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# 2019 TECHNICAL PANEL ON ASSUMPTIONS AND METHODS

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REPORT TO THE SOCIAL SECURITY ADVISORY BOARD

SEPTEMBER 2019



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Report to the  
Social Security Advisory Board  
September 2019



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## Members of the Technical Panel

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## Technical Panel Charter

The Panel of expert actuaries, economists and demographers appointed by the Social Security Advisory Board (the board) is charged with providing technical assistance to the board by reviewing the assumptions and the methods used to integrate those assumptions for projecting the future financial status of the Old Age, Survivors, and Disability Insurance (OASDI) programs. The Panel shall deliver a written report to the board by September 2019. The report should reflect the full range of views expressed by Panel members.

Specifically, the Panel is asked to:

- Review the key economic and demographic assumptions, assess whether they are reasonable, and detail the rationale for considering alternative values.
- Review the current projection methods, assess whether they are reasonable and appropriate, and detail the rationale for considering new methodologies.
- Consult with the board, the Trustees, and the Office of the Chief Actuary regarding specific assumptions or methods that may benefit from additional attention from the Panel.
- Review ways to improve the presentation of key concepts in the Trustees Report so as to make them more accessible and informative to policymakers and the public.



## Acknowledgements

The 2019 Technical Panel on Assumptions and Methods was convened by the Social Security Advisory Board (SSAB) in September 2018 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.

The Technical Panel held seven public meetings on the following dates:

November 16, 2018

December 14, 2018

January 25, 2019 (Social Security Administration Headquarters, Baltimore, MD)

February 15, 2019

March 29, 2019

April 12, 2019

May 10, 2019

Additionally, closed door meetings were held on the day following the public meetings and on June 17-18, 2019. Numerous conference calls were also conducted during this time period.

We benefited greatly from discussions with representatives from:

Trustees' Working Group – Mark Warshawsky, Steve Robinson, Robert O'Quinn, Chet Andrzejewski, Dan Kowalski, Randall Mariger, William Marton

Past Public Trustees – Robert Reischauer, Charles Blahous

Senate Finance Committee – Jeff Wrase, Tom Klouda

House Ways and Means Committee – Kathryn Olson, Amy Shuart

Congressional Budget Office – Julie Topoleski

Additionally, we were greatly informed by presentations from insurance industry, communications, journalism and academic experts including:

Demographics and Disability – Gerard Anderson, David Cutler, Alison Gemmill, Hans-Peter Kohler, Richard Leavitt, Jeffrey Liebman, Doug Massey, Emilio Parrado, Jeffrey Schuh, Greig Woodring

Economics and Methods – Daron Acemoglu, Gary Burtless, Michael Chui, David Deming, Wendy Edelberg, Jagadeesh Gokhale, James Stock

Presentation and Communication - Ricardo Alonso-Zaldivar, Alexia Fernandez Campbell, Martha Coven, Tony Fratto, Greg Ip, Jonathan Schwabish, David Wessel

We also had helpful suggestions and discussions from around the world with: Mike Archer, Peter Banthorpe, Cobus Daneel, Eric Dash, Avi Feller, Amy Goldstein, Wychert Hoekert, Thomas Holzheu, Karolyn Karl, Toshiyuki Kinugasa, Jeffery Passell, Ernie Tedeschi.

The staff in the Social Security Administration's Office of the Chief Actuary (OACT) attended all of our public meetings, made presentations, answered questions, assisted with data requests, performed the projections in this report and hosted our January meeting. We appreciate the support of:

Front Office – Stephen C. Goss (Chief Actuary), Jason Schultz, Beth Hima

Staff Support - Ursula White, Crystal Mackall, Erica Ciccotto

Long-Range Estimates - Karen P. Glenn (Deputy Chief Actuary), Tiffany Bosley, Christopher Chaplain, Michael Morris, Robert Weathers, Seung An, Felicitie Bell, Nadine Blount, Kyle Burkhalter, K. Mark Bye, Anthony Cheng, Sharon Chu, Michael Clingman, Anna Kirjusina, Johanna Maleh, Michael Miller, Kent Morgan, Daniel Nickerson, William Piet, Karen Rose, Andrew Sawyer, Sven Sinclair, Karen Smith, Kathleen Sutton, Polina Vlasenko, Eugene Yang

Short Range Estimates - Michael Stephens, David Olson, Jerry Lin, Sasha Zakharin

Thanks go to the staff of the Social Security Advisory Board who provided the Panel with assistance to enable us to work together as a group focusing on the important issues and not on the many details involved with this massive undertaking. Special thanks go to Joel Feinleib whose vast experience with Technical Panels historically, tireless commitment to bringing the work of the Panel to fruition and personal counsel to me on many issues were invaluable to our tight-knit group.

As chair of the Panel, I am very pleased and proud of our ability to come together as a team. We removed our hats as actuaries, demographers and economists in many discussions and worked together with intellectual prowess. Since we were not necessarily striving for a consensus, we were able to engage in frank and candid discussions to address these important issues in a collegial yet challenging manner. Our goal was to turn over many rocks and pay special attention in our report to the “big rocks”.

Robert M. Beuerlein, Chair

## Executive Summary

The Annual Report of the Board of Trustees of the Federal Old-Age and Survivors Insurance (OASI) and Federal Disability Insurance (DI) Trust Funds is produced each year to report on the actuarial status and the financial condition of the Trust Funds as required by law. The development of the report follows a complex process that involves a detailed financial projection of the Social Security system's future cash flows. The process has been effective historically in providing important information relevant to the financial condition of the trust funds.

The 2019 Technical Panel on Assumptions and Methods was created by the Social Security Advisory Board in September 2018 with a charter to:

- Review the key economic and demographic assumptions underlying the Trustees Report, assess whether they are reasonable, and detail the rationale for considering alternative values.
- Review the current projection methods, assess whether they are reasonable and appropriate, and detail the rationale for considering new methodologies.
- Consult with the board, the Trustees, and the Office of the Chief Actuary (OACT) regarding specific assumptions or methods that may benefit from additional attention from the Panel.
- Review ways to improve the presentation of key concepts in the Trustees Report so as to make them more accessible and informative to policymakers and the public.

The Technical Panel was focused particularly on the likely increased demands on OACT as the date of trust fund depletion nears and potential changes to Social Security receive heightened attention. This report makes recommendations that are intended to enhance OACT's ability to evaluate the potential future financial status of the Social Security system under current law and a wide variety of proposed system reforms in a robust and timely manner and to better convey its findings - and the range of uncertainty around those findings - to stakeholders. The analysis and results contained in the Trustees Report are reasonable and meaningful for today. The recommendations contained herein are intended to position the Trustees Report to take advantage of evolving techniques and tools in order to be equally meaningful and insightful going into the future.

This report is not just forward looking. The Technical Panel also spent significant time analyzing the assumptions and methods that were utilized in the 2018 and 2019 Trustees Reports. While the Panel concluded that the Trustees' assumptions are not unreasonable, we believe that there is evidence to support further changes in some of the assumptions, especially if experience continues as recently observed. A good example of this is the long run unemployment rate assumption and the related assumption of disability incidence, as the recent experience of low unemployment levels combined with low inflation has convinced many experts that the natural rate of unemployment will be lower in the coming years.

Further, each assumption must not be viewed in a vacuum as the interrelationships among the assumptions is vital.

The comments and recommendations herein represent the considered thoughts of a diverse group of experts from the fields of actuarial science, demography and economics. Professional judgment is an essential element of the Trustees' projections. Our independent review seeks to contribute to the body of actuarial, demographic and economic thinking that will inform this professional judgment in the years ahead. The Panel believes that the choice of assumptions and methods in any projection model can and

does vary among honest and dedicated professionals. The willingness of the Trustees and Chief Actuary to open up their projections to detailed scrutiny and consider the recommendations of independent experts is a positive feature that should increase the public's confidence in the projections. The Panel considered a full range of views on the various assumptions underlying the Trustees' projections. For illustrative purposes, the impact of the Panel's consensus recommendations is shown in a supplemental report on the SSAB website: [www.ssab.gov](http://www.ssab.gov).

This report is the culmination of nearly nine months of collaborative research by the Technical Panel. It includes the Panel's observations and recommendations regarding:

- A roadmap for **modernizing the technology** supporting the financial projections;
- Ideas for **improving public understanding** of the key drivers of the financial status of the Old Age, Survivors and Disability Insurance (OASDI) system;
- Recommendations for changes in the **economic, demographic and program-specific assumptions** underlying the OASDI projections; and
- Suggestions for directly incorporating the **uncertainty** inherent in many of the assumptions into the methods underlying the Trustees' projections.

Our conclusions are the result of a detailed review of the 2018 and 2019 Trustees Reports and after working closely with the Chief Actuary and his staff, consulting with staff representing the four ex-officio Trustees, congressional committees, and the Congressional Budget Office (CBO), and speaking with numerous academic and private sector experts. During our discussions, the relative importance of topics for which the Technical Panel might provide meaningful impact and offer insight progressed to prioritize methods and presentation over assumptions. In other words, insights into modern financial modeling techniques and technologies (methods), as well as the effective presentation of the results to policymakers, the media and the public (presentation), became the significant focus of the Panel. Throughout the process, our deliberations were informed by regular discussions with the OCACT, including a meeting of the Technical Panel at the OCACT's office in Baltimore.

Throughout the Technical Panel report, recommendations are presented regarding methods, presentation, and demographic, economic and program-specific assumptions associated with the Trustees Report. These recommendations should not be viewed as criticisms of the Trustees or OCACT. Rather, the recommendations present opportunities that were identified by the independent Panel for enhancements and modifications to ensure that the Trustees and OCACT can continue to effectively provide this essential information to policymakers and the public on this vitally important program. While some specific recommendations regarding assumptions are presented within the report, equally important are the explanations and rationale for considering alternative assumptions that are also presented. Further, the important role of professional judgment in determining assumptions and methods is acknowledged.

For many years, the Trustees Report has predicted that the Trust Funds will be depleted in the early 2030s as the Baby Boom generation retires and the ratio of the working age population to the retired population falls. Significant reforms will need to be enacted before the depletion date to avoid disruption to the system and lives of millions of Americans who depend on Social Security for their retirement income. While the Panel did not speculate on the details of what reforms might be enacted, we envision that numerous and varied proposals will be debated and there will be a growing need for timely and effective information to policymakers, the media and the public. More specifically, this

report provides commentary and recommendations about supplementing and in some cases replacing existing methods and processes with more recently developed techniques and technology. The report also recognizes the importance of effectively communicating these complex issues to all stakeholders, ranging from policymakers to the general American public.

## Methods

The methods and techniques employed by OCACT have worked well over the history of the Trustees Report. Changes to methods have occurred incrementally in response to expanding needs and demands on the Trustees Report for more information. This incremental approach is a well-accepted method for updating systems and methodologies each year. However, in this age in which the ability to amass and analyze vast amounts of data continues to grow exponentially, organizations across the public and private sectors have found it necessary to occasionally embark on an episodic effort of process reengineering and technology refreshment in addition to routine, incremental improvements.

With the maturation of the Baby Boom generation and all related impacts on the OASDI system, the Board of Trustees and OCACT will almost certainly be called upon to perform analyses that will strain the ability of OCACT's current techniques and technology to respond in a robust and timely fashion.

We therefore recommend commencement of a modernization effort that takes full advantage of today's ability to process more data, faster. Our modernization recommendations summarized below seek to ensure that the OCACT's good work will continue in the years ahead, both leading up to and after potential system reforms.

**Methods Recommendation 1: Model refresh.** The Panel recommends that OCACT reengineer and rebuild their computation model(s) using a programming language that supports object-oriented programming (e.g., Python, R, C++) which can be run in a modern environment that includes parallel processing (e.g., cloud processing), automates testing/validation and that streamlines and eliminates many of the manual handoffs between team members that exist today. We recommend that OCACT be given the budget and access to outside experts to begin this multi-year effort now.

**Methods Recommendation 2: Expand use of microsimulation techniques.** The Panel recommends OCACT develop and maintain a core microsimulation model as part of an expanded projection toolbox.

**Methods Recommendation 3: Administrative data.** The Panel recommends expanding the use of available government administrative data to refine and improve OCACT's projections, including of labor force outcomes and household benefit payments.

**Methods recommendation 4: Dynamic effects.** The Panel recommends that OCACT investigate the dynamic impact of potential policy changes and what-if scenarios on the macro-economy, including areas such as capital formation, the payroll tax base, wage growth, and wage-indexed benefits and incorporate such effects in the Trustees Report as appropriate.

**Method Recommendation 5: Statistical methods.** The Panel recommends incorporating recently developed statistical methods when estimating expected outcomes as well as future uncertainty.

**Methods recommendation 6: Current law.** The Panel recommends that projections make consistent assumptions about non-OASDI variables that reflect best projections of future values *or* current law but should avoid mixing the two sets of assumptions within the same projection.

## Presentation

There have been minimal changes to the OASDI system since 1983 except for the 1994 and 2015 reallocations of payroll taxes between the DI and OASI trust funds. However, the nuances inherent in the Trustees Report regarding the trust fund and the 75-year actuarial balance have been of little practical consequence to readers of the report. Thus, for the last 30+ years, the Trustees have issued their report with little fanfare and the media dutifully has reported on a trust fund depletion date that is poorly understood by most Americans.

The next fifteen years will be different. With the depletion of the trust fund reserves drawing ever nearer, the time available to enact changes to avert disruption and assure the long-term financial health of the system is shrinking. The discussions among policymakers and the public at large preceding the passage of reforms will be accompanied by a growing appetite for more information and greater understanding about the Social Security system.

The Panel believes that trust in public institutions is enhanced by greater understanding. Social Security is part of the bedrock of our institutions, accounting for nearly a quarter of Federal government expenditures. In this context, we believe it is paramount for the Trustees to communicate clearly and effectively with the general public about its finances.

Our recommendations revolve around improving the accessibility and transparency of the Trustees Report. In addition to meeting the needs of sophisticated audiences on the status of the trust fund relative to previous years, we recommend putting greater focus on communicating with readers who come to the Trustees Report afresh and without deep experience or knowledge although many of our recommendations would improve accessibility and transparency for those well versed in the Trustees Report as well.

We make several communications recommendations designed to improve understanding of the system's finances. The main theme is that the Trustees Report should be broadly accessible and transparent to Americans without specialized knowledge of the Social Security system.

**Presentation recommendation 1: Graphics.** The Panel recommends turning many of the Trustees Report's tables into graphs. For each assumption, historical data could be shown graphically alongside projected data.

**Presentation recommendation 2: Core messages.** The Panel recommends the Trustees focus the graphs further on the report's core messages.

**Presentation recommendation 3: Plain language.** The Panel recommends the Trustees follow the Federal plain language guidelines where possible.

**Presentation recommendation 4: Presentation of depletion date.** The Panel recommends refining the presentation of the trust fund reserve depletion date by providing further context, showing a simpler graph, and renaming the depletion date.

**Presentation recommendation 5: Communications strategy.** The Panel recommends enhancing the online and media communications strategy by improving the website user interface, creating a Frequently Asked Questions (FAQ) page, improving public outreach on social media, and improving OCACT's webpage on the Trustees Report. The Social Security Administration (SSA) should provide OCACT with a budget to hire communications and user experience professionals to help implement this.

**Presentation recommendation 6: Communicating results.** The Panel recommends clarifying and refining the meaning of the Trustees Report's findings by replacing the current high- and low-cost scenarios with confidence intervals, clarifying the objective of the intermediate-cost projection, and clearly indicating when the Trustees Report does and does not assume current law.

**Presentation recommendation 7: Implicit assumptions.** The Panel recommends expanding the Trustees Report's sensitivity analysis to encompass key implicit assumptions.

**Presentation recommendation 8: External accessibility.** The Panel recommends providing and supporting greater external access to the projection models used to produce the Trustees Report.

**Presentation recommendation 9: Past projections.** The Panel recommends OCACT regularly make available comparisons of the past projections of the assumptions to their past realizations.

## **Demographic assumptions and methods**

The demographic assumptions determine the projected size and age structure of the population into the future. The cost of the Social Security system depends largely on the ratio of the expected number of workers paying into the system and the expected number of people receiving benefits. Birth rates (fertility) are the primary determinant of the relative size of the working age and beneficiary cohorts and falling birth rates after the Baby Boom are the primary driver of our aging society. Death rates (mortality) are a secondary contributor to population aging and also determine how long people are expected to work and to receive benefits. New entrants to the population through immigration affect the size of the population and labor force, future levels of fertility, and the share of the population eligible to receive benefits. As the Panel spoke with experts on these topics and provided their own insights, it became clear that there is a significant amount of uncertainty around each of these assumptions, as reflected in the following recommendations. While the Panel presents specific recommendations, the reader is encouraged to review the report to understand the various points of view that were considered in arriving at these recommendations.

### **Fertility**

The period Total Fertility Rate (TFR) has been declining in the United States for more than a decade, most recently hitting a low of 1.73 in 2018. While many experts thought this was a consequence of the Great Recession, a low TFR has persisted through to the relatively robust economic conditions at present. Like many other assumptions noted in this report, the Panel feels we are in a period of heightened uncertainty as to what the long-term outlook for fertility may be. We recommend that OCACT continue to closely monitor all aspects of fertility: age at first birth, period fertility rates, and completed cohort fertility rates by age, race, income/education and native vs. immigrant status.



**Fertility recommendation 1: Fertility rate.** The Panel recommends slightly lowering the ultimate period TFR to 1.95.

**Fertility recommendation 2: Cohort fertility rates.** The Panel recommends allowing for a continuation of the long-term shift to older ages of motherhood, with long-term fertility being driven by assumptions about cohort fertility rates.

**Fertility recommendation 3: Immigration and fertility.** The Panel recommends OCACT develop the capability to model native and immigrant fertility separately.

## **Mortality**

Over the long-term there has been a steady increase in human life expectancy in the United States and all other industrialized countries. The fact that age-specific rates of mortality have declined at a more-or-less steady pace over long periods of time has led this and past Panels to encourage the Trustees to use this trend as the basis for making long-term projections.

Recently, however, the United States, has seen a striking reversal of progress in life expectancy, with the last 3 years all showing life expectancy at birth falling. Despite ongoing medical improvements in many areas, social issues including drug overdoses, obesity and suicide along with several severe flu seasons have resulted in mortality increasing rather than decreasing at many ages in recent years. While flu-related variations in death rates are normal, the societal issues present a trend that is difficult to project. While the Panel recommends continuing to assume that US mortality will improve over the long term, we also recommend that the Trustees and OCACT monitor emerging data and research, consider projecting little or no improvement for the very short term, and explicitly highlight in the TR the heightened uncertainty in predicting mortality at this point in time.

**Mortality Recommendation 1: Mortality improvement.** The Panel recommends: increasing the ultimate aggregate rate of mortality improvement to align with long-term historical experience, while reflecting recent poor experience in the short term; incorporating greater uncertainty in the projection of future mortality; and continuing to vary the ultimate rate of improvement by age group.

**Mortality Recommendation 2: Cause of death.** The Panel recommends OCACT project mortality in aggregate over the long-term rather than by cause of death, while acknowledging that cause of death analysis has significant value over the intermediate term.

**Mortality Recommendation 3: Heterogeneity.** The Panel recommends OCACT develop the capability to model mortality and other demographic assumptions by either educational attainment, income or both.

**Mortality Recommendation 4: Transparency.** The Panel recommends OCACT look for ways to improve transparency, understanding and reproducibility.

**Mortality Recommendation 5: Data compatibility.** The Panel recommends continuing to investigate differences between the starting mortality rates produced by SSA and the Human Mortality Database (HMD) and take appropriate action.

