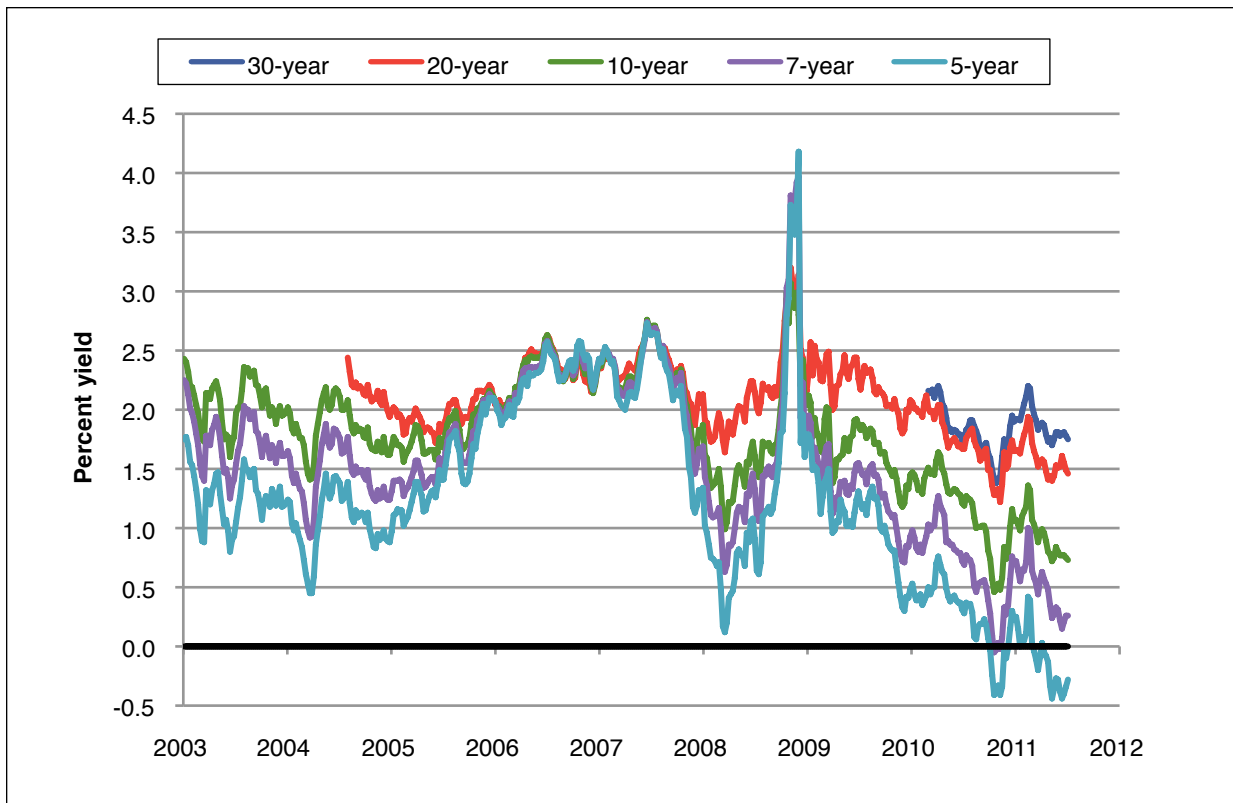
Table 20. Expected Average Annual Interest Rates Implied by TIPS Yield Curve

| Years 0–5 | Years 5–7 | Years 7–10 | Years 10–20 | Years 20–30 |
|-----------|-----------|------------|-------------|-------------|
| -0.28% | 1.62% | 1.84% | 2.20% | 2.33% |

Market participants expect that real interest rates will remain around or below zero for about five years before reverting to levels consistent with the trend of the past two decades. To form the basis of its recommendation, the Technical Panel considers the market forecasts of future interest rates to be informative and therefore recommends an ultimate assumption no higher than 2.7 percent. The Technical Panel’s considerations may be formalized as the following recommendation:

Method Recommendation M-13. The Technical Panel reiterates the recommendation of the 2007 Technical Panel that the approach to determining real and nominal interest rates should place greater weight on the forward-looking information in recent Treasury yield curves.

Figure 57. Yields on Constant-Maturity Treasury Inflation-Protected Securities (TIPS) Portfolios: 2003–2011



Source: Federal Reserve data.

3.5 Inflation

Assumption Recommendation A-18. The Technical Panel recommends retaining CPI-W inflation at 2.8 percent in the intermediate-cost scenario. The Technical Panel also recommends retaining the low- and high-cost values of, respectively, 1.8 and 3.6 percent.

The recommended values for inflation are consistent with the historical evidence from the earlier two decades shown in **Table 17** and **Figure 58**. The five-year moving average of the inflation rate has spent the last 20 years in the narrow range of 2 to 3 percentage points per year. After the monetary contraction of the early 1980s that occurred in response to the particularly high inflation of the late 1970s, the annual rate of inflation has not exceeded 5 percent in any year.