## **Immigration**

OCACT projections make a distinction between two types of foreign-born non-citizens: lawful permanent residents (LPRs) and other than LPRs. The latter category includes unauthorized immigrants, temporary workers, and students. The OCACT projects annual immigration flows for LPRs and other-



than-LPRs. It also projects legal emigration flows (including LPRs and citizens) and other-than-LPR emigration flows. Finally, it projects the annual number of individuals with other-than-LPR status who become LPRs. The total flow in each category is broken down by age and sex.

OACT applies current law caps to project the annual inflow of those categories of LPRs that are capped by law. There are certain categories that are not capped, primarily immediate relatives of citizens. Annual legal emigration is assumed to be 25 percent of the level of LPR immigration. Annual other-than-LPR immigration is assumed to be 1,350,000. Transfers from other-than-LPR to LPR status are assumed to equal one-third of the other-than-LPR inflow. All flows except other-than-LPR emigrants are held constant. Other-than-LPR emigration is assumed to be proportional to the size of the other-than-LPR population, which is projected to increase. Thus, net annual immigration is projected to decline from about 1.4 million in 2020 to 1.2 million in 2095.

LPR immigrants' labor force behavior and earnings are assumed to be the same as that of the native born. The assumptions for other-than-LPR immigrants vary by category.

**Immigration Recommendation 1: Population basis.** The Panel believes the Trustees' assumptions are reasonable for the near term (five to ten years). Beyond the next five to ten years, the Panel recommends tying assumed levels of LPR immigration and other-than-LPR immigration to the size of the population, with the three scenarios reflecting the range of plausible outcomes for immigration projected as a fraction of the population.

**Immigration Recommendation 2: Heterogeneity.** The Panel recommends OACT develop the capability to reflect more heterogeneity among immigrants in the projection model to capture the changing characteristics of immigrants.

## **Economic assumptions and methods**

The economic assumptions are key determinants of the Social Security program's cost and income. The labor force participation rate and the unemployment rate assumptions determine the size of the working population contributing revenue and earning eligibility for benefits. Real wage assumptions determine how the earnings generated by the working population are expected to grow over time. Wage growth increases payroll tax revenue and leads to future increases in benefit levels. The taxable share assumption describes the percentage of earnings covered by Social Security that fall below the Social Security payroll tax threshold. Inflation rates determine how much the Cost of Living Adjustment (COLA) will increase existing benefits and affects the size in nominal dollars of Gross Domestic Product (GDP), earnings and taxable payroll. Interest rates determine expected revenue from trust fund reserves (held as special issue US Treasury bonds) and are the discount factor used to calculate financial measures summarized over a period of years. While the Panel presents specific recommendations, the reader is encouraged to review the report to understand the various points of view that were considered in arriving at these recommendations.

### **Labor Force Participation**

The projections of labor force participation affect both the revenues and the costs of the Social Security system. Higher rates of labor force participation mean a larger Social Security tax base, which boosts revenues and eventually boosts benefits as well.

**Economics Recommendation 1.1: Labor force participation.** The Panel agrees with the 2017 Technical Panel on Labor Force Participation that the OCACT model should assume that the forces underlying the long-term trends in labor force participation abate slowly over the medium term. In particular, we recommend that the historical trend of 0.14 percentage point per year decline in age-adjusted prime-age male labor force participation abate gradually over 25 years.

**Economics Recommendation 1.2: Labor force participation.** The Panel recommends that the historical trend of 0.5 percentage point per year decline in the labor force participation of men and women ages 16–19 and the 0.35 percentage point per year decline in labor force participation of men ages 20–24 abate gradually over 25 years.

**Economics Recommendation 1.3: Labor force participation.** The Panel recommends that the Trustees maintain their assumption of increasing labor force participation of older workers.

**Economics Recommendation 1.4: Labor force participation.** The Panel recommends that the Trustees assume that the cyclical recovery in labor force participation following the Great Recession has ended and use current labor force participation rates as the jumping off point for the trends discussed in recommendations 1.1 and 1.2.

**Economics Recommendation 1.5: Labor force participation.** The Panel recommends that the low-cost scenario assume that labor force participation rises gradually over 25 years, so that participation in 25 years for each age group is equal to participation 25 years prior and then remain at that level for the remainder of the projection. For the high-cost scenario, we recommend allowing the declines suggested above to abate slowly over the entire 75 years of the projection, instead of 25 years.

**Economics Recommendation 1.6: Labor force participation.** The Panel further recommends that labor force participation be better linked to changes in wages. Under current assumptions, a given percentage increase in the labor force raises payroll one-for-one, without accounting for the likely wages (and hours) of those whose participation is changing, whereas most of these changes likely are for low-education workers and teenagers.

**Economics Recommendation 2: Unemployment.** The Panel recommends lowering the assumed ultimate unemployment rate in the intermediate scenario from 5.5 percent to 4.8 percent and to 3.8 percent and 5.8 percent in the low-cost and high-cost scenarios, respectively.

## Real Wage Growth

The rate of real earnings growth is one of the most important assumptions in the Social Security projections. While higher earnings growth eventually leads to higher benefit growth for current and future workers, it has no effect on the benefits of the currently retired. Thus, the higher the rate of real earnings growth, the smaller the actuarial imbalance in the system.

The Trustees break down the real earnings into five components: (1) economy-wide productivity growth; (2) the labor share of output; (3) Social Security earnings as a share of total compensation; (4) average hours per worker; and (5) the ratio of the GDP price deflator to the Consumer Price Index (CPI).

$$\text{Real earnings per worker} = \frac{(1) \frac{\text{Nominal GDP}}{\text{GDP Deflator}}}{\text{Hours}} \times \frac{(2) \text{Compensation}}{\text{GDP}} \times \frac{(3) \text{Earnings}}{\text{Compensation}} \times \frac{(4) \text{Hours}}{\text{Employment}} \times \frac{(5) \text{GDP deflator}}{\text{CPI}}$$

**Economics Recommendation 3: Real wage growth.** For the intermediate projection, the Panel recommends the Trustees assume that average real earnings per worker increase 1.08 percent per year from 2028 to 2063, down from the 1.18 percent assumed in the 2019 Trustees Report. For the low-cost and high-cost scenarios, we recommend an average increase of 1.71 percent and 0.45 percent, respectively, per year (down from 1.77 and 0.6 in the 2019 Trustees Report).

**Economics Recommendation 3.1.1: Real wage growth: productivity growth.** The Panel recommends that the Trustees lower their long-run assumption for non-farm business productivity growth to 1.9 percent and for economy-wide productivity growth to 1.55 percent.

**Economics Recommendation 3.1.2: Real wage growth: productivity growth.** The Panel recommends maintaining a 0.3 percentage point difference for the high- and low-cost scenarios, so that non-farm business productivity growth is 1.5 percent in the high-cost scenario and 2.1 percent in the low-cost scenario and economy-wide productivity growth is 1.25 percent in the high-cost scenario and 1.85 percent in the low-cost scenario.

**Economics Recommendation 3.2.1: Real wage growth: labor share.** The Panel recommends that the Trustees assume that the labor share of GDP be 61.5 from 2028 on. This means lowering the growth in the compensation share of GDP over the first ten years of the projection (2019 to 2028) from an average of 0.384 percent per year as in the 2019 Trustees Report to 0.114 percent per year.

**Economics Recommendation 3.2.2: Real wage growth: labor share.** The Panel recommends retaining the Trustees' assumption of no change in the ratio of compensation to GDP after 2028 in the intermediate scenario.

**Economics Recommendation 3.2.3: Real wage growth: labor share.** The Panel recommends incorporating uncertainty in the trajectory of the labor share, with the low- and high-cost scenario having a labor share that trends 0.05 percentage points per year up and down, respectively, over the intermediate 25-year horizon, before stabilizing. Under these scenarios, the labor share at the end of 25 years would be 60.3 percent of GDP under the high-cost scenario and 62.8 of GDP under the low-cost scenario.

**Economics Recommendation 3.2.4: Real wage growth: labor share.** The Panel recommends that OCACT analyze net labor shares by economic sector: non-housing non-farm private, housing, government and non-profit institutions.

**Economics recommendation 3.3.1: Real wage growth: earnings to compensation.** The Panel recommends that the Trustees use an average of 0.07 percentage point increase in the health spending share of compensation as a pre-excite tax value for 2028–2093, which is the result of assuming an excess cost growth rate of 1 percent gradually declining to 0.5 percent over 75 years. This assumption translates into a decline in the earnings share of compensation of 0.07 percentage point per year from 2028–2093.

**Economics recommendation 3.3.2: Real wage growth: earnings to compensation.** The Panel recommends that the Trustees maintain the range of plus or minus 0.1 percentage point for the average change in high-cost and low-cost scenarios, so that earnings to compensation would decline 0.17 percentage point per year in the high-cost scenario and increase 0.03 percentage points per year in the low-cost scenario.

**Economics recommendation 3.4.1: Real wage growth: hours worked.** The Panel thinks that the assumption of continuing declines in average hours worked of 0.05 percent per year is reasonable. We

also think the changes in hours under the high- and low-cost scenarios of -0.15 percent per year and 0.05 percent per year, respectively, are reasonable.

**Economics recommendation 3.4.2: Real wage growth: hours worked.** Given the changes in labor force participation the Panel is recommending, the Panel recommends OCACT investigate more fully the impact of changing the sex/age mix of the workforce hours. As noted in the methodology section, a microsimulation model would account for these changes automatically, but, short of that, OCACT should perform some analysis to see if these effects are likely to be important.

**Economics recommendation 3.5: Real wage growth: PGDP-CPI price differential.** The Panel recommends no changes to the Trustees' assumptions about the wedge between the GDP deflator and the CPI.

### Real interest rates

**Economics recommendation 4.1: Real interest rate.** The Panel recommends allowing real interest rates to rise gradually over the medium term (25 years) to 2.3 percent, a level closer to, but still below, the average since 1962. That would mean that the real interest rate would average about 1.2 percent over the next 25 years.

**Economics recommendation 4.2: Real interest rate.** The Panel recommends that real interest rates rise gradually over 25 years in both the low-cost and high-cost scenarios, reaching 1.5 percent in the high-cost scenario and 3 percent in the low-cost scenario. Under the 2019 Trustees' projections, these values were 2 percent and 3 percent, respectively. We believe that the magnitude of uncertainty is larger than encompassed by the current range of ultimate values.

### Inflation

**Economics recommendation 5.1: CPI.** The Panel recommends lowering the assumed rate of CPI-W inflation from 2.6 percent to 2.4 percent.

**Economics recommendation 5.2: CPI.** The Panel recommends maintaining a 0.6 percentage point difference between the intermediate and low- and high-cost scenarios, so that the CPI-W is 1.8 percent in the high-cost scenario and 3.0 percent in the low-cost scenario.

### Taxable share of covered earnings

**Economics recommendation 6.1: Taxable share.** The Panel recommends that OCACT assume that the taxable share of covered earnings will continue to decline over the medium term. The Panel recommends allowing a 0.15 percentage point decline to abate slowly over 25 years. That would bring the taxable share down to about 80.8 percent by 2043.

**Economics recommendation 6.2: Taxable share.** The Panel recommends using a similar 25-year trend for the low- and high-cost scenarios, beginning at -0.4 percentage point per year for the high-cost scenario (the time trend from 1982 through 2012) and +0.1 percentage point per year for the low-cost scenario to be symmetric, and allowing these trends to abate over 25 years. Over the 2028–2093 period, this recommendation would lower the growth rate of taxable earnings by 0.04 percentage point per year for the high-cost scenario and increase it by 0.01 percentage point per year in the low-cost scenario.

## Program-specific assumptions and methods

The Trustees' projections of the cost of the OASI portion of the program are based on the number of retired worker and dependent beneficiaries, as well as average benefit levels. Beneficiaries are projected by age, sex, and marital status. In each cohort, the number of individuals receiving retired worker benefits at age 62 is tied to labor force participation and the time to full retirement age.

### Benefit model

**Benefit model recommendation 1: Model comparison.** In Methods Recommendation 2, the Panel recommends that OCACT develop and maintain a core microsimulation model as part of an expanded projection toolkit. The Panel specifically recommends comparing benefit projections based on the current methodology against results from alternate models such as a microsimulation model. Any significant differences should be analyzed and appropriate action taken.

**Benefit model recommendation 2: Benefit claiming patterns.** In Presentation Recommendation 7, the Panel recommends expanding the Trustees Report's sensitivity analysis to key implicit assumptions. With respect to specific assumptions needed to project benefits, the Panel recommends that SSA conduct studies on the sensitivity of key financial outcomes (cost and income rates and the trust fund reserve depletion date) to benefit claiming age patterns.

### Disability

The disability incidence rate was highlighted in the most recent Trustees Report due to a significant downward shift over the past ten years. Even when adjusted for declining unemployment rates, this shift has not been totally explainable. Discussions with experts in the insurance industry confirm their observation of a downward shift in disability insurance incidence rates that is being analyzed.

**Disability Recommendation 1: Incidence rates.** The Panel recommends lowering the ultimate age-sex adjusted disability incidence rate to 4.9, consistent with the Panel's preferred assumption of 4.8 for the long-run unemployment rate and taking into account some of the recent observed downward shift in disability incidence. Because the incidence rate appears to have undergone rapid changes over the last decade, with some recent signs of reversal among the youngest age groups, the Panel recommends that SSA closely monitor trends in incidence rates as they evolve over time and explicitly linking the disability incidence and unemployment rate assumptions in its projections.

**Disability Recommendation 2: External consultation.** With respect to making judgments about the future evolution of disability incidence rates, in addition to closely monitoring trends in Social Security Disability Insurance (SSDI) incidence rates, the Panel recommends that the SSA maintain regular contact with experts in the disability insurance industry to benefit from these experts' insights into disability incidence rates experienced in the private market.

## 1.0 INTRODUCTION

The charter of the Technical Panel was sufficiently broad to allow us to review and discuss all aspects of the Trustees Report. This included reviewing all assumptions inherent in the projections of the Trustees as well as the complex methodology that was utilized and the manner in which the results were communicated and presented. In this process, we turned over many rocks and focused primarily on the “big rocks”.

The Technical Panel was focused particularly on the likely increased demands on OCACT as the date of trust fund depletion nears and potential changes to Social Security receive heightened attention. This report makes recommendations that are intended to enhance OCACT’s ability to evaluate the potential future financial status of the Social Security system under current law and a wide variety of proposed system reforms in a robust and timely manner and to better convey its findings - and the range of uncertainty around those findings - to stakeholders. The analysis and results contained in the Trustees Report are reasonable and meaningful for today. The recommendations contained herein are intended to position the Trustees Report to take advantage of evolving techniques and tools in order to be equally meaningful and insightful going into the future.

The comments and recommendations herein represent the considered thoughts of a diverse group of experts from the fields of actuarial science, demography and economics. Professional judgment is an essential element of the Trustees’ projections. Our independent review seeks to contribute to the body of actuarial, demographic and economic thinking that will inform this professional judgment in the years ahead. The Panel believes that the choice of assumptions and methods in any projection model can and does vary among honest and dedicated professionals. The willingness of the Trustees and Chief Actuary to open up their projections to detailed scrutiny and consider the recommendations of independent experts is a positive feature that should increase the public’s confidence in the projections.

This report is the culmination of nearly nine months of collaborative research by the Technical Panel. It includes the Panel’s observations and recommendations regarding:

- A roadmap for **modernizing the technology** supporting the financial projections;
- Ideas for **improving public understanding** of the key drivers of the financial status of the Old Age, Survivors and Disability Insurance (OASDI) system;
- Recommendations for changes in the economic and demographic assumptions underlying the OASDI projections; and
- Suggestions for directly incorporating the **uncertainty** inherent in many of the assumptions into the methods underlying the Trustees’ projections.

Our conclusions are the result of a detailed review of the 2018 and 2019 Trustees Reports and after working closely with the Chief Actuary and his staff, consulting with staff representing the four ex-officio Trustees, congressional committees, and the Congressional Budget Office (CBO), and speaking with numerous academic and private sector experts.

## 1.1 Modernizing

The Panel recommends commencement of a modernization effort that takes full advantage of today's ability to develop models with more flexibility and to process data faster. These modernization recommendations seek to assure that OCACT's good work will continue in the years ahead.

The Panel's recommendations regarding methods are made following a review of the current methodology with OCACT. The work of OCACT is model and data processing intensive. While the current hardware and software have been adequate to date, they do constrain OCACT's ability to directly reflect many characteristics of the covered population and to model proposed changes to the system in a robust and timely manner.

Historically, the OCACT projection systems have been updated periodically on an incremental basis. This is understandable when the complexities and ongoing requirements of the current processes as well as the cost of substantial modifications are considered. However, at this point in time the recommendations focus on something more than incremental changes.

The recommendations envision a significant movement forward in the methods and processes that are used to make the financial projections for the Trustees Report. These recommendations contemplate a multi-year project tapping the expertise of outside experts who are skilled in such transformational undertakings. The detailed reasons for and value of implementing these recommendations are discussed within the report. It is important to note that such an implementation will enhance the nimbleness and robustness that will be required of the systems in the future as the complexities associated with the changing environment are recognized. In making these recommendations, we recognize the need for additional budget to fund this transformation, an investment which we believe will provide significant returns in future years.

## 1.2 Improving Public Understanding

The importance of effective communication of the projections made in the Trustees Report cannot be overstated. It is essential to an improved public understanding of the issues surrounding the future of Social Security and the types of reforms needed to ensure its financial sustainability. The Panel engaged with users of the Trustees Report, including policymakers and other groups that publish projections, as well as journalists and communications specialists to identify opportunities for enhancing the communication of findings from the Trustees Report. Effective communication requires an understanding of the subject matter between the preparers of the Trustees Report and the users of the report. In particular, many of these users serve as interpreters of the report for the general public.

Communication in today's world is much different than in the past. With the prevalence of social media and immediate access to current news, the Trustees Report has many opportunities to convey a clear, focused message to a wide range of audiences in a variety of forms. The recommendations are intended to provide a vision of how the findings from the Trustees Report might be more clearly and effectively communicated to a broader range of people.

There have been minimal changes to the OASDI system since 1983 except for the 1994 and 2015 reallocation of payroll taxes between the Disability Insurance and Old-Age and Survivors Insurance Trust Funds. The nuances inherent in the Trustees Report regarding the trust fund and the 75-year actuarial



balance have been of little practical consequence to the readers of the report. Thus, each year the Trustees issue their report with little fanfare and the media dutifully reports on a trust fund depletion date that is poorly understood by most Americans.

The next 15 years will be different. With the impact of the very large negative cash flows on the unified U.S. budget and depletion of the trust fund reserves looming, changes will be required in order for the system to continue to pay scheduled benefits. The inevitable discussions among policymakers and the public about program reform will be accompanied by a growing appetite for more information and greater understanding about the Social Security system.

We make several communications recommendations designed to improve understanding of the OASDI system's finances. The main theme is that the Trustees Report should be broadly accessible and transparent to Americans without specialized knowledge of Social Security. The Trustees Report is a technical report that addresses a very complex set of issues that are used to address the financial status of the OASDI program. As with any technical report, the value of the report is enhanced by making the highly technical content readable and understandable.

Social Security is part of the bedrock of our institutions, accounting for nearly a quarter of Federal government expenditures. Public trust in U.S. social institutions, including the government, is near record lows. In this context, the Panel believes that it is paramount for the Trustees of Social Security to communicate clearly and effectively with the general public about the program's finances.

### 1.3 Uncertainty

A common theme in discussions that the Panel had with many external experts regarding various topics was that we are more uncertain about some of the most important assumptions in the Trustees Report now than has often been the case in the past. This theme, expressed by experts within the insurance industry and the academic community alike, applies particularly to assumptions regarding mortality, fertility and disability. As the Panel discussed these and other assumptions that have an important impact on the Trustees projections, it frequently was not clear if recent experience is a trend, an aberration, or a new normal.

For a program such as OASDI that involves lifelong commitments to the American public, the ability to understand that a wide range of outcomes may occur due to many uncertain factors is necessary. Techniques for reflecting and portraying uncertainty and the interconnectedness of assumptions have evolved greatly over the last several decades, enabled by advances in technology.

The Panel believes it is prudent at this time to place greater emphasis on uncertainty in the Trustees Report and to incorporate state-of-the-art techniques to understand the possible range of outcomes for the system. As more understanding is gained, policymakers may be able to take advantage of these insights to inform legislative reforms.

### 1.4 Additional Information

This report is the culmination of an effort that involved consultations and discussions with a wide array of experts in the various subject areas, many of whom are identified in the Acknowledgements section. The Panel considered a full range of views on the various assumptions underlying the Trustees'



projections. For illustrative purposes, the impact of the Panel's consensus recommendations is shown in a supplemental report on the SSAB website at: [www.ssab.gov](http://www.ssab.gov).

All Panel members have disclosed any potential conflicts of interest. For these disclosures and additional information, including papers, presentations, agendas and other materials utilized by the Panel, the reader is encouraged to visit the SSAB website.

## 2.0 METHODS

The work of OCACT is data processing and computationally intensive. In the recommendations in this chapter, the Technical Panel describes a modernization effort that takes full advantage of today's ability to process more data faster, while creating a flexible platform that can accommodate an expanded array of potential future changes to the program. These recommendations seek to ensure that OCACT's good work will continue in the years ahead, both during and after any system reforms.

### 2.1 Model refresh

**Methods Recommendation 1:** The Panel recommends that OCACT reengineer and rebuild their computation model(s) using a programming language that supports object-oriented programming (e.g., Python, R, C++) which can be run in a modern environment that includes parallel processing (e.g., cloud processing), automates testing/validation and that streamlines and eliminates many of the manual handoffs between team members that exist today. We recommend that OCACT be given the budget and access to outside experts to begin this multi-year effort now.

In developing the Trustees' projections, OCACT relies heavily on a number of different computer programs, many written in the FORTRAN programming language. FORTRAN was developed in the 1950s for scientific and engineering applications and has been widely used for tasks involving heavy numerical computations.

While these programs have served OCACT well over the years, they have some important inherent limitations that can be mitigated by a modernization effort. Incorporating modern software languages and architecture will permit the modeling of characteristics beyond age and gender (and occasionally marital status). Educational attainment and income level are just two examples of additional, potentially relevant attributes that currently are impractical to model.

Modernizing the architecture will enable operational improvements for OCACT. For example, the time and effort devoted to quality control can be reduced to the extent that a more integrated model replaces today's array of distinct programs. In addition, modernization brings with it the advantages of greater automation of testing and validation.

The OCACT's staffing necessarily will evolve with these changes. Computer Science graduates will assimilate more readily into the work of the office as the modern tools and languages taught on college campuses today are integrated into OCACT's projection models. And because OCACT staff of the future will spend less time focused on specializing in a discrete element of the projection process, they will more readily develop the essential deep understanding of the entire projection process.

### 2.2 Expand use of microsimulation techniques

**Methods Recommendation 2:** The Panel recommends OCACT develop and maintain a core microsimulation model as part of an expanded projection toolkit.

The current projection methodology involves applying various demographic, economic and program-specific assumptions to groupings of the population by age and sex. This top-down methodology demands significant rigor and discipline in ensuring consistency between and among the various

assumptions. These assumption correlations are not explicitly documented because they are subject to moment-by-moment judgment when modeling any specific projection scenario.

Microsimulation is a modeling technique that can be thought of as more bottom-up in that it begins with granular data at the individual level. These granular data are projected forward in a disciplined manner in which the relationships between and among the key projection assumptions are explicit. A key advantage of this technique is the assurance of internal consistency of assumptions when conducting projections, especially during times of demographic or economic transition.

As an example, the microsimulation methodology would permit the Trustees to more explicitly project different what-if scenarios as part of an examination of the impact on the program of the recent phenomenon of growing income disparity.

The top-down projection methodology currently deployed by the OCACT has been used for many years. The bottom-up microsimulation methodology is a newer projection methodology that is growing in popularity because of its many advantages. Its emergence has been enabled by the availability of newer, more efficient programming languages, as well as faster computer processors capable of processing much larger data sets.

The Panel believes that over time the microsimulation model will become increasingly important in informing the judgment that goes into the current methodology. In time, we expect that OCACT's projections will incorporate elements of both the top-down and bottom-up approaches.

## 2.3 Expand use of available government administrative data

**Methods Recommendation 3: The Panel recommends expanding the use of available government administrative data to refine and improve OCACT's projections, including of labor force outcomes and household benefit payments.**

The OCACT's projection methodologies start with a snapshot of U.S. workers and program beneficiaries. Today, there is considerable reliance on Master Beneficiary Record files that have sparse demographic information on individuals, especially their marital status. The Panel recommends that this data be augmented by other administrative data sources (e.g., tax data from the U.S. Treasury) to improve projections of key employment variables such as earnings, employment, and labor supply elasticities across household earner types, as well as household benefits (dependent, spousal and survivor benefits, which depend on a marriage match).

Data augmentation that captures employment and earnings from administrative data can help improve projections of labor force outcomes. Augmentation of spousal and survivor data can help improve projections of this very sizeable component of total Social Security benefit payments.

Acknowledging the legal barriers that generally prevent sharing data across government agencies, nothing prevents linking the existing data with demographic data from panel studies such as the Panel Study of Income Dynamics by the Institute for Social Research at the University of Michigan, the Health and Retirement Study sponsored by SSA and the National Institute on Aging, and the Survey of Income and Program Participation by the U.S. Census Bureau.

## 2.4 Develop capacity to model dynamic effects on the economy

**Methods recommendation 4:** The Panel recommends that OCACT investigate the dynamic impact of potential policy changes and what-if scenarios on the macro-economy, including areas such as capital formation, the payroll tax base, wage growth, and wage-indexed benefits and incorporate such effects in the Trustees Report as appropriate.

The Panel believes that in addition to the financial projection scenarios currently developed by OCACT, policymakers and the public would benefit by the insights gleaned from additional projection scenarios that embrace the possible macro-economic effects of prospective Social Security policy changes.

For example, macro-economic theory suggests that future scenarios that reflect substantially different Social Security benefit payments (and/or substantially different payroll tax rates) following the projected trust fund reserve depletion date also should reflect the likely disparate effects on the payroll tax rate, GDP, the payroll tax base, and, thus, program revenues. These important effects are not evident in the scenarios presented in the Trustees Report.

The Panel recommends that OCACT begin this investigation of dynamic impacts as a research project. We expect that incorporating dynamic impacts into OCACT's projections would occur only after a rigorous examination process. We offer these suggestions:

- The research should examine assumptions related to debt, labor supply elasticities, and tax avoidance, as well as the potential interdependencies between and among these assumptions.
- The research should also shed light on which factors are best modeled explicitly versus implicitly and what is the optimal degree of detail in the assumed firm production assumptions.
- There is substantial literature and historical evidence that can offer guidance in setting the empirical basis for parameters and calibration targets for defining the model's economic environment.
- In addition, and more generally, there is now a rich set of dynamic models that OCACT and the Trustees could explore. In particular, the CBO recently commissioned a study that examined the impact of a highly stylized Social Security reform policy using seven different models.<sup>1</sup> Much can be learned by closely examining these and other alternative models.

In the meantime, the Panel recommends that the Trustees adopt terminology so that projections that do not incorporate dynamic effects be more clearly identified as such.

## 2.5 Statistical methods

**Method Recommendation 5:** The Panel recommends incorporating recently developed statistical methods when estimating expected outcomes as well as future uncertainty.

First, the various long-term projections in the Trustees Report currently are based on a variety of Demographic, economic and program-specific assumptions chosen by studying the past and applying professional judgment about what this portends for the future. The Panel believes that this process of assumption development can be improved by taking into account recent statistical methods to develop

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<sup>1</sup> <https://www.cbo.gov/publication/55246>

long-term predictions based on extrapolating patterns in past data (e.g., Muller and Watson, 2016; Stock, 2019). These methods also can be used to inform the speed of the transition period to a longer-run steady state. Some on the Panel recommend using these methods exclusively while others feel that there is still an important role for judgment to play.

Second, the alternative cost projections (low-cost and high-cost) currently are based on varying numerous assumptions from their “intermediate-cost” value to what are considered “optimistic” and “pessimistic” values for each assumption in a single projection run. However, there is no step in the process that ensures that the combination of assumptions is mutually consistent, either statistically or theoretically or both. For example, in the low-cost scenario, it is assumed that disability rates are low (i.e., a large share of the population is healthy) and OASI benefits are paid over a shorter time period (i.e., a large share of the population is *not* healthy). The probability of either the low- or high-cost scenario occurring is extremely low. We recommend instead calculating 95% confidence intervals for each variable in an internally consistent manner using the recent statistical methods described above, as in the Stock (2019) discussion of uncertainty surrounding projections of OASDI-related parameters. As discussed further in the presentation section, we recommend ultimately replacing the low-cost and high-cost projections with the endpoints of this confidence interval. In the interim, we recommend that the assumptions within each scenario be internally consistent.

Third, currently a sensitivity analysis is performed on each variable separately, wherein an outcome such as the depletion date or actuarial balance is calculated under the high- or low-cost scenario for that variable alone, holding other variables constant. We recommend placing each variable at the endpoints of its 95% confidence interval, calculated using a recent statistical method.

Presenting recent statistical models, their parameters, and the origin of these parameters explicitly, perhaps in an Appendix of the Trustees Report, with a brief discussion in the main text of the report when appropriate, will make the derivation and rationale for the Trustees’ results more transparent. Even if judgment ultimately is used, we believe OCACT, the Trustees and users of the Trustees Report will gain valuable insight from these models and what they predict, including a description of the process and rationale of the judgmental elements used to arrive at the final parameter value.

## 2.6 Interpretation of the projections: current law

**Methods recommendation 6:** The Panel recommends that the projections should make consistent assumptions about non-OASDI variables that reflect the most plausible projection of future values *or* current law but not a mix of the two approaches within the same projection.

In some cases, such as for immigration, the Trustees rely on current law in establishing the assumed number of annual immigrants. However, in projecting no bracket creep after the first decade in estimating revenue from the taxation of Social Security benefits, the Trustees depart from current law.

We recommend choosing non-OASDI assumptions so that they reflect an internally consistent framework. The Trustees should explore the possibility of presenting projections under two distinct sets of baseline projections for non-OASDI variables: (1) a most plausible projection of

future values, e.g., those that minimize *ex ante* mean squared error, as in the new statistical methods suggested in the methods recommendation; and (2) current law. Of course, OASDI variables in each case would be calculated under the baseline appropriate for the exercise. For example, shortfall measures would continue to be calculated under current policy (scheduled benefits) while required reductions in benefits upon trust fund depletion would be calculated under current law (payable benefits).

Our inclination is to include both of these projections in the Trustees Report, with an emphasis on the most plausible projection. If all assumptions are most plausible and Social Security policy does not change, the projections can be compared readily against reality.

## 2.7 Methods Supplement: Advantages of adopting a modern computing environment

**Modernizing OCACT's computing environment would make it easier to build an integrated model that could be executed in a single step and take advantage of parallel processing.** The current OCACT "model" is actually a series of different programs, where computations are done in a sequence of multiple steps with a fair amount of manual intervention and handoffs from team to team within OCACT. While integration of the existing programs may be possible, we feel that approach would be susceptible to increased coding bugs, as the unified program would become unwieldy without a comprehensive object model.<sup>1</sup> An integrated model built with an object-oriented coding base and appropriate quality controls, however, could be executed simultaneously across a range of scenarios ("parallel processing"), as is now common in modern actuarial and economics analysis. This would make it possible to run a rich set of model-consistent stochastic scenarios across the entire model, where thousands of sequences of potential exogenous assumptions are individually varied to gauge uncertainty.

**Modern computation environments support automated testing and validation, a well-established "best practice" in software engineering.** In particular, a suite of "unit," "functional" and, in some cases, "regression" tests (known as the "test suite") are constructed and accumulated over time. Whenever the model is executed, these tests are automatically run. These tests are reusable, repeatable, and objectively determined ahead of time. New model updates, if properly modularized, do not have to be coordinated across all staff; they are simply incorporated, and the test suite is run. Related, Integrated Development Environments (IDE's) are substantially more developed for modern programming languages like Python. These IDE's include basic tools like code completion that ensures consistency, code syntax checking, code runtime analysis (bottleneck analysis) and a wide range of easy-to-use debugging tools.

**The adoption of a modern software development process, programming language and computing environment would also substantially reduce training costs of new staff and allow staff to more easily understand how their work fits into the overall projection.** Modern languages support self-documentation as well as the automated generation of object model descriptions, code logic descriptions and even external documentation. Programmers would also have greater visibility to the entire code logic, reducing communication costs and bugs. Massive community-based support for modern coding languages provides many free online learning resources. Because modern languages require substantially less work to get a job done, they are also more enjoyable to learn and use. Not surprisingly, many students are already learning languages like Python and R in school and on their own. In contrast, FORTRAN is not regularly used today except to support legacy code. For example, a major online job board was checked on July 17, 2019 for job postings. It listed 1,266 jobs listing Python in the job title or desired skill set section and just two FORTRAN jobs (of which one appeared to be related to moving existing code to a modern coding environment). Another online popular website for contract coders included 3,249 available contractors who listed Python as a main skill set and no contractors listing FORTRAN.

**Reengineering the current model, using an object-oriented programming language and running the model on modern infrastructure (e.g., a "cloud" environment) would make it much easier to directly reflect more of the heterogeneity of the US population in the projection model.** Many assumptions in the OCACT model are applied to population counts that vary by only a few factors, generally age, gender and sometimes marital status. OCACT staff told Panel members it would be a major undertaking in the...

## 2.7 Methods Supplement continued

...current coding environment to directly reflect more population attributes, such as educational attainment or income in the model. Technical Panels, including this one, often recommend considering additional attributes in the hopes that additional detail can result in more robust projections. Currently, determining how the heterogeneity of the population might affect the projected aggregate results relies on informed judgment. This was the only practical approach in years past when computer processors were slower and not capable of distributed processing, but this is no longer the case.

**Object-oriented languages allow for dynamic memory allocation which makes handling large data sets much easier.** FORTRAN's standard memory allocation on a computer is statically bound at compilation time of the code.<sup>2</sup> As a result, considerable effort is required within FORTRAN to write and rewrite this static allocation to process large data sets. FORTRAN's limitations make it difficult to process large data sets, requiring OCACT to use small samples (e.g., 300,000 households) despite being in the unique position of having access to the full universe of relevant participant data. For heavily aggregated projections, these samples may be sufficient in size. However, for analyses that focus on particular subgroups (e.g., the impact of a potential Social Security policy change on people without a college education), it would be desirable to use a much larger sample. Modern coding languages support dynamic memory allocation (and deallocation known as "garbage collection") that allows data to be processed with ease, meaning that OCACT could run all estimates using the universe of data, without having to decide when such use is required.

<sup>1</sup> In theory, if the FORTRAN code base were fully integrated, it could be run in parallel using tools such as MPI and OpenMP (or "hybrid computing" that combines the two). The ongoing variable costs of MPI and OpenMP, which require CPU computing, are higher than modern coding environments that, for example, exploit GPU computing. For example, with major computing cloud providers, it is now possible to obtain up to 40,000 simultaneous GPU processing cores, producing 70 trillion calculations in total per second, for under \$7 per hour. These costs are falling over time.

<sup>2</sup> FORTRAN 90 supports dynamic allocation with some extra work, which is uncommon in practice.



## 3.0 PRESENTATION

The Panel believes that trust in public institutions is enhanced by greater understanding.<sup>2</sup> Social Security is part of the bedrock of our institutions, accounting for nearly a quarter of Federal government expenditures. At least half of Social Security beneficiaries receive the majority of their income from Social Security.<sup>3</sup> In this context, we believe it is paramount for Trustees and other leaders to communicate clearly and effectively with the general public about its finances.

Our recommendations revolve around improving the accessibility and transparency of the Trustees Report. Trustees Reports historically have been focused on updating sophisticated audiences on the status of the Trust Fund relative to previous years. We recommend putting greater emphasis on communicating with readers who come to the Trustees Report afresh without deep experience or knowledge. Many of our recommendations could improve accessibility and transparency for those not already steeped in the issues, as well as for those well versed in them. We begin with the accessibility of the Trustees Report and address transparency in the next section.

### 3.1 Improve accessibility of the Trustees Report

The technical nature of the Trustees Report can be forbidding for many would-be readers. Even the language of summary materials such as the Summary and Highlights can be inaccessible. Improved accessibility would be helpful not only to the general public but to Congress, other policymakers, the media, and researchers.

#### ***Expand and improve graphical presentation***

We first consider the accessibility of the graphs, before turning to the writing. Presenting graphical results is more an art than a science. Nonetheless, experts have developed graphical presentation guidelines that can be implemented in the Trustees Report.

**Presentation recommendation 1.** The Panel recommends turning many of the Trustees Report’s tables into graphs. For each assumption, the historical data could be shown graphically alongside projected data.

As the 2015 Technical Panel report notes, the Trustees Report has a number of large tables of information. In many cases this information could be summarized following the adage that “a picture is worth a thousand words.” To illustrate how this recommendation could be implemented, in **Figure 1** we show an existing table of data on mortality assumptions from the Trustees Report, as well as a suggested graph to replace them.

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<sup>2</sup> Numerous polls suggest trust in government and other institutions is at a low point. See for example, Pew Research Center: <https://www.people-press.org/2019/04/11/public-trust-in-government-1958-2019/> and Gallup, 2019 Trust in Government Poll, available at <https://news.gallup.com/poll/5392/trust-government.aspx>. Also

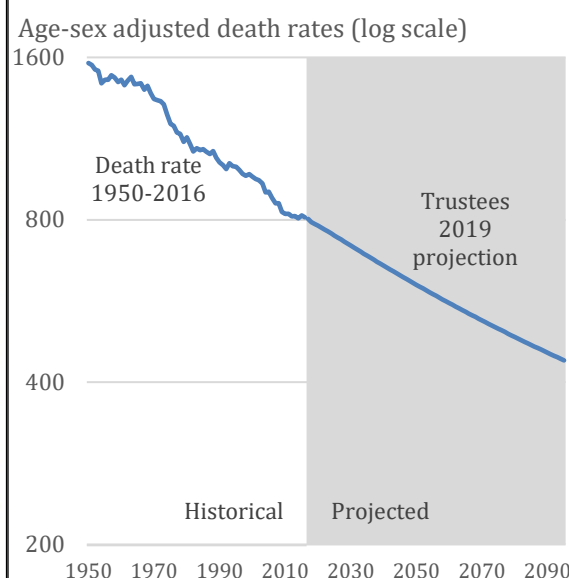
<sup>3</sup> See Bee and Mitchell, “Do Older Americans Have More Income Than We Think?” U.S. Census SESH Working Paper #2017-39, and Social Security Administration, “Income of the Aged Chartbook, 2012,” SSA Publication 113-11727.