Assumption Recommendation A-19. The Technical Panel recommends setting the nominal interest rate to 5.5 percent in the intermediate-cost sce-

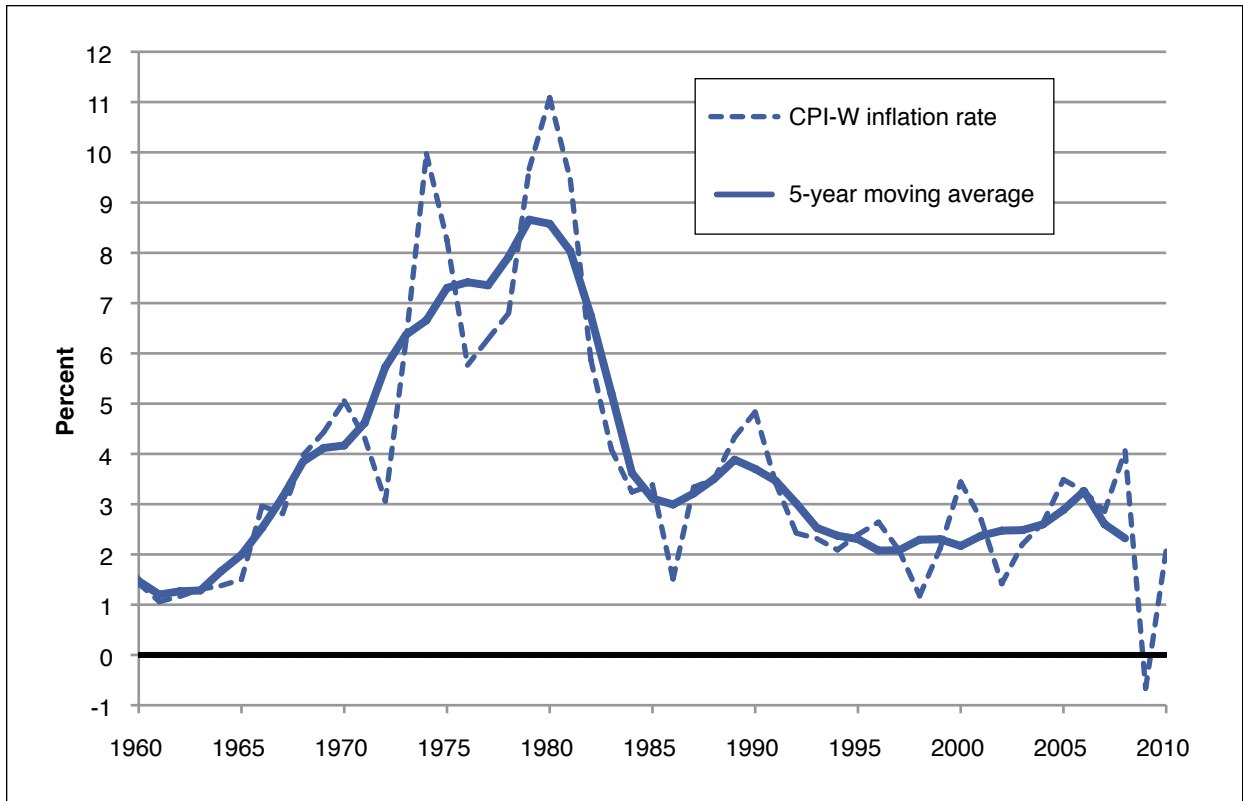
nario, based on a 2.8 percent inflation rate and a 2.7 percent real interest rate. The Technical Panel also recommends a low-cost nominal interest rate of 5.4 percent (1.8 percent inflation plus 3.6 percent real interest rate) and a high-cost nominal interest rate of 5.7 percent (3.6 percent inflation plus 2.1 percent real interest rate).

The recommended values for the nominal interest rate are consistent with the assumptions about real interest rates noted earlier and the inflation rates just specified. They imply slightly higher nominal interest rates than what may be inferred at present from the longest-maturity nominal Treasuries.

3.6 Taxable Share of Covered Wages

Assumption Recommendation A-20. The Technical Panel recommends the brief continuation of the downward trend in the taxable share of covered wages as the economy fully recovers from the recession and then reaches an ultimate level of

Figure 58. Annual CPI-W Inflation: 1960–2010



Source: Bureau of Labor Statistics. The data in the figure come from the CPI-W-RS series constructed above.

82.2 percent. The Technical Panel also recommends significantly expanding the range of uncertainty around the taxable share given that the taxable share could continue to shift rapidly in the coming years. The Technical Panel recommends a low-cost value of 84.3 percent and a high-cost value of 80.0 percent, a range that is modestly asymmetric around the recommended intermediate value.

Method Recommendation M-14. The Technical Panel recommends consideration of a formal linkage between the assumed earnings to compensation ratio and the taxable share.