**Figure 1: Example of replacing tables with graphs: mortality data presentation.**

**Original Table (LEFT):**

Calendar year	Total fertility rate <sup>b</sup>	Age-sex-adjusted death rate <sup>c</sup> per 100,000		
		Total	Under 65	65 and over
<b>Historical data:</b>				
1940	2.23	1,919.8	750.1	9,718.8
1945	2.42	1,716.6	674.8	8,662.9
1950	3.03	1,561.9	570.2	8,173.7
1955	3.50	1,453.8	508.2	7,758.4
1960	3.61	1,454.3	503.2	7,795.4
1965	2.88	1,428.8	495.2	7,653.3
1970	2.43	1,340.0	485.7	7,036.3
1975	1.77	1,204.8	426.6	6,393.6
1980	1.82	1,136.9	384.3	6,154.3
1985	1.83	1,081.0	353.3	5,931.9
1990	2.07	1,022.9	333.6	5,618.9
1995	1.98	1,002.7	317.9	5,568.6
2000	2.05	961.5	281.0	5,498.9
2005	2.06	901.9	270.7	5,110.3
2010	1.93	820.8	248.5	4,636.1
2011	1.89	820.7	249.1	4,631.3
2012	1.87	811.7	248.6	4,565.6
2013	1.85	812.2	249.4	4,564.6
2014	1.86	804.9	251.4	4,495.1
2015	1.84	815.0	254.9	4,549.7
2016	1.82	808.2	260.5	4,460.0
2017	1.76	802.7	250.6	4,483.6
2018	1.74	791.8	249.3	4,408.3
<b>Intermediate:</b>				
2020	1.76	779.9	245.9	4,339.7
2025	1.98	748.2	234.8	4,170.8
2030	2.00	716.5	222.6	4,009.3
2035	2.00	686.2	210.6	3,857.2
2040	2.00	657.7	199.3	3,714.4
2045	2.00	631.0	188.6	3,580.6
2050	2.00	606.0	178.7	3,455.2
2055	2.00	582.6	169.4	3,337.4
2060	2.00	560.6	160.7	3,226.7
2065	2.00	540.0	152.6	3,122.5
2070	2.00	520.6	145.0	3,024.3
2075	2.00	502.3	137.9	2,931.6
2080	2.00	485.1	131.3	2,844.0
2085	2.00	468.8	125.0	2,761.1
2090	2.00	453.5	119.1	2,682.6
2095	2.00	438.9	113.6	2,608.1

**Suggested revision (RIGHT):**



Source: Trustees Report 2019, Table V.A1

The table of mortality data in the Trustees Report is extensive, while the suggested figure shows the same data concisely and in a manner that allows easy visual comparison of past trends with the projections.<sup>4</sup>

Tables with the exact numbers, which could be hyperlinked from the graphs, could be included in the Appendix for users of the report who wish to see information presented in the same way as in the past for comparison purposes. In addition, the full series of annual data (instead of every five years) could be provided in these appendix tables. Users who are interested in the underlying data likely would value the added detail.

**Presentation recommendation 2.** The Panel recommends the Trustees focus the graphs further on the report's core messages.

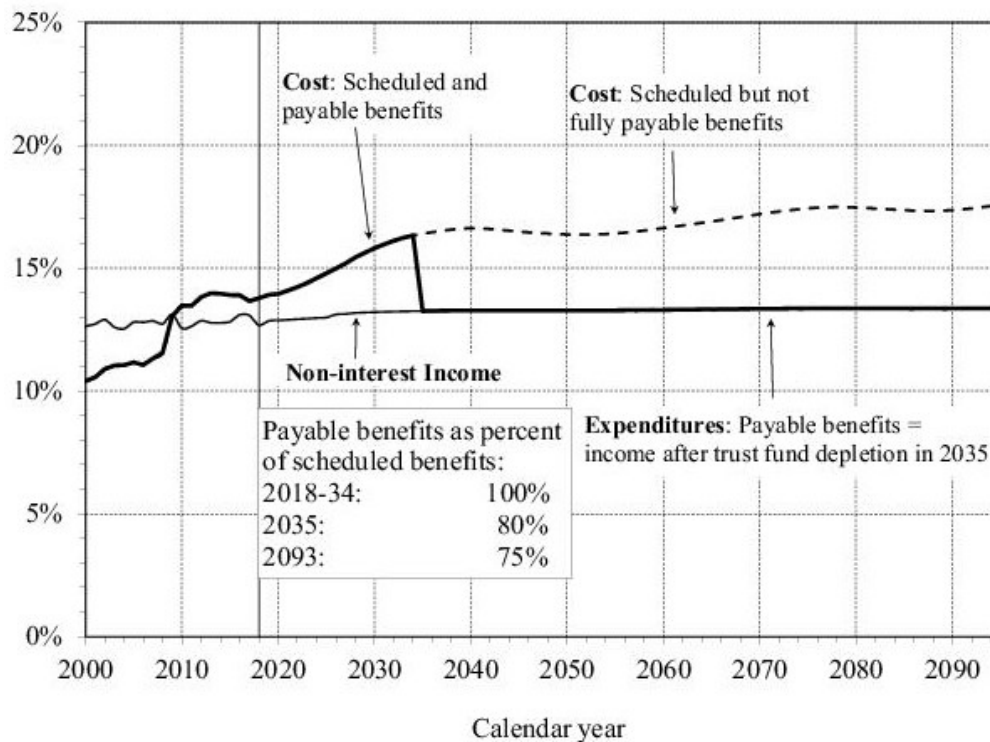
To illustrate one way in which this recommendation could be implemented, **Figure 2A & 2B** show Figure II.D2 from the Trustees Report depicting Social Security's revenues and expenditures, as well as a suggested version of the same figure. While there could be different views on exactly how to improve this figure, we provide it as an example of the types of changes that could focus the graphical material on the report's core messages.<sup>5</sup>

<sup>4</sup> The mortality data are displayed in the graph using a log scale. We believe this is a useful way to present the data, given that the improvement in mortality has been relatively steady in percentage terms. However, this is not core to this recommendation, which focuses primarily on turning tables into graphs for each assumption.

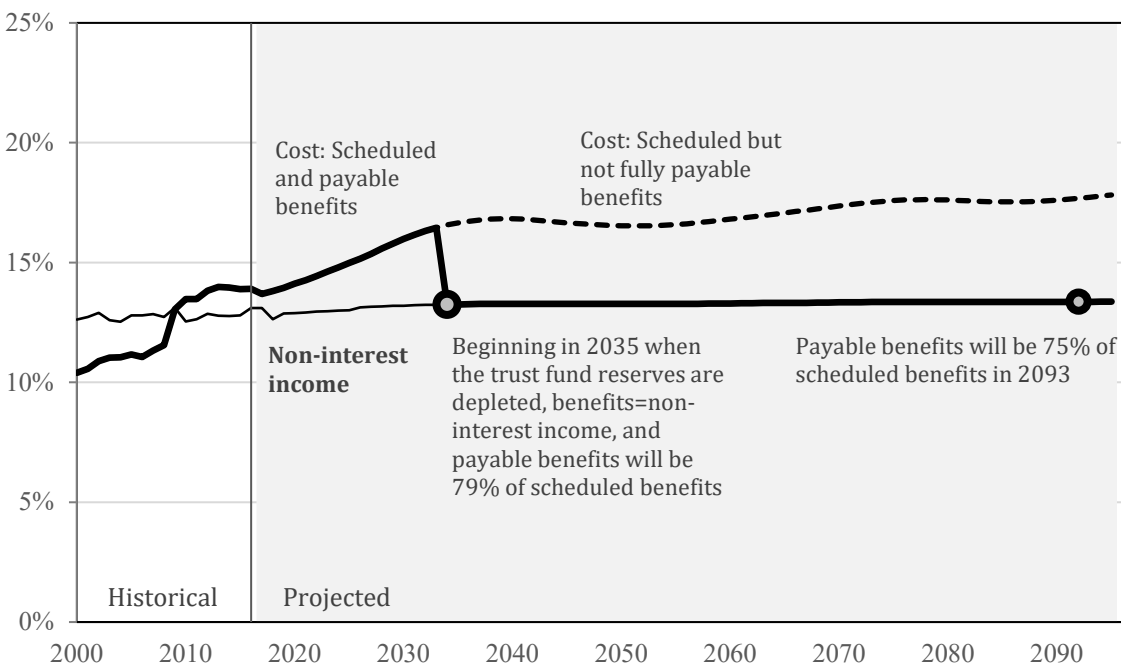
<sup>5</sup> We thank Jonathan Schwabish for creating this graph.

**Figure 2A: Original figure from the Trustees Report, “Figure II.D2: OASDI Income, Cost and Expenditures as Percentages of Taxable Payroll”.**

**Figure II.D2.—OASDI Income, Cost, and Expenditures as Percentages of Taxable Payroll**  
[Under Intermediate Assumptions]



**Figure 2B: Revised Figure II.D2 based on improved data visualization principles.**



The revised version of the graph makes several changes to focus on the core visual and substantive messages:

- Minimizing graphical information other than the data.
- Highlighting key words and dates.
- Aligning the text more closely with the data it refers to.

By applying such techniques to other graphs where appropriate, we believe the messages of the report could be made more accessible to a broader audience.

### ***Write the report and related material more clearly***

We recommend increasing the accessibility of the Trustees Report's writing for readers not already steeped in the issues, through the following steps:

#### **Presentation recommendation 3. The Panel recommends the Trustees follow the Federal plain language guidelines where possible.<sup>6</sup>**

Although technical language is inevitable in a technical report such as the Trustees Report, this language should be minimized and simplified to the extent possible. Such techniques could include:

- Putting central messages nearer to the front of the report and related documents.
- Using more frequent headings to further organize the findings.
- Using relatively short paragraphs.
- Explaining and simplifying the description of technical concepts where appropriate. For example, the term "disability incidence rate" is not explained in the report.
- Using short, declarative sentences.

It is especially important for the Trustees Report summaries and press releases, which are intended to communicate with the general public, to be accessible. The summary documents (including the Highlights section in the Trustees Report and the separate booklet "Status of the Social Security and Medicare Programs," which includes a "Message to the Public" and a report summary) are among the key tools that many stakeholders use to understand the Trustees Report. In these documents, the Trustees should focus on increasing the use of communications techniques consistent with the Federal plain language guidelines to allow easier scanning of the material, such as:

- Bullet points
- Bolding, underlining, and italicizing
- A table showing how the key outcomes changed since last year's report
- Shortened summaries
- Key figures illustrating central messages at the beginning of summaries

To illustrate how this could be implemented, the Appendix shows a suggested set of revisions to the first page of the Summary.<sup>7</sup> Observers may differ about the specifics of how to implement these suggestions. We view these suggested revisions not as a set of instructions for the Trustees to follow exactly but as a conceptual guide illustrating one way of implementing the recommendations. We recommend that the

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<sup>6</sup> These are available at <https://www.plainlanguage.gov/guidelines/>

<sup>7</sup> We thank Martha Coven for this rewriting of the Summary.

Trustees hire a communications consultant to help with this rewriting of the Summary and Highlights of the report.

### ***Improve presentation of the trust fund reserve depletion date***

**Presentation recommendation 4.** The Panel recommends refining the presentation of the trust fund reserve depletion date by providing further context, showing a simpler graph, and renaming the depletion date.

Americans typically believe that they will receive far less in Social Security benefits than the Trustees Report and other sophisticated observers project (Luttmer and Samwick, 2018). In fact, 51 percent of non-retirees believe they will receive no Social Security benefits at all (Gallup, 2015).

The OASDI trust fund reserve depletion date and its implications reflect a complex—and crucial—set of concepts to explain to the public. Indeed, media reporting on the Trustees Report often focuses on the depletion date of the trust fund.<sup>8</sup>

The trust fund depletion date terminology evokes a number of complex concepts that require a relatively sophisticated understanding of Social Security, namely:

- The existence of the trust fund;
- The fact that the trust fund reserve balance will go from positive to zero at the depletion date;
- The fact that Social Security currently is financed both through current tax revenue and trust fund reserves but not out of general revenues; and
- The fact that current tax revenue would continue to finance a portion of Social Security benefits after the trust fund reserves have been depleted.

Particularly given the underestimation of future Social Security benefits by the general public, many Americans may not understand all of these features of the system. Some may believe that Social Security benefits will cease to be paid entirely at the reserve depletion date.

The depletion date should be presented in a way that is accurate, concise, and accessible. We therefore make three sub-recommendations to improve the presentation of the depletion date.

First, further context about the reserve depletion date should be provided in the Trustees Report and related documents. For example, prior to presenting the reserve depletion date, the report could briefly describe the degree of Social Security financing provided by the trust fund. It also could emphasize more prominently after introducing the concept of the reserve depletion date that under current law benefits could be paid in part, but not in full, after the depletion date. Both of these changes are made in the rewritten Summary provided as an illustration in the Appendix to this chapter.

Second, the Trustees Report should show an additional, simpler graph illustrating the percent of scheduled benefits that are payable by year, as illustrated in **Figure 3**. The figure currently illustrating the depletion date, Figure II.D2 in the Trustees Report and **Figure 2B**, may appear inaccessible to many

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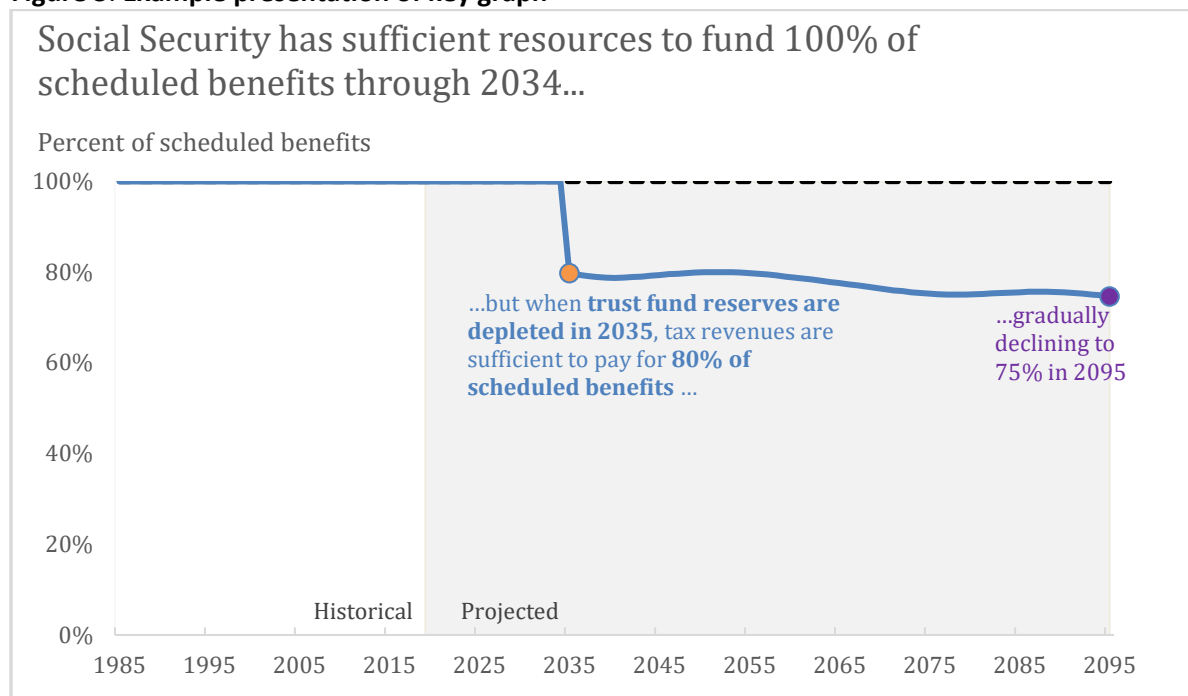
<sup>8</sup> See Coven, Martha, “Writing for a Public Audience: A Presentation to the Social Security Technical Panel on Assumptions and Methods,” available at [https://www.ssab.gov/Portals/0/2019%20TPAM/PUBLIC/SLIDES-COVEN-%20advice%20on%20SSTrustees Report-051019.pdf?ver=2019-05-09-233247-917](https://www.ssab.gov/Portals/0/2019%20TPAM/PUBLIC/SLIDES-COVEN-%20advice%20on%20SSTrustees%20Report-051019.pdf?ver=2019-05-09-233247-917).

users. The graph illustrates several different concepts, including non-interest income, benefits that are scheduled and payable, benefits that are scheduled but not fully payable, and payable benefits as a percent of scheduled benefits.

The figure we suggest communicates the graph’s key messages by focusing on the central issue at stake for many Americans: the percent of benefits that will be payable. For the 2019 Trustees Report, this figure would show a horizontal line at 100 percent until the depletion date, followed by a discontinuous decrease to 80% at the depletion date and 75% by 2095, as illustrated in **Figure 3**. We believe this simplified graph would greatly aid the Trustees in their public communications. It can be included in the Summary and Highlights, as well as in other communications such as blog posts or tweets. We view **Figure 3** as supplementing Figure II.D2, especially as a central communications tool, but Figure II.D2 would remain in the report.

It also may be desirable to add additional graphs that break the information currently contained in Figure II.D2 into component pieces, each of which is more easily digestible and could focus on other core messages of the report.

**Figure 3: Example presentation of key graph**



Source: Trustees Report, 2019

Third, we suggest renaming the depletion date as the date when aggregate benefits are reduced due to the depletion of the trust fund, i.e., the “partial benefits date” or “reduced benefits date.” In choosing a name for the depletion date, the Trustees should concisely convey that benefits could be paid in part, but not in full, after the depletion date, without invoking concepts such as depletion that require an understanding of the trust fund to grasp the implications for individual benefits. The 2019 Trustees Report states, “OASI and DI Trust Funds declines from 273 percent at the beginning of 2019 until the combined fund reserves become depleted in 2035 (one year later than projected in last year’s report), at which time 80 percent of scheduled benefits would be payable” (p. 64). The partial benefits date or

reduced benefits date terminology, therefore, follows the existing logic of the Trustees Report that explains that only part of scheduled benefits would be payable.

This new formulation focuses the terminology on the central issue at stake for most Americans: the future of Social Security benefits. The Trustees Report would explain that this terminology refers to the percent of aggregate benefits that are payable in steady state, in a way that is accessible to Trustees Report readers. Experts already understand these nuances, and their understanding will not be affected by the change in terminology. The new terminology, however, will be more accessible to non-experts.

Finally, accessibility is influenced not only by the graphs and writing, but also by the strategy for communicating these findings to stakeholders. Our next recommendations focus on the communications strategy.

### ***Online and media communications strategy***

**Presentation recommendation 5.** The Panel recommends enhancing the online and media communications strategy by improving the website user interface, creating a Frequently Asked Questions (FAQ) page, improving public outreach on social media, and improving OCACT's webpage on the Trustees Report. The Social Security Administration (SSA) should provide OCACT with a budget to hire communications and user experience professionals to help implement this.

The SSA should improve the user interface for accessing the projections. Social Security Trustees Reports date back to 1941, when printed reports were the primary means of communicating. In a printed report, decisions must be made about what data to include. Moreover, in a printed report or online PDF of the report, users must use an index to find specific items of interest and page through the report to find these items or search the PDF using phrases that may or may not lead them to the correct passages. Extensive research demonstrates that such inconveniences can cause large decreases in user engagement, while designing a user-friendly experience can greatly increase usage and, therefore, understanding.<sup>9</sup>

A user-friendly web tool could supplement the written report and make its findings more easily accessible to Congress, the media, and the general public. We envision a tool that would allow users to easily query and view key results from the report. For example, a basic version of such a web tool could have two drop-down menus: one for the outcome or assumption one wishes to see (e.g., the actuarial balance, the mortality rate) and a second for the scenario (e.g., high-cost, intermediate-cost or low-cost). After the user makes a selection from each menu, the tool would show a graph of the outcome in each year. By mousing over the graph, the user could view the value of the outcome for the highlighted year. Users would be able to download the relevant data into a spreadsheet. An example of a tool that has these features can be found at <https://budgetmodel.wharton.upenn.edu/social-security/>. Slightly more complex tools could be developed if SSA determines this is worth the investment. For example, the tool could allow users to select a Trustees Report by year, allowing them to see data from any past report. Information about SSA's scores of policy proposals eventually could be made available along with the Trustees Report projections on a separate website.