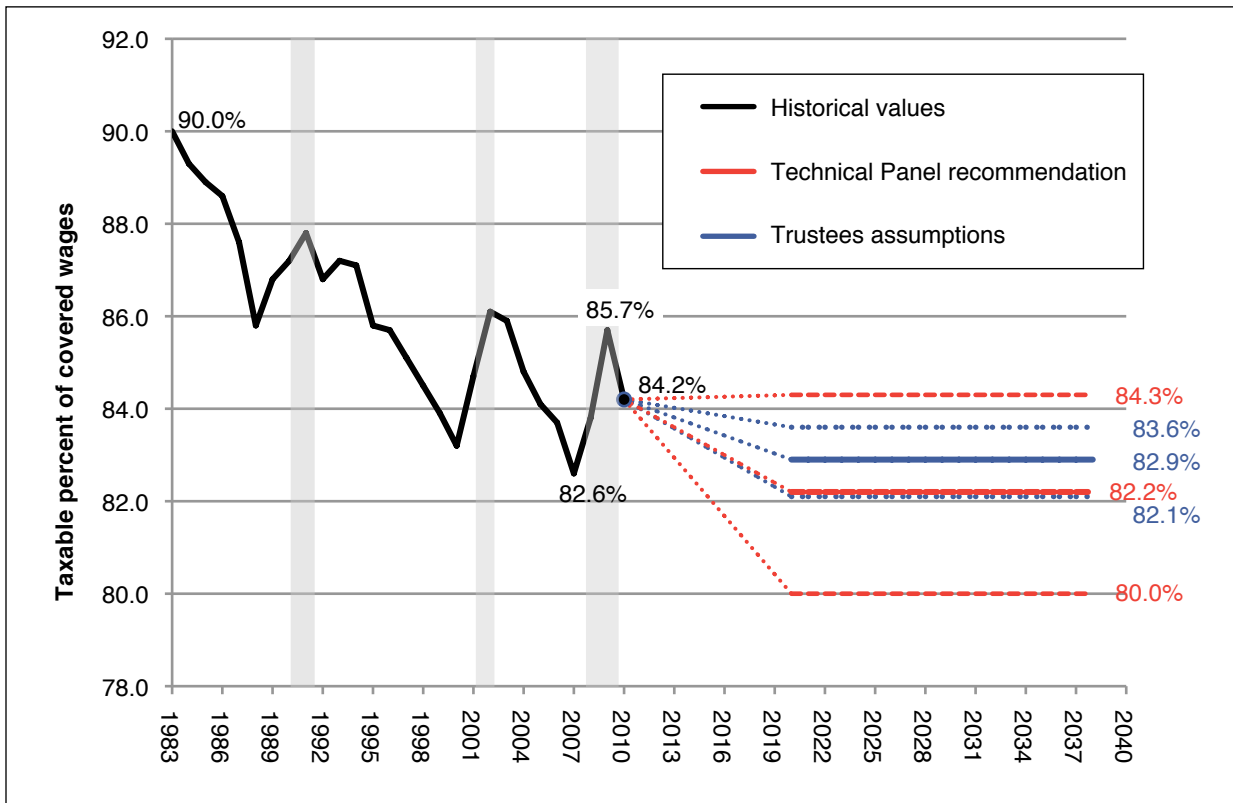
Method Recommendation M-15. Consistent with Recommendation P-1, the Technical Panel recommends characterizing the taxable share as a basic assumption with a meaningful range of uncertainty. It should also be part of the formal sensitivity analyses currently presented in Appendix D.

Only earnings below the contribution and benefit base (also known as the taxable maximum), set at \$106,800 per year in 2009–2011, are subject to OASDI payroll taxes and counted toward Social Security benefits.⁷⁷ The taxable share refers to the fraction of total earnings in OASDI-covered jobs below this threshold (and therefore subject to payroll tax) and thus encompasses one aspect of earnings dispersion that is important for Social Security costs.

Since 1983, the taxable share has steadily trended downward, as observed in **Figure 59**. The only exceptions have been periods of recession (and a recession's immediate aftermath), when the taxable share briefly turned upward, only to continue its decline again shortly after the recession's end. Data from 2010 (presented in the 2011 Trustees Report) suggest that the pattern is repeating and that the taxable share has begun to turn downward.

⁷⁷ The threshold is indexed to account for wage inflation but did not increase in years without a Cost of Living Adjustment. Section 1300 of the *Social Security Handbook* details the types of compensation subject to payroll taxation.

Figure 59. Historical and Projected Values of the Taxable Share of Covered Wages: 2011 Trustees Report and Technical Panel Recommendations



Source: Table 4.B1, Annual Statistical Supplement to the Social Security Bulletin; OASDI Trustees Report, 2011, p. 115.

Notes: Vertical axis does not start at zero. Recessionary periods as defined by National Bureau of Economic Research are shaded. Interpolations between last observed historical value and ultimate values are simplified.

Detailed data on the U.S. earnings distribution suggest that the driving force behind the downward trend in taxable share has been rapid increases in the earnings of the very highest earners (e.g., Bakija, Cole, and Heim 2010; Kopczuk, Saez, and Song 2007; Piketty and Saez 2003, 2010).⁷⁸ We define highest earners as just a fraction of the top 1 percent of all earners; that is, a fairly small subset of the approximately 6 percent of the covered labor

force that earns over the taxable maximum. While the downward trend is also attributable to (1) the aging of the Baby Boom generation into cohorts at which workers are more likely to earn above the taxable maximum and (2) other compositional changes (e.g., a growing foreign-born population with highly heterogeneous earnings), such effects appear to have been comparatively modest (Cheng 2011). At the same time, however, changing shares of compensation awarded as employee benefits rather than as wages at various points in the earnings distribution may help explain the trend (Pierce 2010).