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<sup>9</sup> See, for example, Nielsen, Jakob. *Designing web usability: The practice of simplicity*. New Riders Publishing, 1999; Garrett, Jesse James. *The elements of user experience: user-centered design for the web and beyond*. Pearson Education, 2010.



We recommend that SSA work with user experience and communications professionals to present the findings in a way that is useful and transparent to all key stakeholders. We believe that a relatively modest investment of time and resources in building this tool would significantly increase the accessibility of the Trustees Report's findings to Congress, the media, and the general public.

Separately, all Trustees Report tables should be made accessible and downloadable as Excel files on OCACT's Trustees Report website, which would allow users to access these data directly.

We also recommend that SSA provide OCACT (and the Social Security Press Office as appropriate) with a budget to engage a communications consultant to increase the ability of stakeholders to access the messages of the Trustees Report online, including by:

- Creating a FAQ page on the Trustees Report. This page should be accessible from OCACT's [Trustees Report webpage](#), including guidance on how to use and understand the Trustees Report and the associated materials. This could clarify common questions and misperceptions about the Trustees Report.
- Improving public outreach through social media. For example, the Trustees could focus postings on social media outlets such as Twitter or Facebook on one key figure from the Trustees Report. A simple key figure, such as the figure showing the percent of benefits payable by year, could receive attention on social and other media.
- Improving OCACT's Trustees Report webpage for more user-friendly design. One component of this involves creating a link to the web tool discussed above, but the organization of the main webpages can be re-examined more broadly (The webpage "2019 OASDI Trustees Report" can be found at <https://www.ssa.gov/OACT/TR/2019/> and the webpage "Reports from the Board of Trustees" can be found at <https://www.ssa.gov/oact/TR/>). SSA should provide OCACT with a budget to hire communications and user experience professionals to redesign the OCACT webpage on the Trustees Report, keeping the existing materials available and centralizing as much of OCACT's disparate information about the Trustees Report as possible on this page (for example, allowing users to download Excel tables through links from this page).

The last several Technical Panels have been asked by the Social Security Advisory Board to make recommendations to improve the presentation of key concepts in the Trustees Report. Even if the Trustees were to accept all of this Panel's recommendations on accessibility, implementation will take time. Therefore, the Panel recommends that the Social Security Advisory Board monitor the Trustees' progress on implementing these recommendations.

### 3.2 Increase transparency of the projections

Increasing the Trustees Report's accessibility goes hand-in-hand with increasing its transparency. Several recommendations could improve the transparency of the projections by refining their meaning, presenting more information about implicit assumptions, and allowing increased access to OCACT's model.



### ***Clarify the meaning of the report findings***

**Presentation recommendation 6.** The Panel recommends clarifying and refining the meaning of the Trustees Report's findings by replacing the current high- and low-cost scenarios with confidence intervals, clarifying the objective of the intermediate-cost projection, and clearly indicating when the Trustees Report does and does not assume current law.

First, we suggest clarifying the conceptual meaning of the intermediate-cost projection. Is it a projection of the median outcome conditional on OASDI following current law? The conditional mode? The projection of the conditional mean? The certainty-equivalent projection? Because estimates of these different concepts can diverge substantially, the answer matters for how we interpret and use the projections.

The methods section suggests using econometric methods to make this projection. In the case of the "most plausible" projection, this would correspond to projecting the mean conditional on OASDI following current law. In the case of the current law projection, this would correspond to projecting the mean conditional on current law for all policies.

Second, we suggest clearly indicating when the Trustees Report does and does not assume current law. As discussed in the methods section, in some cases the Trustees Report relies on current law in performing the projections, such as for the immigration assumptions. However, in projecting no bracket creep after the first decade in estimating revenue from the taxation of Social Security benefits, the Trustees Report relaxes current law. In the case of the Social Security parameters, the Trustees Report calculates the actuarial balance assuming that benefits are paid as in current policy (i.e., they continue to be paid as they are in current policy even after the depletion date), while taxes continue to be raised as they are under current law and policy after the depletion date. We recommend that the Trustees Report should clearly indicate what it assumes about the maintenance of current law or policy for each assumption.

Third, we suggest replacing the current high- and low-cost scenarios with confidence intervals. The high- and low-cost scenarios reflect illustrative sets of assumptions that are collectively pessimistic and optimistic, respectively, regarding Social Security's finances. However, it is unclear how extreme these scenarios are in a statistical sense. Some users could even infer that the three cost scenarios are equally likely. We recommend showing a statistical confidence interval instead, such as a 95 percent confidence interval (conditional on OASDI following current law as recommended in the methods section). The upper and lower ends of this interval would then be called the high-cost or low-cost scenarios. The recommendations in the methods section provide a guide to constructing these intervals.

### ***Expand the sensitivity analysis***

**Presentation recommendation 7.** The Panel recommends expanding the Trustees Report's sensitivity analysis to encompass key implicit assumptions.

Many of the Trustees Report's assumptions, including mortality, inflation, the taxable share, are discussed explicitly in the report. A number of other assumptions are made implicitly and receive far less scrutiny. Assumptions about lifetime earnings inequality, differential mortality by average indexed monthly earnings (AIME), the yield curve and term structure of interest rates, duration of marriage,

assortative mating patterns, benefit claiming ages and others are not explicitly explored but could affect the projections substantially. In some cases, these assumptions could be consequential for the projections of income, costs, or the trust fund reserve depletion date—in which case showing sensitivity analysis in the Trustees Report would be helpful. For example, the program-specific assumptions section of this report illustrates why the assumptions about claim ages could be significant for outcomes, including the depletion date. Other assumptions may be less significant and need not appear.

We recommend OCACT publish studies on its website of the importance of these and other implicit assumptions. We further recommend that the Trustees Report present explicit sensitivity analysis when the assumptions significantly affect the estimates of costs, income, or the trust fund reserve depletion date.

### ***Model documentation and access***

**Presentation recommendation 8.** The Panel recommends providing and supporting greater external access to the projection models used to produce the Trustees Report.

OCACT regularly fields questions about its modeling techniques and assumptions. Social scientists have recently increased their focus on transparency of methods, while the open source movement has gained momentum. Researchers would benefit from the ability to assess OCACT's code directly.

OCACT could post its models' full code, along with adequate documentation, on SSA's public website. SSA could allow researchers to apply for access to the underlying data, similar to the Internal Revenue Service call for proposals to use the IRS administrative data. Social Security could also fund research projects on OCACT's model.

In the long run, we believe public trust in these projection methods would increase if the methods were subject to scrutiny and rigorous debate informed by public access. Greater scrutiny from researchers also could help improve the models in the long run.

### ***Learning from past projections***

**Presentation recommendation 9.** The Panel recommends OCACT regularly make available comparisons of the past projections of the assumptions to their past realizations.

Projections are inherently subject to uncertainty. Accordingly, it is natural that OCACT's or any other projections of the assumptions would differ from their realizations. The degree of divergence between past economic, demographic, and program-specific assumptions and subsequent reality can be informative, for example about the magnitude of the plausible confidence intervals or high-cost/low-cost scenarios that OCACT projects for the future. We applaud and encourage continued publication of past forecasts, the detailed data used for these forecasts, and the comparison of past forecasts about assumptions with the subsequent reality. In principle, it would also be possible to produce information on the degree of divergence of outcomes (such as revenues and costs) from reality if policy had hypothetically been held constant; this would be a useful additional metric. Standard metrics of forecast error can be applied, such as the mean squared error or mean absolute percentage error.<sup>10</sup>

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<sup>10</sup> Since the projections are largely done on a current-law basis, changes in current law can influence the realizations of outcomes such as the actuarial balance. Divergences of such outcomes from the projections can depend both on changes in

### 3.3 Presentation Supplement: Suggested revision of beginning of Trustees Report Summary

#### Exhibit A: Current text of the Trustees Report Summary

## II. Overview

### A. Highlights

This section summarizes the report's major findings.

#### In 2018

At the end of 2018, the OASDI program was providing benefit payments<sup>[1]</sup> to about 63 million people: 47 million retired workers and dependents of retired workers, 6 million survivors of deceased workers, and 10 million disabled workers and dependents of disabled workers. During the year, an estimated 176 million people had earnings covered by Social Security and paid payroll taxes on those earnings. The total cost of the program in 2018 was \$1,000 billion. Total income was \$1,003 billion, which consisted of \$920 billion in non-interest income and \$83 billion in interest earnings. Asset reserves held in special issue U.S. Treasury securities grew from \$2,892 billion at the beginning of the year to \$2,895 billion at the end of the year.

#### Short-Range Results

Under the Trustees' intermediate assumptions, Social Security's total cost is projected to be less than its total income in 2019 and higher than its total income in 2020 and all later years. Social Security's cost has exceeded its non-interest income since 2010. For 2019, program cost is projected to be less than total income by about \$1 billion and exceed non-interest income by about \$81 billion.

To illustrate the actuarial status of the Social Security program as a whole, the operations of the OASI and DI funds are often shown on a combined basis as OASDI. However, by law, the two funds are separate entities and therefore the combined fund operations and reserves are hypothetical. The combined reserves are projected to decrease from \$2,895 billion at the beginning of 2019 to \$2,148 billion at the end of 2028.

The reserves of the combined OASI and DI Trust Funds along with projected program income are adequate to cover projected program cost over the next 10 years under the intermediate assumptions. The ratio of reserves to annual cost is projected to decline from 273 percent at the beginning of 2019 to 130 percent at the beginning of 2028. By remaining at or above 100 percent,

...

<sup>[1]</sup>The definitions of "benefit payments" and other terms appear in the Glossary.

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policy and divergences between the economic, demographic, and program-specific assumptions and reality. Thus, the degree of divergence of outcomes from reality may be less informative than the degree of divergence of the assumptions.

### **Background**

The Board of Trustees oversees the financial operations of the Old-Age and Survivors Insurance (OASI) and Disability Insurance (DI) Trust Funds. Trust fund reserves are held in special issue U.S. Treasury securities, which earn interest and can be drawn down as needed to supplement the income Social Security receives from payroll taxes and other sources.

Each year, the Trustees are required to report to Congress on the outlook for the trust funds. The Trustees examine three alternative scenarios, reflecting a range of demographic, economic, and programmatic assumptions. The findings listed below are projections based on an intermediate set of assumptions, which reflect the Trustees' best estimates.

### **Key Findings:**

- The combined Social Security trust fund reserves will last until 2035. Legally, there are two separate trust funds; the OASI reserves will last until 2034 and the DI reserves until 2052.
- Starting in 2035, Social Security will be able to pay 80 percent of scheduled benefits, using continuing income from payroll taxes and other sources.
- Social Security will begin drawing down the trust fund reserves in 2020, when program costs will begin to exceed program income.

### **Changes from Last Year's Report**

The most notable change in this year's report is the improvement in the DI Trust Fund finances. DI reserves are projected to last 20 years longer than in the 2018 report, which projected they would last until 2032 rather than 2052. This is mainly due to a steady decline in disability applications. (See page 37 for more details on changes in the DI projections.)

### **Other changes include:**

- The combined trust fund reserves are projected to last a year longer than in the 2018 report, which projected they would last until 2034 rather than 2035.
- Social Security is projected to be able to pay 80 percent of scheduled benefits when reserves are gone, compared to 77 percent in the 2018 report.
- Social Security is projected to begin drawing down its reserves in 2020, two years later than in the 2018 report, which projected the drawdown would begin that same year, in 2018.

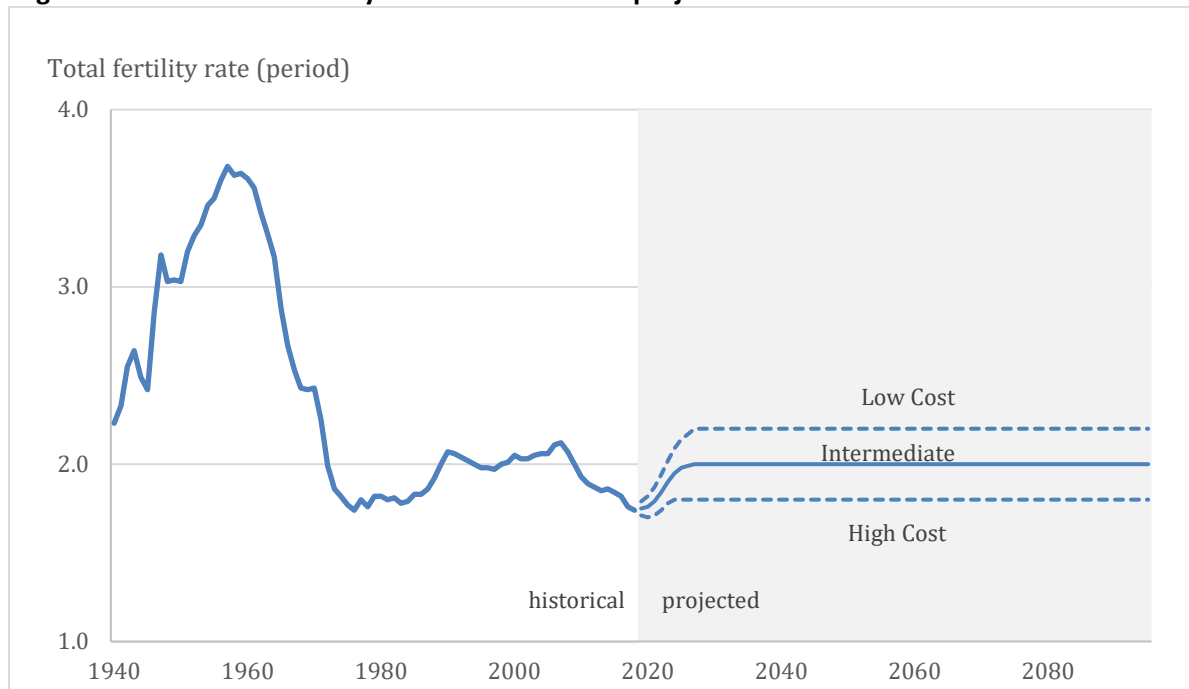
## 4.0 DEMOGRAPHIC ASSUMPTIONS AND METHODS

The demographic assumptions are key determinants of what the modeled population will look like each year in the future. The expected number of people paying into the system and the expected number of people receiving benefits from the system are highly dependent on these assumptions for births (fertility), deaths (mortality), and other new entrants (immigration). As the Panel spoke with experts on these topics and provided their own insights, it became clear that there is a significant amount of uncertainty around each of these assumptions, as reflected in the following recommendations.

### 4.1 Fertility assumptions and methods

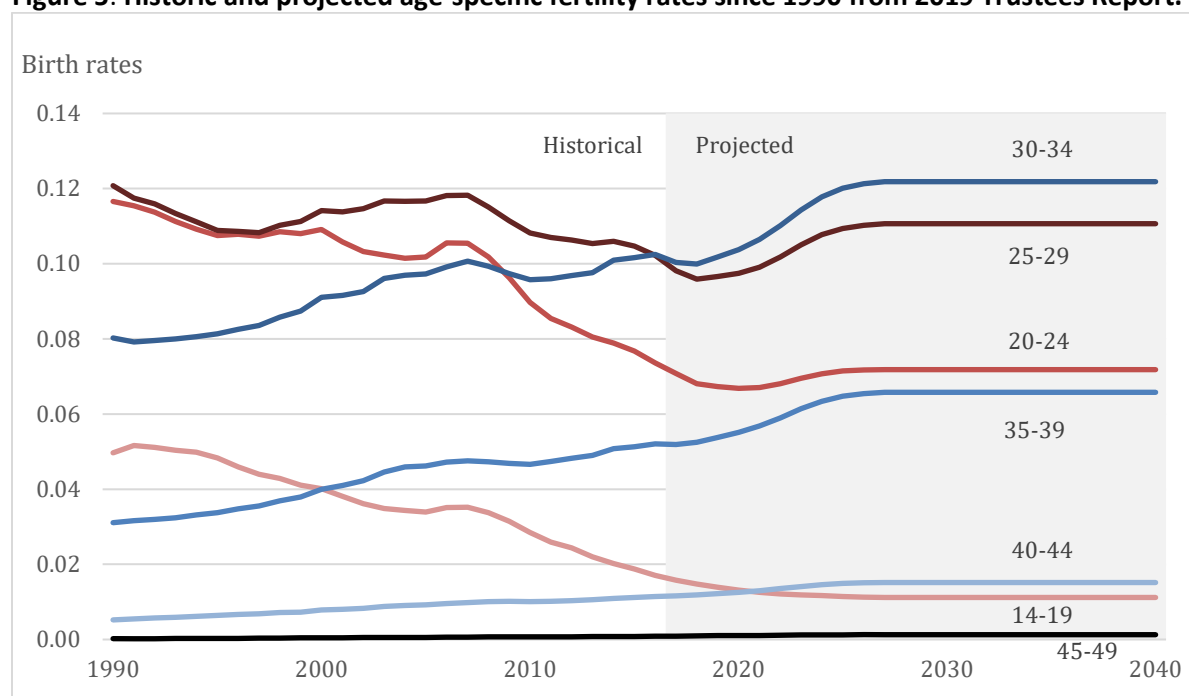
The United States has a long history of relatively high fertility relative to the rest of the industrialized world. However, since the onset of the Great Recession annual birth rates have fallen and continue to fall even though the economy has recovered, with period TFR recently hitting a low of 1.73 in 2018 as shown in **Figure 4**. While the initial declines were thought to have been due to the recession, it remains unclear to experts why the expected recovery has not materialized. A number of explanations have emerged, including large declines in the fertility of Hispanics, both natives and immigrants; the continuation of economic uncertainty for young adults; and the increased use of more effective contraception. An additional factor making it difficult to forecast future fertility is that an unusually large part of the decline in period fertility has been at younger ages, making it unclear whether births have been foregone or simply postponed. **Figure 5** shows historical birth rates by age, and the Trustees projected rates.

**Figure 4: Period Total Fertility Rate since 1940 and projected to 2095**



Source: Trustees Report 2019, Table V. A1

**Figure 5: Historic and projected age-specific fertility rates since 1990 from 2019 Trustees Report.**



Source: Data provided by the Office of the Chief Actuary

Overall, the Panel finds the Trustee's projections of fertility to be plausible and well grounded. However, the surprising persistence of post-recession low fertility among women in their twenties leads the Panel to suggest that the ultimate assumed fertility rate in the intermediate scenario should be lowered slightly. The Panel also recommends two methodological changes in fertility projections, concerning allowing for continued shift in the timing of motherhood to older ages, and immigration. Specifically, the Panel makes the following recommendations.

**Fertility recommendation 1: The Panel recommends slightly lowering the ultimate period TFR to 1.95.**

As noted, the period TFR has not rebounded from the recession as expected and continues to fall. While we agree with the Trustees that fertility is likely to rise from its current levels and that the United States is likely to continue to have higher birth rates than most other industrialized countries, there are several reasons to suspect that some of the recent forces that have lowered fertility will persist. These include a decline in immigration and immigrant fertility, a decline in the fertility of low-income women (toward that of higher income groups), the increased use of highly effective contraception, and some indication that fertility intentions for young women have declined.

Taking all of these factors into account, some on the Panel preferred an ultimate period TFR of 1.90 for the intermediate scenario, while others felt 2.00 was not unreasonable. The consensus was that the period TFR would approach 1.95 while the Cohort Fertility Rate (CFR) could be 2.00, as immigration may increase (as discussed in the immigration section), the improving economy may create good new jobs for younger people, and younger women still have time to have a second child even if their first birth is delayed. TFR and CFR can and do differ for a population. For example, during a period when women are generally delaying their childbearing to older ages, TFR is lower than CFR which we discuss in our second recommendation.