The 2011 Trustees Report projected that the taxable share will level off at an ultimate rate of 82.9 percent of covered payroll. The projection assumes that the taxable share’s decline reached a nadir at about its 2007 value and should remain relatively stable at just above that value. In the low- and high-cost alternatives of the 2011 Trustees Report,

⁷⁸ The underlying mechanisms discussed in the literature suggest that the rapid increases result from skill-biased technological change (Autor et al. 2006), technologies that permit “superstars” to increase their compensation (Rosen 1981), executive pay (Bebchuk and Fried 2003; Bebchuk and Grinstein 2005; Frydman and Jenter 2010; Frydman and Saks 2010), and changing roles of key institutions (DiNardo, Fortin, and Lemieux 1996; Levy and Temin 2007). Some speculate that much of the trend may be attributable to the realization of salary gains associated with concurrent stock market and real estate bubbles. That this phenomenon is evident primarily in English-speaking countries leads some to conclude that norms about inequality play a significant role (Atkinson, Piketty, and Saez 2011).

the taxable share ultimately reaches, respectively, 83.6 and 82.1 percent of covered payroll.

Because the literature and expert judgment are sharply divided on the question of whether the earnings of the very highest earners will continue to outpace earnings at lower points in the distribution, the Technical Panel recommends only modest change to the current Trustees' assumption. Analysts who foresee a continuation of the trend toward a lower taxable share see few institutional mechanisms that would inhibit further rapid growth in earnings for the most highly compensated workers. Those who expect the trend to slow, flatten, or even reverse point to several explanatory factors. Such factors include the likelihood that marginal tax rates will increase, perhaps markedly, in coming years, especially for very high earners and that health care reform could reduce the share of total compensation awarded as health benefits, with greater effects in the middle of the earnings distribution rather than at the top. Some posit that bubbles fueled much of the recent growth in compensation of the highest earners and are unlikely to occur again.

The Technical Panel believes that the argument that the downward trend is likely to continue is somewhat stronger, but it does recognize that the trend is unlikely to continue indefinitely. We therefore recommend only a slightly steeper downward slope until the taxable share reaches its ultimate value, proposed at 82.2 percent, just below the 2007 value.

Given that the taxable share depends heavily on earnings for a just small fraction of the labor force, it could shift quickly and markedly with changes in the policy environment, including, for example, comprehensive reform of the personal income tax system, financial reform, change in the tax treatment of carried interest, or health reform. The Technical Panel therefore recommends that OACT continue to monitor earnings data closely to determine the extent to which the taxable share changes with the economy's recovery from the recession and as various provisions of the *Affordable Care Act* take effect.

While the evidence supporting a change to the intermediate value of the taxable share assumption is mixed, the Technical Panel reached a strong consensus that the future uncertainty of earnings variability is particularly high and that the currently assumed range between the low- and high-cost bands for the taxable share is too narrow given the pos-

sibility of continued change. This position echoes Recommendation O-2 from the 2007 Technical Panel ("High- and low-cost ratios should provide a realistic range of uncertainty"). The Technical Panel recommends a band of + 2.1 and -2.2 percentage points around the intermediate value assumed for the taxable share.

We recognize that the objective for the ultimate rate is a level that remains stable for a long period, yet many plausible scenarios imply levels that fall significantly outside the existing range for the low- and high-cost values in the 2011 Trustees Report (+ 0.7/- 0.8 percentage points around the intermediate value). If the linear trend from 1983 to 2007 were to continue for even 7 years before leveling off, the taxable share would be more than a percentage point lower than under the high-cost alternative. Analogously, the taxable share over the past 10 non-recession years has averaged about 84.4 percent, 0.8 percentage point above the ultimate low-cost alternative. Neither alternative seems at all unreasonable for sensitivity analyses.

Changes to the taxable share could affect system financing in different ways depending on the types of changes introduced; in particular, the extent to which high earners' wages change the average wage plays an important role (see, for example, Favreault 2009; Gustman, Steinmeier, and Tabatabai 2010). The Technical Panel encourages the Trustees to raise the prominence of earnings dispersion in its discussion of the OASDI system's financing, given that the recent downward trend in the taxable share has contributed to deterioration in OASDI's long-run fiscal status.

Current OACT techniques for modeling the taxable share do not include information about the earnings to compensation ratio. The literature suggests that employers view employee compensation in total; accordingly, changes in any compensation type have implications for the earnings distribution and thus for the taxable share. Given that regulatory and market adjustments will likely change shares of non-earnings compensation of various types (health benefits, employer pension contributions), the Technical Panel encourages OACT to examine closely the resultant relationships. If appropriate, such outcomes could be formally linked.⁷⁹

⁷⁹ Disentangling correlation and causation in these relationships may require additional research and further refinement of other variables in the model of the taxable share.

■ CHAPTER 1: Methodology

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Compilation of 2011 Technical Panel Recommendations

■ CHAPTER 1. METHODOLOGY

Section 1.1 Presentation of Uncertainty

Presentation Recommendation P-1. The Technical Panel recommends expanding the list of key assumptions in summary Table II.C1 to include missing drivers of long-run Social Security finances. In addition, as warranted, the Technical Panel recommends presenting the values for key assumptions in a way that is useful to readers. Improved communication will likely involve reporting values for “indicator” variables that are directly determined by the more precise (but not easily interpretable) basic assumptions.

Presentation Recommendation P-2. The Technical Panel recommends removing the current presentation of uncertainty from the Summary (Chapter II) and from the section on Long-Run Actuarial Estimates (Chapter IV) and recommends replacing the Summary chapter presentation with sensitivity analysis for each of the key drivers of system finances. In addition, the Technical Panel recommends basing the selection of the low- and high-cost values for key assumptions on consistency – in a probabilistic sense – both across and within assumptions. In other words, it is essential to make certain that the low- and high-cost values for any given variable are equally likely alternatives with respect to the intermediate alternative, even if this implies an asymmetric range between the intermediate and the high- and low-cost assumptions. Further, the Technical Panel recommends ensuring that the likelihood of realizations within the range of outcomes is the same across all key assumptions.

Presentation Recommendation P-3. The Technical Panel recommends adding a chapter on uncertainty that explains, compares, and contrasts the high- and low-cost scenarios with integrated scenarios and stochastic simulation. The Technical Panel also recommends emphasizing that sensitivity analysis is the starting point for every measure of overall uncertainty and noting that any overall measure of uncertainty involves varying the combinations of key assumptions in particular ways. Each scenario and stochastic approach should be presented in a comparable way, specify how the key assumptions vary in each measure of overall uncertainty, and discuss the impact on various measures of system financial outcomes.

Section 1.2 Actuarial Metrics

Method Recommendation M-1. The Technical Panel recommends providing micro-level (individual) financial measures of the Social Security system in conjunction with macro-level (program-wide) financial measures of the system.

Method Recommendation M-2. The Technical Panel recommends adding a subsection to Chapter IV, Section B of the Trustees Report that provides more discussion and analysis of sustainable solvency.

Method Recommendation M-3. If the Trustees accept Recommendation M-2, then the Technical Panel recommends eliminating the Infinite Horizon metric.

Section 1.3 Models and Methods

Method Recommendation M-4. The Technical Panel commends OACT for its progress in increasing the transparency of its methods and in communicating detailed information to policymakers and the research community through its web site. The Technical Panel recommends maintaining and expanding these efforts in the coming years.

Method Recommendation M-5. The Technical Panel commends the Social Security Administration (SSA) for investing in the development of matched data files that link survey information with administrative records on earnings and benefit receipt. The Technical Panel recommends making continued investments a high priority.

Method Recommendation M-6. The Technical Panel recommends that SSA develop a strategic plan for expanding its dynamic microsimulation capacity and for integrating its segmented and microsimulation strategies. One objective of the strategic plan should be to increase coordination of dynamic microsimulation efforts within SSA in order to maximize existing resources. The Technical Panel recommends that the Social Security Advisory Board monitor progress on the development of these plans. The Board should consider convening or hosting a regular series of meetings of model developers within SSA and across various government agencies to review innovations, challenges, and prospects for collaboration. In deciding how to allocate scarce modeling resources, the Technical Panel recommends assigning a high priority to policies with potentially significant but uncertain effects on OASDI's fiscal position.

Method Recommendation M-7. The Technical Panel recommends basing the intermediate projection of revenues from taxation of OASDI benefits more closely on the current income tax code rather than on historical shares of income subject to federal income taxation. The Technical Panel also recommends basing the projections of OASDI's long-range actuarial status on two alternative sets of assumptions about future taxation that are analogous to "current law"/"extended baseline" and "current policy"/"alternative fiscal" scenarios, as is the practice of other government

and private forecasting groups. At a minimum, the Technical Panel strongly recommends adding sensitivity analyses to the Trustees Report to demonstrate how projections of the long-range financial status of the OASDI program vary with alternative assumptions about laws governing personal income tax.

Section 1.4 Implications of Health Care Reform

Assumption Recommendation A-1. The Technical Panel recommends increasing the range of uncertainty around the major assumptions, including those regarding labor force participation and the earnings ratio, that are likely to be affected by health care reform. The expanded range reflects the uncertainty inherent in how health care reform will unfold. Over time, the extent of uncertainty is likely to narrow, at which point the recommended ranges for the affected assumptions will lend themselves to reduction.

Research Recommendation R-1. The Technical Panel recommends research into the impacts of health care reform on relevant outcomes as reform provisions start to take effect. Such outcomes include labor force participation, disability receipt, the earnings ratio, the taxable share, and mortality. The research findings should help determine the need for changes to the relevant assumptions and the need for adjustments to the range of uncertainty.

■ Chapter 2. Demographic Assumptions and Methods

Section 2.1 Fertility

Assumption Recommendation A-2. The Technical Panel recommends retaining the intermediate total fertility rate assumption of 2.0 from the 2011 Trustees Report. The Technical Panel also recommends low- and high-cost total fertility rates of 2.2 and 1.6, respectively. We agree with previous Technical Panels that asymmetry in the range between the intermediate- and low- and high-cost values is appropriate, although our current estimate of such asymmetry is modest.