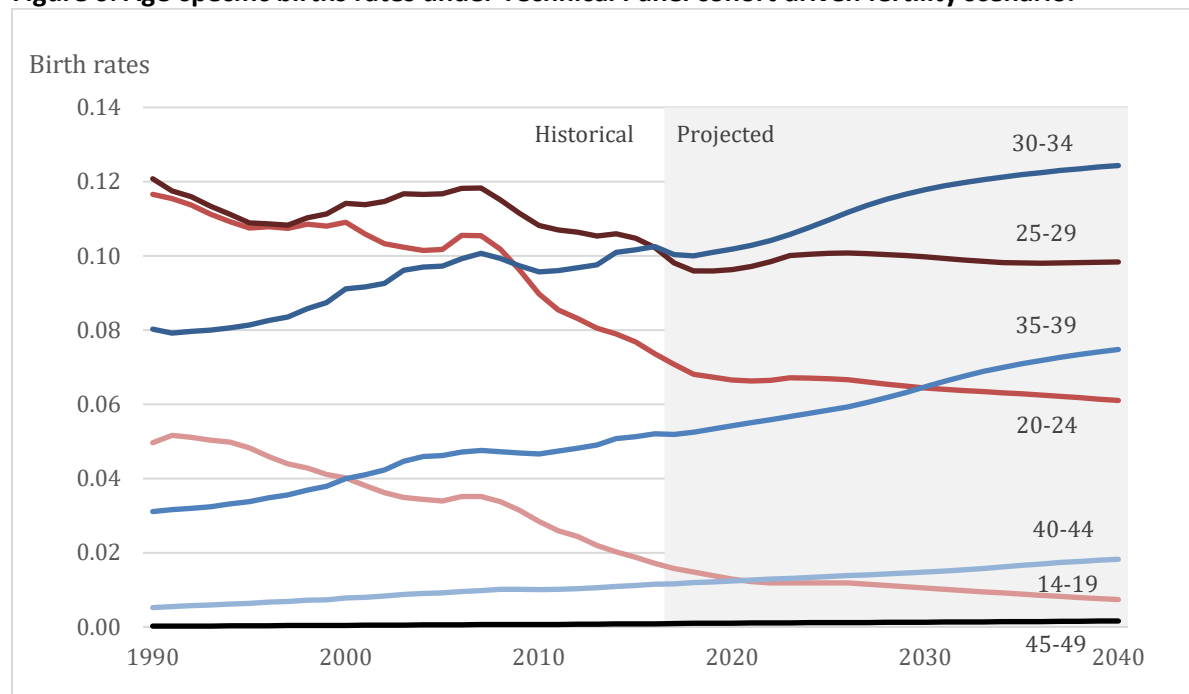
Given the lack of agreement among fertility experts of what has caused the TFR to decline for the last decade and what that portends for the future, the Panel felt that uncertainty around future fertility has increased substantially. The Panel expressed a strong preference for probabilistically rigorous projections of uncertainty around the intermediate assumption, with an explicit statistical model as recommended in Methods Recommendation 5. However, given the continued likely use of high and low scenarios in the near term, the Panel recommends a reduction in the ultimate high-cost fertility assumption, keeping the low-cost fertility assumption at 2.2. Opinion was divided as to whether the high-cost TFR should be 1.6 or 1.7. Both values acknowledge an increased likelihood of low fertility given recent experience and expand the range between high and low. The value of 1.6 suggests that the uncertainty in fertility is asymmetric ( $1.95 - 1.60 = 0.35$  vs.  $2.20 - 1.95 = 0.25$ ). The Panel emphasizes that the alternate scenarios are not uncertainty levels or bounds on fertility in any particular year, but rather represent uncertainty about long-term averages (Goldstein, 2004; Lee, 1993).

**Fertility recommendation 2: The Panel recommends allowing for a continuation of the long-term shift to older ages of motherhood, with long-term fertility being driven by assumptions about cohort fertility rates.**

The OCACT projection freezes the age-structure of fertility after ten years (see **Figure 5**). The Panel believes this is quite unlikely and recommends instead a continued shift in fertility to older ages of motherhood. This would create a more direct link between the fertility expectation surveys cited by the Trustees, which concern cohort fertility, and the period fertility rates that are used for demographic projections. We also believe that the transition to our recommended TFR of 1.95 should be longer than ten years.

The Technical Panel produced a set of alternative fertility projections that incorporate our recommendations 1 and 2. These projections are meant to be illustrative of continued postponement with lower long-run period fertility and are not meant to be a fixed prescription of how the Trustees should implement our recommendations. The Panel's fertility projections exhibit the continued decline in fertility at younger ages and increase at older ages (**Figure 6**) and the resulting transition to the long-run period TFR of 1.95 and CFR of 2.0 (**Figures 8 & 9**).

**Figure 6: Age-specific births rates under Technical Panel cohort driven fertility scenario.**

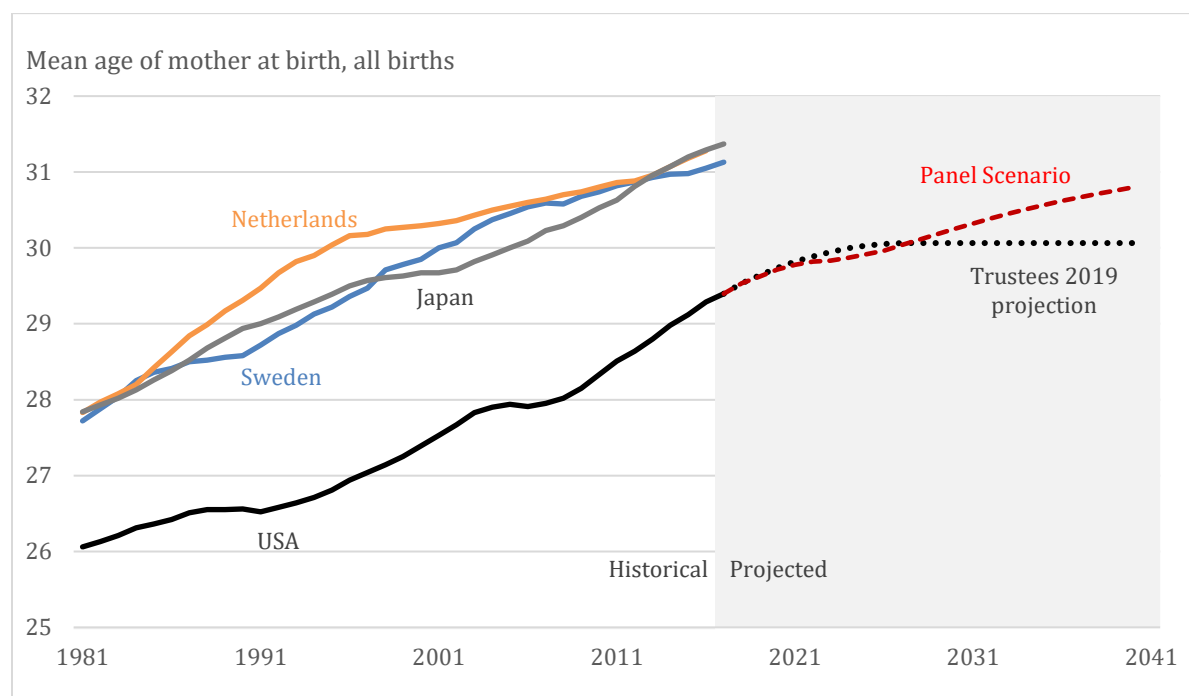


*Source: Panel projections based on historical data provided by Office of the Chief Actuary*

**Figure 7** shows how the mean age of mothers giving birth in the United States and several comparison countries has been consistently increasing for the last several decades. Furthermore, women in the United States, on average, still have children at significantly younger ages than in other countries. This, along with other factors such as women’s rising labor force participation, suggests to the Panel that it is very likely that United States women will continue to postpone having children to older ages well into the foreseeable future. In our alternate fertility scenario (Technical Panel scenario), the mean age of childbearing in the United States rises for several decades yet is still younger than the ages of motherhood observed today in Japan, the Netherlands, and Sweden.



**Figure 7: Mean age at birth in the US and selected OECD countries.**

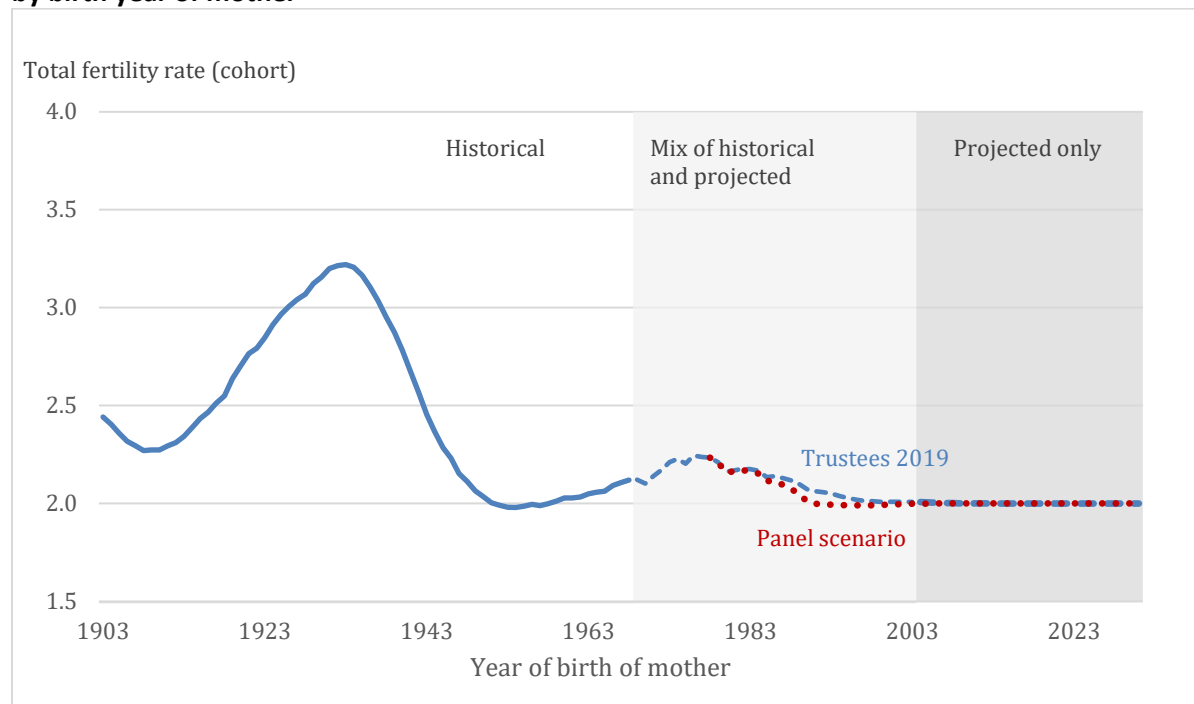


Source: Human Fertility Database; Panel calculations based on data provided by Office of the Chief Actuary

As noted above, changes in the timing of births have different effects on period and cohort TFR (Ryder, 1964; Bongaarts and Feeney, 1998; Goldstein and Cassidy, 2014). Roughly speaking, a postponement rate of 0.1 years per year will make TFR 10 percent lower than the CFR. Thus, under continued postponement, the Trustee's current intermediate assumption of a period TFR of 2.0 would translate to a cohort TFR of 2.2, close to the fertility of the most recent completed cohorts but as mentioned above, there is some indication that fertility intentions for young women have declined. By contrast, the current Trustee's projection implicitly assumes a rapid convergence of period and cohort fertility, with cohort fertility falling by a substantial amount from about 2.2 to about 2.0.

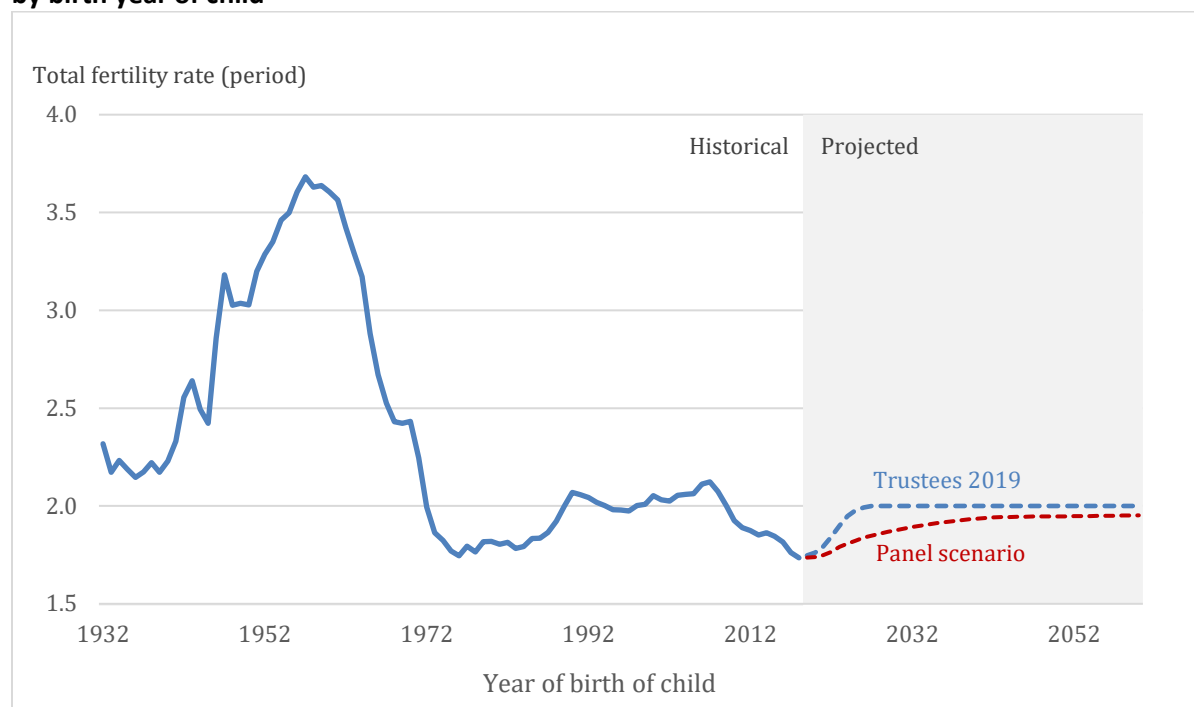
Over the long-term, we recommend that the framework for projecting period fertility levels be thought of in terms of the average number of children women have over their lifetimes (cohort fertility), mediated by the change in the timing of fertility (the tempo effect), with period fertility being an outcome of cohort levels and timing changes. Such a framework would improve the rationale for long-term fertility levels. Another advantage is that it would make clearer the implications of fertility intention surveys, which concern cohort levels.

**Figure 8: Cohort fertility rate historical and Trustees projection compared to Technical Panel scenario, by birth year of mother**



Source: Data provided by Office of the Chief Actuary, and Panel calculations

**Figure 9: Total Fertility Rate Historical and Trustees projection compared to Technical Panel scenario, by birth year of child**



Source: Trustees Report, Table V.A1 A1 (supplemental single year tables found at <https://www.ssa.gov/OACT/TR/2019/IrIndex.html>); and Panel calculations based on data provided by Office of the Chief Actuary

**Fertility recommendation 3: The Panel recommends OCACT develop the capability to model native and immigrant fertility separately.**

Immigrant fertility has a different pattern than native fertility, not only because levels of fertility may differ but also because immigrant fertility is highly related to the timing of immigration (Parrado, 2011) (Toulemon, 2004).

Changes in the levels of immigration thus not only influence the stock of migrant potential parents but also influence the duration structure of the immigrant population. For example, in 2017, 72% of immigrants had been in the US over 10 years, up from 58% in 2000.<sup>11</sup>

We recommend that the models used by OCACT and the Trustees be expanded to include the capacity to model the fertility of immigrants and natives separately, allowing immigrant fertility rates to depend on duration in the United States.

This recommendation has two advantages. First, it would bring consistency between immigration forecasts and fertility forecasts. In the current projections, a change in the level of migration has no influence on the level of fertility (although it does influence the number of births by changing the number of women in the population). Second, it would allow the modeling of the special dynamics of immigrant fertility, permitting birth rates of immigrants to rise when there are more recent arrivals and fall when there are fewer recent arrivals. A further advantage of separately modeling immigrant fertility is that it would allow for the potential to distinguish immigrants by country of origin, which may be of particular importance as shifts take place.

## 4.2 Mortality assumptions and methods

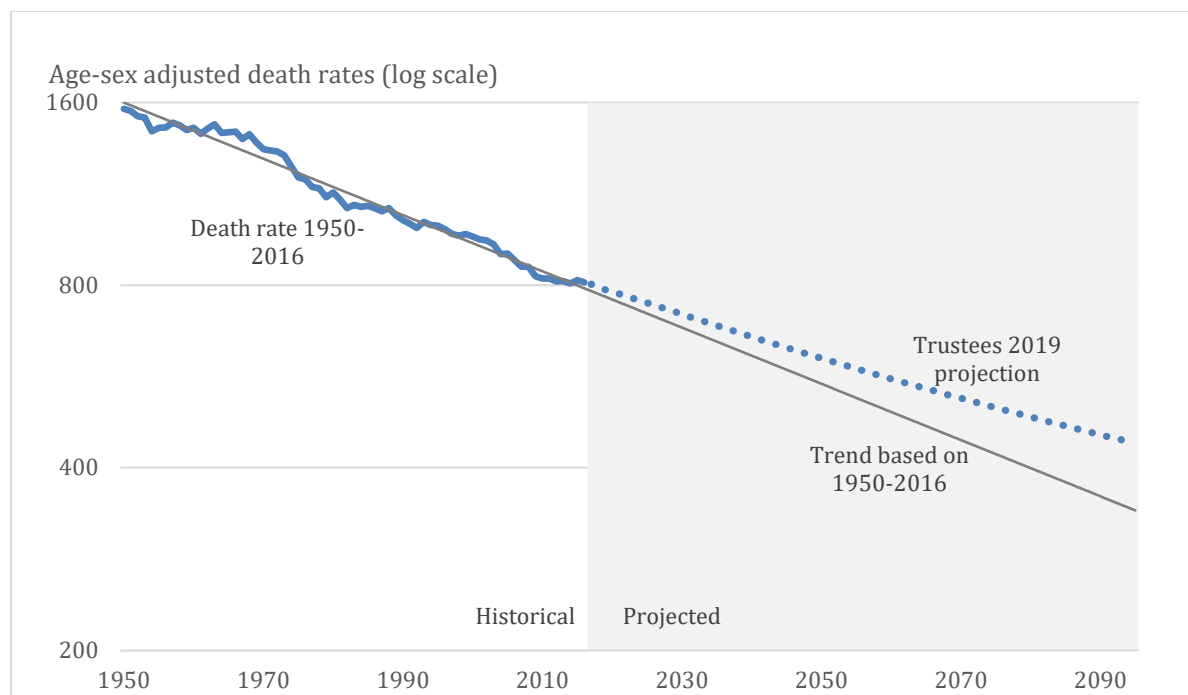
Over the long term there has been a steady increase in human life expectancy in the United States and all other industrialized countries. The fact that age-specific rates of mortality have declined at a more-or-less steady pace over long periods of time (see **Figure 10**) has led past Panels to encourage the Trustees to use this trend as the basis for making long-term projections.

Recently, however, the United States has seen a striking reversal of progress in life expectancy, with the last three years showing life expectancy at birth falling. Despite ongoing medical improvements in many areas, social issues including drug overdoses, obesity and suicide, along with several severe flu seasons, have resulted in mortality increasing, rather than decreasing, at many ages in recent years. While flu-related variations in death rates are normal, the societal issues present a trend that is difficult to project. While the Panel recommends continuing to assume that U.S. mortality will improve over the long term, we recommend that the Trustees and OCACT monitor emerging data and research, consider projecting little or no improvement for the very short term, and explicitly highlight in the Trustees Report the heightened uncertainty in predicting mortality at this point in time. We also encourage OCACT to continue its engagement with public and private sector actuaries from around the world.