Section 2.2 Mortality

Presentation Recommendation P-4. The Technical Panel recommends summarizing the assumptions about future mortality in terms of life expectancy at birth at the end of the projection period rather than in terms of the average annual percentage reduction in total age- and sex-adjusted death rates.

Method Recommendation M-8. The Technical Panel recommends simplifying the mortality projection model by eliminating separate projections by cause of death.

Assumption Recommendation A-3. The Technical Panel recommends increasing the intermediate life expectancy assumption to 88.7 years in 2085, which is 3.7 years higher than the 2011 Trustees Report's assumption of 85.0 years. The Technical Panel also recommends low- and high-cost assumed life expectancies of 83.7 and 93.7 years. The difference between these low- and high-cost assumptions is 10 years (93.7 minus 83.7 years) compared with 7.7 years in the 2011 Trustees Report; this range reflects the high degree of uncertainty about future mortality trends and the lack of agreement among experts about such trends.

Section 2.3 Immigration

Assumption Recommendation A-4. The Technical Panel recommends that immigration scenarios should tie the level of net immigration to historical evidence on net immigration and population size rather than decreasing or increasing constant numbers of immigrants. The Technical Panel recommends that the Trustees express their ultimate net migration assumptions as rates of the annual number of net migrants divided by population size.

Assumption Recommendation A-5. The Technical Panel recommends making the assumptions regarding future immigration more consistent with long-range historical averages for earlier periods. Specifically, the Technical Panel recommends that the intermediate assumption should ultimately be 3.2 net migrants per 1,000 persons. The Trust-

ees' current intermediate assumptions about net legal and net other immigrants in 2015 and assumptions about increases for 2015 through 2025 may be appropriate based on current evidence, but the Technical Panel believes that net immigration levels beyond 2025 will not decline as reflected in the ultimate assumption for the remainder of the projection period. The Technical Panel also recommends that the low- and high-cost assumptions should ultimately be 4.2 and 2.2 net migrants, respectively, per 1,000 persons.

Section 2.4 Disability

Assumption Recommendation A-6. The Technical Panel recommends increasing the age-sex-adjusted disability incidence rate to 5.8 per 1,000 insured workers, with somewhat larger increases for women and smaller increases for men; this is higher than the 5.2 per 1,000 rate assumed in the 2011 Trustees Report. The Technical Panel also recommends low- and high-cost disability incidence rates of, respectively, 4.8 and 6.9.

Assumption Recommendation A-7. The Technical Panel recommends a more rapid decline in DI mortality rates for both men and women from 2020 through 2030 than is currently assumed. The effect of the recommended reduction on the age-adjusted mortality rate for men is a 15.7 percent lower mortality rate from 2030 through 2085; for women, it is a 14.3 percent lower mortality rate during the same period. The recommended intermediate age-adjusted DI mortality rate for men in 2085 is 11.10 per 1,000 DI beneficiaries, which is lower than the currently assumed mortality rate of 13.20. The recommended intermediate age-adjusted DI mortality rate for women in 2085 is 8.20 per 1,000 DI beneficiaries, which is lower than the currently assumed mortality rate of 9.57. The recommended total age-sex-adjusted mortality rate in 2085 is 9.86, which is 13.7 percent lower than the currently assumed 11.42. The Technical Panel also recommends ultimate low- and high-cost total age-sex-adjusted mortality rates of, respectively, 17.10 and 6.30.

Assumption Recommendation A-8. The Technical Panel recommends reducing the assumed DI recovery rate from the currently assumed rate of

10.7 per 1,000 DI beneficiaries to 8.7 per 1,000 DI beneficiaries. The Technical Panel also recommends an increase in the range of uncertainty about the recovery rate, with low- and high-cost values of, respectively, 11.4 and 6.0 relative to the currently assumed low- and high-cost values of, respectively, 12.9 and 8.5.

Method Recommendation M-9. The Technical Panel recommends expanding the discussion of the factors leading to the projected decline in the share of DI-insured men and careful monitoring of the share to see if the recent declines among younger men carry forward to men at older ages. The Technical Panel notes that similar discussion and monitoring are warranted given the projection that the steady rise in the share of DI-insured women will level off in the short term.

Method Recommendation M-10. The Technical Panel recommends exploring in greater depth the effect of diagnoses of DI recipients on program exit rates because of recovery or death. The Technical Panel recommends similar exploration for the projected share exiting DI because of conversion to retired worker benefits.

Presentation Recommendation P-5. The Technical Panel recommends presenting more detail on the programmatic, economic, and health factors that drive DI applications and how the factors are assumed to change in the future.

■ Chapter 3. Economic Assumptions and Methods

Section 3.1 Labor Force Participation Rate

Method Recommendation M-11. Consistent with Recommendation P-1, the Technical Panel recommends characterizing labor force participation rates as a basic assumption with a meaningful range of uncertainty. Labor force participation rates should also be part of the formal sensitivity analyses currently presented in Appendix D.