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<sup>11</sup> Pew Hispanic Center, Facts on US Immigrants, 2017. <https://www.pewresearch.org/hispanic/2019/06/03/facts-on-u-s-immigrants/>

**Figure 10: Age-sex adjusted rates of mortality have declined at a steady pace over long periods of time**



Source: Trustees Report, Table V.A1 (supplemental single year tables found at <https://www.ssa.gov/OACT/TR/2019/IrIndex.html>); and Panel calculations

The Panel makes the following recommendations:

**Mortality Recommendation 1:** The Panel recommends: increasing the ultimate rate of mortality improvement to align with long-term historical experience, while reflecting recent poor experience in the short term; incorporating greater uncertainty in the projection of future mortality; and continuing to vary the ultimate rate of improvement by age group.

### ***Ultimate Rate of Improvement***

In line with previous Panels, we believe the most plausible long-term assumption for future mortality at this time is for improvement to occur at rates similar to the long period of history. While various age groupings and cohorts have experienced periods of faster and slower improvement, the annual aggregate annual decline in mortality has averaged 1 percent over the last century, and we believe that despite not yet knowing exactly what will drive mortality improvement in the future, the universal desire to increase health and longevity will continue unabated in the century to come. Thus, like previous Technical Panels, we recommend an ultimate age and sex adjusted rate of mortality improvement in the intermediate scenario on the order of 1 percent rather than the 0.73 percent in the current Trustees Report for last 50 years of the projection horizon.<sup>12</sup> One way to enact this would be the adoption of the Lee-Carter method of forecasting. Lee-Carter includes assessment of uncertainty, not just extrapolation, and has been thoroughly reviewed (Lee and Miller, 2001). In addition, the Panel makes the following observations:

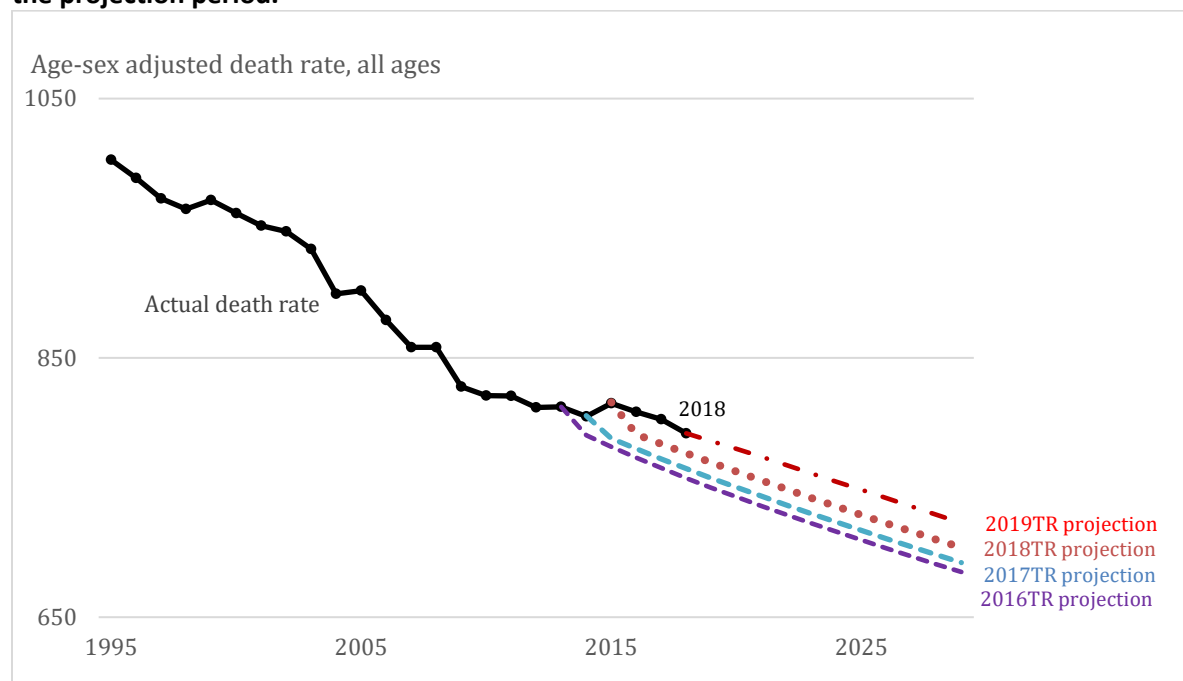
<sup>12</sup> The Trustees assume an average annual percent reduction in age-adjusted central death rates (for men and women combined) of 0.85% from 2016-2043, and 0.73% from 2043-2093. The average annual percent reduction for the period 2016-2093 is 0.77%. See OACT, The Long-Range Demographic Assumptions for the 2019 Trustees Report, Table 2.2.

- While the Trustees Report notes a number of drivers of past improvement that are unlikely to repeat (e.g., the introduction of Medicare and Medicaid, the discovery of antibiotics), the Panel recommends balancing this with the potential upside from breakthroughs in cancer and Alzheimer’s research, and the possibility that customized therapies and other new technologies that are extraordinarily expensive today might follow the path of many other technologies (e.g., DNA sequencing, solar Panels, computing power) to become affordable for broad swaths of the population, resulting in a meaningful impact on overall population mortality.
- Many of the reasons for the recent slow-down in mortality improvement may be eliminated in the long term through sustained efforts to reduce obesity and the impacts of drug abuse, along with increased focus on improving mental health. There are questions on how much we can reduce deaths of despair, but even there, improvements can occur, as we have seen in Japan.
- Note that the United States has fallen to last in life expectancy among key industrialized countries but there is no biological reason for this. It may be attributable to the lack of access to quality healthcare for some segments in the United States, but given the attention this issue is getting, it is not unreasonable to think that this will change in the long term and that the US may experience a spurt in mortality improvement to catch up in life expectancy.
- Countries that lead in life expectancy have not shown a sustained slowdown in mortality improvement. This also lends support to being optimistic that mortality improvement in the United States can return to historic levels.

### ***Near Term Improvement***

Drug overdoses, obesity, and suicide have resulted in mortality increasing, rather than decreasing, at many ages in recent years. As **Figure 11** highlights, the last three Trustee Reports have overestimated the degree of mortality improvement that would occur in the initial years of the projection. We recommend that the Trustees and OCACT reflect little to no improvement in aggregate mortality in the short term and a slower transition to the recommended ultimate rates of improvement.

**Figure 11: Recent Trustees Reports have overestimated mortality improvement in the first years of the projection period.**



Source: *Trustee Reports, various years, Table V.A1*

### **Greater Uncertainty**

The potential for both great advances in life extending technologies, such as genetic engineering, and threats to the health of the U.S. population, such as untreatable pathogens or an inability to curb obesity and drug abuse, seem greater at this point in history than in the past, so the Panel recommends widening the bands of uncertainty around the intermediate scenario. This can be done by increasing the variance in the stochastic projections (recommended) or, if the low-cost and high-cost scenarios continue to be shown, widening the range of these assumptions.

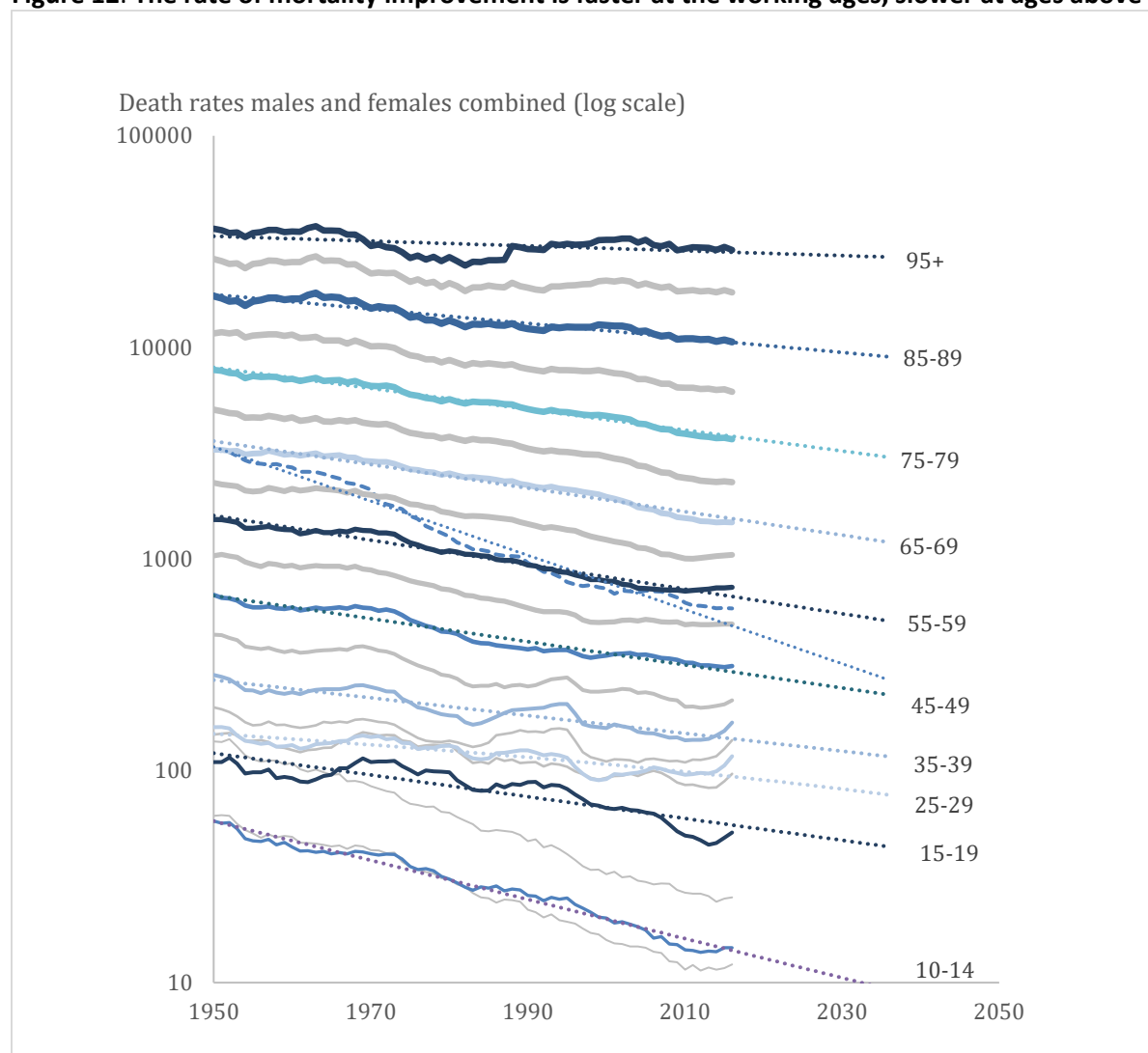
### **Age-gradient**

We agree with OCACT that it is appropriate to assume an age-gradient in the ultimate rate of mortality improvement such that the rate is faster at the working ages and slower at ages above 85 (see **Figure 12**). For example, for the period from 1900 to 2017, mortality improvement averaged around 1.0 percent for all ages but was only 0.8 percent for ages 65+, while it was 1.5 percent for ages below 65. Further, the Panel thinks the current approach, which has somewhat lower-than-historical improvement at younger ages and somewhat higher-than-historical improvement at advanced ages, is reasonable in light of the ongoing improvements to cardiovascular diseases, extensive efforts being made to improve the treatment of cancer, Alzheimer's, and other diseases prevalent at older ages, along with the cohort effect of smoking cessation working its way into older age groups. We also note that flattening the age gradient (compared to history) is consistent with recent academic thought<sup>13</sup>.

<sup>13</sup> For example, see N. Li, R. Lee and P. Gerland.2013. "Extending the Lee-Carter Method to Model the Rotation of Age Patterns of Mortality Decline for Long-Term Projections, *Demography*, 50(6):2037-51. December.

We encourage OCACT to continue its monitoring and research into the changing pattern of mortality improvement and to consider whether utilizing a new age grouping is warranted (i.e., breaking down age 85+ into age 85–95 and age 95+).

**Figure 12: The rate of mortality improvement is faster at the working ages, slower at ages above 85**



*Source: Data provided by Office of the Chief Actuary; trends calculated by Panel*

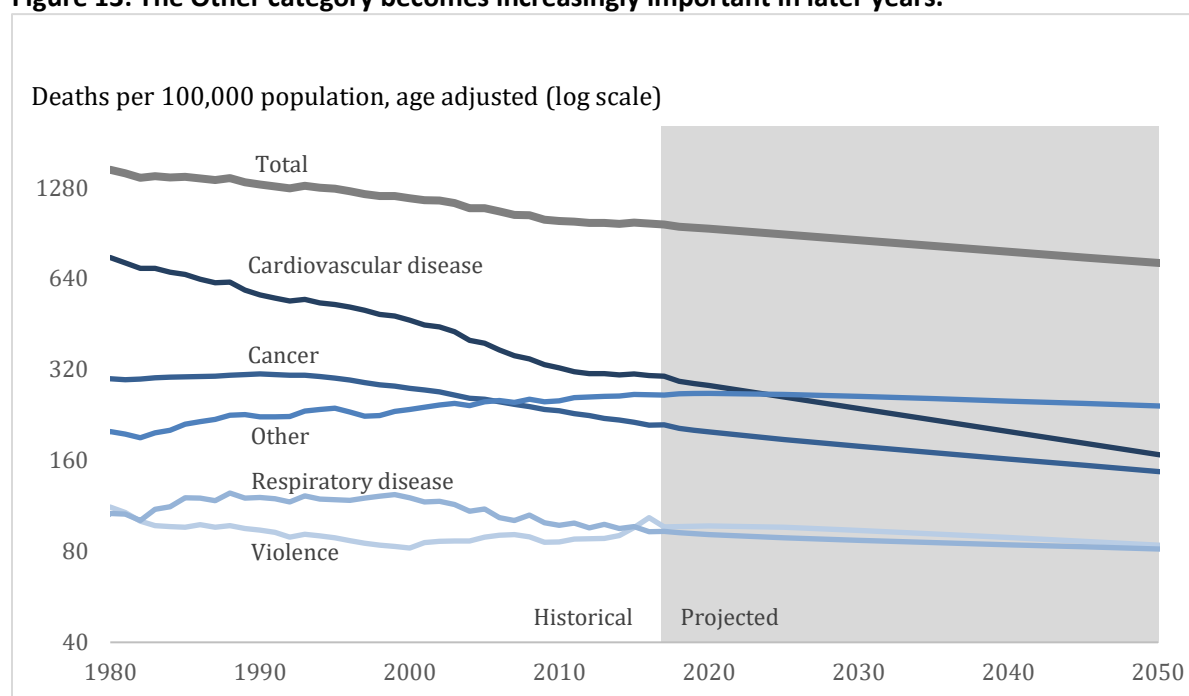
**Mortality Recommendation 2:** The Panel recommends OCACT project mortality in aggregate over the long-term rather than by cause of death, while acknowledging that cause of death analysis has significant value over the intermediate term.

Projecting mortality in aggregate will simplify the calculations and aid transparency. We recommend using cause of death to inform the expected rate of mortality improvement over the intermediate term, say 20 years, rather than projecting mortality directly by cause of death. The time frame over which medical practitioner expert input (for example, Romo et. al. 2016) is likely to be more accurate is the next ten to twenty years. Over longer periods, expert opinion is likely to miss future medical

breakthroughs and future diseases along with changes in societal norms. In addition, as shown in **Figure 13** below, the “other” category is set to become the leading cause of death for most of the 75-year projection period, and projecting improvements in this category is analogous to our recommendation since the Trustees are predicting an improvement rate for “most causes” combined, a short step from our recommendation to project all-cause mortality in aggregate. An alternate approach that some of the Panel supported was to continue cause of death projections for the initial 20 or so years of the projection and use aggregate, all-cause mortality thereafter.

We recommend that OCACT continue to monitor the factors influencing mortality, particularly the role of healthcare delivery, cohort effects, trends in smoking, obesity, education and income levels, drug addiction and deaths of despair, along with ongoing medical research and opinion. In particular, the increase in death rates at ages 60–69 over the last several years is a point that should be followed closely.

**Figure 13: The Other category becomes increasingly important in later years.**



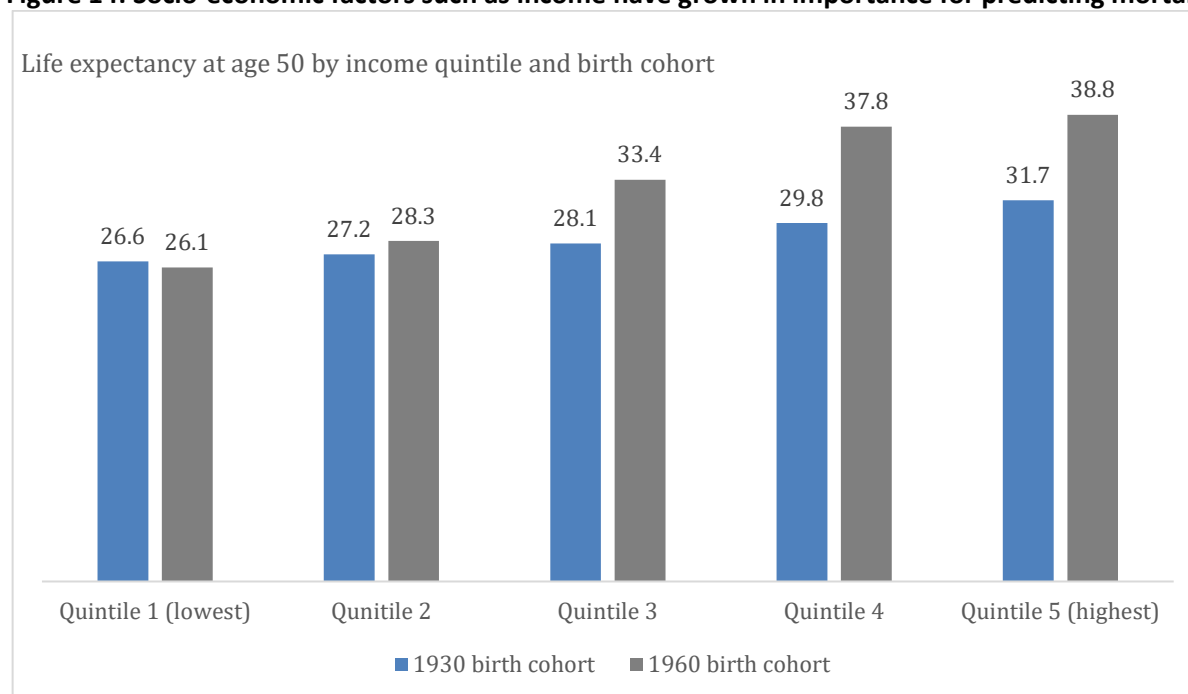
Source: Data provided by Office of the Chief Actuary

**Mortality Recommendation 3:** The Panel recommends OCACT develop the capability to model mortality and other demographic assumptions by either educational attainment, income or both.

Currently the demographic assumptions vary by age and sex, both of which are critical parameters for projecting a population. However, research has shown that socioeconomic factors such as educational attainment, lifetime income (see **Figure 14**) or access to healthcare also are very important predictive factors for mortality, fertility and potentially other key assumptions in the Trustees Report. If the Trustees adopt the Panel’s second recommendation to change from projecting mortality by cause of death to all causes combined, it will be more feasible to add more cells to the model for key characteristics like income, education and possibly other items.



**Figure 14: Socio-economic factors such as income have grown in importance for predicting mortality.**



Source: Figure 3.2 in National Academies of Sciences, Engineering, and Medicine. 2015. *The Growing Gap in Life Expectancy by Income: Implications for Federal Programs and Policy Responses*. Committee's calculations based on Health and Retirement Study data.