Assumption Recommendation A-9. The Technical Panel recommends increasing the assumed labor force participation rates with intermediate values of 75.0 for men and 61.9 percent for

women in 2085; these rates are higher than the currently assumed values of 72.9 percent for men and 60.8 percent for women. Together, the recommended values would raise the age-sex-adjusted labor force participation rate from 66.6 to 68.2 percent. The Technical Panel also recommends a substantial increase in the range of uncertainty about labor force participation, with low- and high-cost age-sex-adjusted participation rates of, respectively, 70.3 and 64.8 percent in 2085.

Method Recommendation M-12. The Technical Panel recommends moving toward a heuristic life-cycle approach for projecting labor force participation by age and sex. Ultimately, labor force participation should be driven by life-cycle-specific labor supply measures such as typical age of first entry, percentage of the working-age population in the labor force, age of primary job exit, and fraction of the retired population still working. The Technical Panel's recommended intermediate-, low-, and high-cost values above are based on consideration of labor force participation across eight age/sex groups and thus represent a move in the desired direction.

Section 3.2 Real Wage Growth Rate

Assumption Recommendation A-10. The Technical Panel recommends retaining the productivity growth rate of 1.7 percent per year assumed in the 2011 Trustees Report. The Technical Panel also recommends retaining the currently assumed low- and high-cost values of 2.0 and 1.4 percent, respectively.

Assumption Recommendation A-11. The Technical Panel recommends retaining the intermediate assumption of a 0.0 percent annual growth rate for the compensation share of GDP. The Technical Panel further recommends introducing uncertainty about this parameter. Specifically, starting from a current value of 54.5 percent for the compensation ratio, the Technical Panel recommends low- and high-cost values of, respectively, 56 and 53 percent over the projection period. Growth rates of, respectively, 0.1 and -0.1 percent per year for 25 years in the low- and high-cost scenarios would generate the suggested range in the compensation ratio.

Assumption Recommendation A-12. The Technical Panel recommends setting the annual growth rate for the earnings to compensation ratio at 0.0 percent in the intermediate-cost scenario, an increase from the current assumption of -0.1 percent. The Technical Panel also recommends low- and high-cost annual growth rates of, respectively, 0.1 and -0.1 percent per year, which yield an ultimate range for the earnings to compensation ratio of 77 to 89 percent relative to a starting value of 83 percent. The adjustment for the effects of health care reform made in the 2010 Trustees Report (+0.1 percent per year) is reasonable and should be maintained, pending direct observation of the law's impact in the coming years. The Technical Panel's recommendation of an intermediate-cost assumption of 0.0 percent incorporates such adjustment.

Assumption Recommendation A-13. The Technical Panel recommends retaining the intermediate-cost assumption of 0.0 percent for the annual change in hours worked. For the low-cost scenario, the Technical Panel recommends a slight increase of 0.05 percent per year in hours worked over the 75-year period. Recognizing a greater risk of a decline in hours worked, the Technical Panel recommends a reduction in annual hours of -0.15 percent per year for the 75-year period in the high-cost scenario.

Assumption Recommendation A-14. The Technical Panel recommends reducing the magnitude of the intermediate-cost assumed GDP-CPI price differential to -0.2 percent per year, relative to the currently assumed -0.4 percent price differential. The Technical Panel also recommends low- and high-cost price differentials of -0.1 and -0.3 percent, respectively.

Assumption Recommendation A-15. Taken together, the Technical Panel's recommendations A-10 through A-15 for productivity growth and the four linkages generate an intermediate real wage growth rate of 1.5 percent per year in years 25 through 75, with low- and high-cost values of, respectively, 2.05 and 0.85 percent. Over the first 25 years, our recommendations also generate an intermediate real wage growth rate of 1.5 percent, but with low- and high-cost values of, respectively, 2.15 and 0.75 percent per year.

Section 3.3 Unemployment Rate

Assumption Recommendation A-16. The Technical Panel recommends retaining the assumed ultimate long-run unemployment rate of 5.5 percent from the 2011 Trustees Report. The Technical Panel also recommends retaining the low- and high-cost assumed unemployment rates of, respectively, 4.5 and 6.5 percent.

Section 3.4 Interest Rates

Assumption Recommendation A-17. The Technical Panel recommends reducing the assumed long-run real interest rate to 2.7 percent. The rate is lower than the 2.9 percent long-run real interest rate assumed in the 2011 Trustees Report and more in line with market-based forecasts derived from current yields on inflation-protected Treasury securities. The Technical Panel recommends retaining the low- and high-cost values of, respectively, 3.6 and 2.1 percent for the real interest rate.

Method Recommendation M-13. The Technical Panel reiterates the recommendation of the 2007 Technical Panel that the approach to determining real and nominal interest rates should place greater weight on the forward-looking information in recent Treasury yield curves.

Section 3.5 Inflation

Assumption Recommendation A-18. The Technical Panel recommends retaining CPI-W inflation at 2.8 percent in the intermediate-cost scenario. The Technical Panel also recommends retaining the low- and high-cost values of, respectively, 1.8 and 3.6 percent.

Assumption Recommendation A-19. The Technical Panel recommends setting the nominal interest rate to 5.5 percent in the intermediate-cost scenario, based on a 2.8 percent inflation rate and a 2.7 percent real interest rate. The Technical Panel also recommends a low-cost nominal interest rate of 5.4 percent (1.8 percent inflation plus 3.6 percent real interest rate) and a high-cost

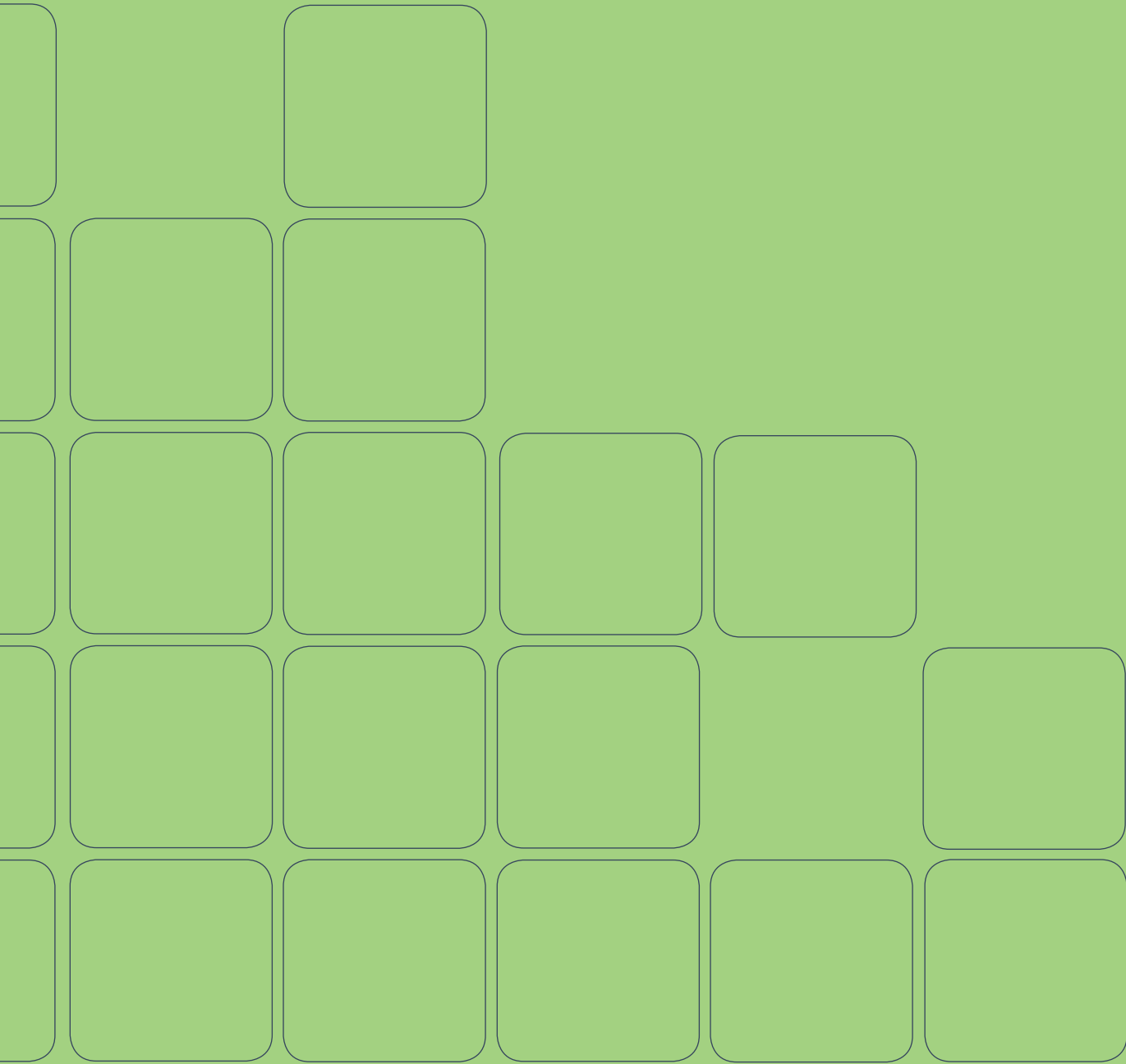
nominal interest rate of 5.7 percent (3.6 percent inflation plus 2.1 percent real interest rate).

Section 3.6 Taxable Share of Covered Wages

Assumption Recommendation A-20. The Technical Panel recommends the brief continuation of the downward trend in the taxable share of covered wages as the economy fully recovers from the recession and then reaches an ultimate level of 82.2 percent. The Technical Panel also recommends significantly expanding the range of uncertainty around the taxable share given that the taxable share could continue to shift rapidly in the coming years. The Technical Panel recommends a low-cost value of 84.3 percent and a high-cost value of 80.0 percent, a range that is modestly asymmetric around the recommended intermediate value.

Method Recommendation M-14. The Technical Panel recommends consideration of a formal linkage between the assumed earnings to compensation ratio and the taxable share.

Method Recommendation M-15. Consistent with Recommendation P-1, the Technical Panel recommends characterizing the taxable share as a basic assumption with a meaningful range of uncertainty. It should also be part of the formal sensitivity analyses currently presented in Appendix D.



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