**Mortality Recommendation 4:** The Panel recommends OCACT look for ways to improve transparency, understanding and reproducibility.

We recommend using charts of historical and projected mortality rates for documenting the Trustees' assumption. As has been noted in the presentation section of this report, trends are easier to visualize from charts and graphs than tables of raw data. It also matters how charts are drawn. For example, the use of the log-scale in **Figure 10** makes it clear that the rate of improvement in the Trustees projections is less than has been observed historically. The log-scale is particularly appropriate for quantities that are bounded below by zero, which when plotted in the natural scale make it seem as if progress is slowing when in fact the rate of progress has been roughly constant.

We also recommend including in the Trustees Report a graph of historical and projected life expectancy at age 65 to improve the readers' grasp of the implications of the Trustee's assumptions. For most readers, life expectancy will be more intuitive than trends in deaths rates or the summary statistic, the average annual percent reduction in age-sex adjusted central death rates. In addition, we recommend showing the differential in observed mortality improvement by socioeconomic group and being clear about how this is reflected, if at all, in the Trustee Report. We applaud and encourage continued publication of past graphs of forecasts, the detailed data used for these forecasts, and the comparison of past forecasts with actual mortality.

**Mortality Recommendation 5:** The Panel recommends continuing to investigate differences between the starting mortality rates produced by SSA and by the Human Mortality Database (HMD) and take appropriate action.

The mortality tables produced by SSA and HMD are two of the most widely used indicators of U.S. mortality, yet they differ and the gap has been growing progressively since the 1980s. The HMD shows more rapid improvement in life expectancy at older ages than the SSA, with the differences growing over time. It is important to have a good understanding of trends at older ages upon which to base future projections. Early investigations such as Barbieri (2018) and Goss, et al. (2013) are a good start on understanding how much of the difference is due to data and how much is due to methods, but more work is needed to fully understand the issue.

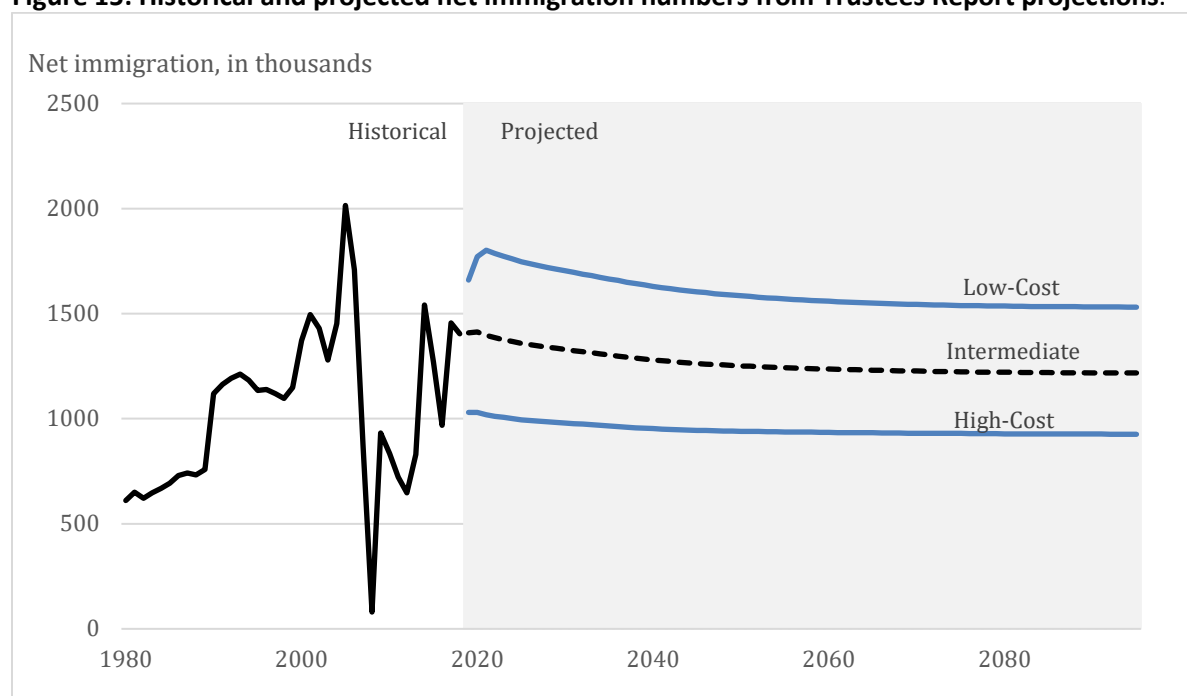
## 4.3 Immigration assumptions and methods

### ***Current Modeling Approach and Assumptions***

OCACT projections make a distinction between the two types of foreign-born non-citizens: lawful permanent residents (LPRs) and other than LPRs. The latter category includes unauthorized immigrants, temporary workers, and students. OCACT projects annual immigration flows for LPRs and other-than-LPRs. It also projects legal emigration flows (defined as emigration by LPRs and citizens) and other-than-LPR emigration flows. Finally, it projects the annual number of individuals with other-than-LPR status who become LPRs. The total flow in each category is broken down by age and sex.

OCACT applies current law caps to project the annual inflow of those categories of LPRs that are capped by law. There are certain categories that are not capped, primarily immediate relatives of citizens. Under the intermediate cost scenario of the 2019 Trustees Report, the ultimate level of LPR immigration (number of LPR immigrants + number who transfer status to LPR) is assumed to be 1,050,000 per year. Annual legal emigration is assumed to be 25 percent of the level of LPR immigration. Annual other-than-LPR immigration is assumed to be 1,350,000. Transfers from other-than-LPR to LPR status are assumed to equal one-third of the other-than-LPR inflow, and the number of other-than-LPR emigrants is assumed to rise from 275,000 in 2020 to 470,000 in 2095. All flows except other-than-LPR emigrants are held constant. Other-than-LPR emigration is assumed to be proportional to the size of the other-than-LPR population, which is projected to increase. Thus, net annual immigration is projected to decline from about 1.4 million in 2020 to 1.2 million in 2095. **Figure 15** shows counts of historical net immigration and the Trustees Report projections under the three scenarios. (As noted in the presentation section, such figures are more helpful to readers than tables of numbers.)

**Figure 15: Historical and projected net immigration numbers from Trustees Report projections.**



*Source: Data from 2019 Trustees Report, Table V.A2. Prior to 1980, net other-than-LPR immigration is not reported*

LPR immigrants' labor force behavior and earnings are assumed to be the same as that of the native born. The assumptions for other-than-LPR immigrants vary by category. Undocumented immigrants are assumed to have the same labor force participation as the native born but lower earnings on average. They also are assumed to be less likely to work in covered employment and qualify for benefits. Foreign students are assumed to have lower labor force participation and lower earnings, and their employment is generally not covered by Social Security. Temporary workers are assumed to have higher labor force participation than the native born, while their earnings and coverage status vary by further subgroups.

### ***Immigration relative to population***

**Immigration Recommendation 1:** The Panel believes the Trustees assumptions are reasonable for the near-term (five to ten years). Beyond the next five to ten years, the Panel recommends tying assumed levels of LPR immigration and other-than-LPR immigration to the size of the population, with the three scenarios reflecting the range of plausible outcomes for immigration projected as a fraction of the population.

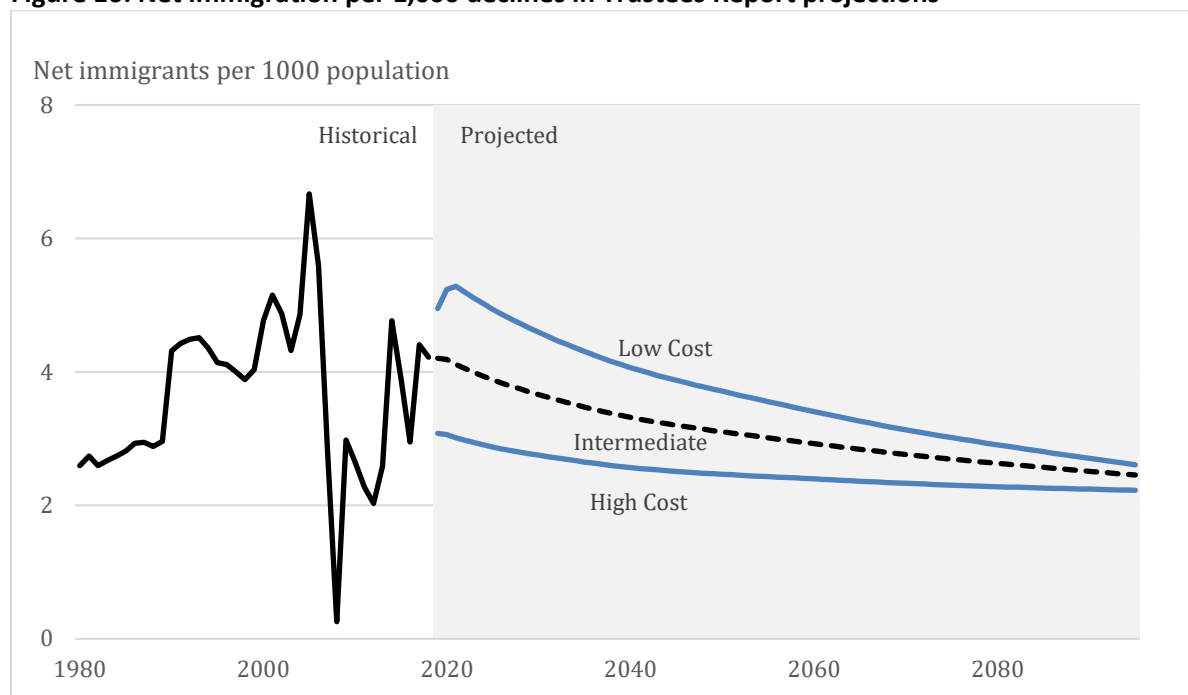
Current law imposes numerical caps on the number of LPRs in some categories that generally are not tied to population size. In the near term, it is reasonable to expect no major changes in these caps. However, there is no reason to believe that current law alone represents the most plausible long-term scenario for LPR immigration. Even if current law is reasonable in the short term, it is equally reasonable to expect immigration policy to adapt to changing circumstances further down the road. Even under current law, certain categories of LPR immigration (such as immediate relatives of U.S. citizens) are not subject to caps and are plausibly tied to the size of the population.

Theoretically, many different factors can influence immigration and emigration rates, including current law, enforcement of current law, and the demand for labor in the United States and in other countries. Current law and enforcement policies also can be expected to change in response to a multitude of

economic, social, and political factors. While modeling each of the factors that can influence immigration is challenging, it is important for the three scenarios to reflect the range of plausible outcomes for immigration.

**Figure 16** shows historical net immigration and the Trustees Report projections as a share of the population (net immigration per 1,000 population). Under the intermediate assumptions, LPR immigration is held to a constant number, and the net number of other-than-LPR immigrants are assumed to decline somewhat. Thus, total immigration declines as a share of the growing population. The high-cost and low-cost scenarios also project net LPR immigration as a fixed number of individuals rather than tying their values to the size of the population. Thus, as shares of the population, the immigration levels projected under the three scenarios start to converge. The convergence suggests that the scenarios fail to reflect the range of plausible outcomes for immigration as a share of the population.

**Figure 16: Net immigration per 1,000 declines in Trustees Report projections**



*Source: Net immigration data come from Table V.A2 in the 2019 Trustees Report. Population counts come from Table V.A3 in the 2019 Trustees Report. The ratio for each scenario uses both the net immigration and the population count for that scenario.*

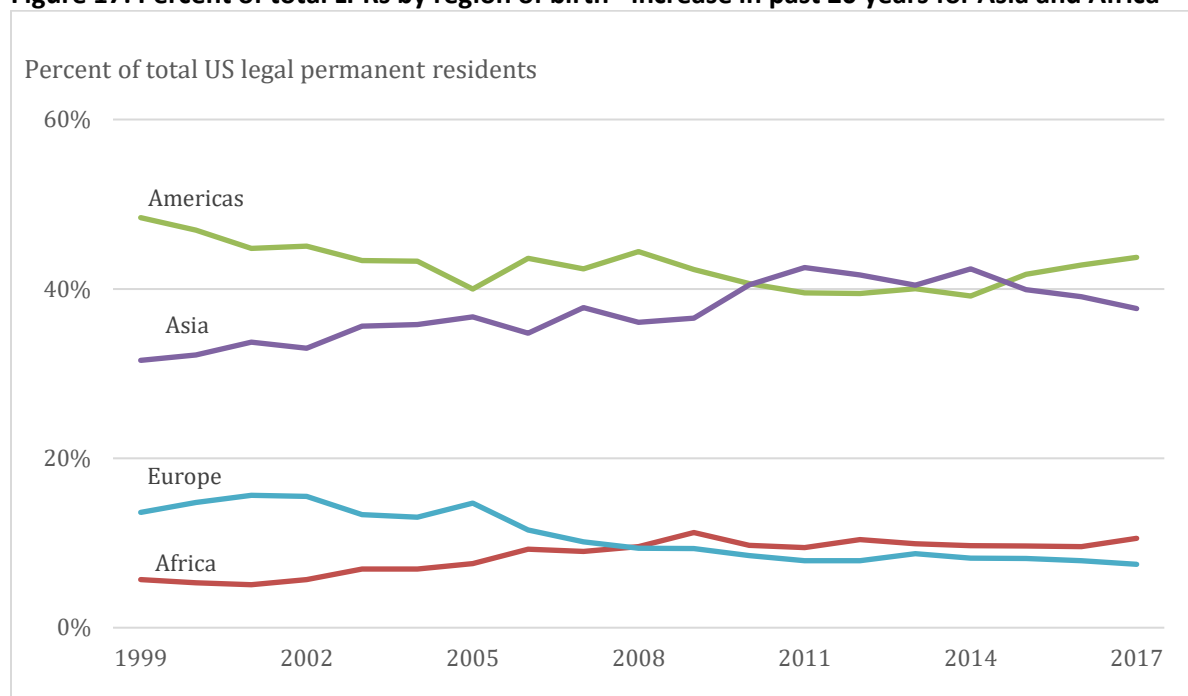
Our recommendation is consistent with those of the 2007 and 2011 technical Panels, which explicitly recommended tying net migration to the size of the population. The 2015 Panel also emphasized that rising total net immigration is more plausible than the declining numbers currently assumed. The 2007 Panel recommended that the intermediate assumptions reflect a net immigration rate of 4.4 per 1,000 initially, rising to 4.6 per 1,000, and then declining to 4.2 per 1,000 at the end of the 75-year projection period. The 2011 Panel recommended that the intermediate assumptions reflect an ultimate net immigration rate of 3.2 per 1,000. While we remain agnostic about the exact ratio, some value in this range is reasonable. The average rate of net immigration over 1980–2018, based on the 2019 Trustees Report, was 3.6 per 1,000. For the purposes of illustrating how this recommendation affects the projections, we fixed net immigration as a share of population at its 2029 value for the remainder of the projection period (under the 2019 Trustees Report intermediate projections, this is 3.7 per 1,000).

Finally, we note that this recommendation applies to obtaining a more reasonable long-term projection of future immigration levels. As stated in the methods section, we recommend showing two projections consistently for all assumptions: one reflecting current law and the other reflecting the most plausible long-term projections, with the emphasis on the latter.

**Immigration Recommendation 2:** The Panel recommends that OCACT develop the capability to reflect more heterogeneity among immigrants in the projection model to capture the changing characteristics of immigrants.

OCACT assumptions do not make distinctions among different immigrant groups based on skill or national origin. However, the characteristics of immigrants have been changing, and these changes can be expected to continue in the future. **Figure 17** shows that over the past two decades, the share of LPRs coming from Asia and Africa have increased, while the share coming from the Americas has declined. Similar trends are occurring among other-than-LPR immigrants as well. Passel and Cohn (2019) find that the number of unauthorized immigrants who recently arrived from Mexico has declined, while the number of unauthorized immigrants who recently arrived from other parts of the world did not change much. Thus, immigrants from countries other than Mexico account for an increasing share of recently arrived unauthorized immigrants. **Table 1** summarizes these findings.

**Figure 17: Percent of total LPRs by region of birth - increase in past 20 years for Asia and Africa**



Source: Migration Policy Institute, *Legal Immigrants by Country of Origin*

**Table 1: Shift in country of birth of unauthorized immigrants over the past ten years**

Country of Birth	2007	2017
Mexico	52%	20%
Northern Triangle (El Salvador, Guatemala, and Honduras)	11%	17%
Asia	13%	23%
Other Countries	24%	40%

*Source: Passel and Cohn (2019)*

To highlight one dimension along which more recent immigrants may differ from earlier ones, **Table 2** shows the educational attainment of the native born and of immigrants from China, India, and Mexico. The differences in skills highlighted in the table are likely to translate to differences in fertility and labor force behavior. The changing characteristics of immigrants also may affect emigration rates and the rate of transfer between other-than-LPR and LPR status.

**Table 2: Educational attainment by country of birth**

Country of Birth	Less than 9th Grade	9th-12th Grade	High School Diploma or GED	Some College or Associate's Degree	Bachelor's Degree or Higher
U.S.	17%	10%	23%	19%	31%
Mexico	36%	18%	26%	13%	7%
China	13%	8%	18%	12%	49%
India	3%	4%	7%	7%	79%

*Source: Migration Policy Institute, Educational Attainment of U.S. Population by Nativity and Country of Birth, 2017*

It is hard to predict where future immigrants will come from, as that depends on a range of supply and demand factors in the United States and other countries. The Panel recommends that OCACT do a more detailed analysis of immigrant types to capture heterogeneity. That goal could be achieved through more refined modeling of cohorts or through microsimulation. Social Security administrative data contain information on country of birth, allowing for the examination of how labor market, fertility rates, longevity, and claiming patterns may vary by nativity and country of origin.

## 5.0 ECONOMIC ASSUMPTIONS AND METHODS

The economic assumptions are key determinants of the Social Security program's finances. The contributions to the program depend on the labor force participation rate (LFPR) and the unemployment rate. Real wage growth rates apply to those who are working and the taxable share impacts the percentage of these earnings that is subject to tax. Other significant economic assumptions include real interest rates and inflation rates.

### 5.1 Labor Force Participation

The projections of labor force participation affect both the revenues and the costs of the Social Security system. Higher labor force participation means a larger social security tax base, which boosts revenues and eventually boosts benefits as well.

**Economics Recommendation 1.1: Labor force participation.** The Panel agrees with the 2017 Technical Panel on Labor Force Participation that the OCACT model should assume that the forces underlying the long-term trends in labor force participation abate slowly over the medium term. In particular, we recommend that the historical trend of 0.14 percentage point per year decline in age-adjusted prime-age male labor force participation abate gradually over 25 years.

**Economics Recommendation 1.2: Labor force participation.** The Panel recommends that the historical trend of 0.5 percentage point per year decline in the labor force participation of men and women ages 16–19 and the 0.35 percentage point per year decline in labor force participation of men ages 20–24 abate gradually over 25 years.

**Economics Recommendation 1.3: Labor force participation.** The Panel recommends that the Trustees maintain their assumption of increasing labor force participation of older workers.

**Economics Recommendation 1.4: Labor force participation.** The Panel recommends that the Trustees assume that the cyclical recovery in labor force participation following the Great Recession has ended and use current labor force participation rates as the jumping off point for the trends discussed in recommendations 1.1 and 1.2.

**Economics Recommendation 1.5: Labor force participation.** The Panel recommends that the low-cost scenario assume that labor force participation rises gradually over 25 years, so that participation in 25 years for each age group is equal to participation 25 years prior, and then remain at that level for the remainder of the projection. For the high-cost scenario, we recommend allowing the declines suggested above to abate slowly over the entire 75 years of the projection, instead of just 25 years.

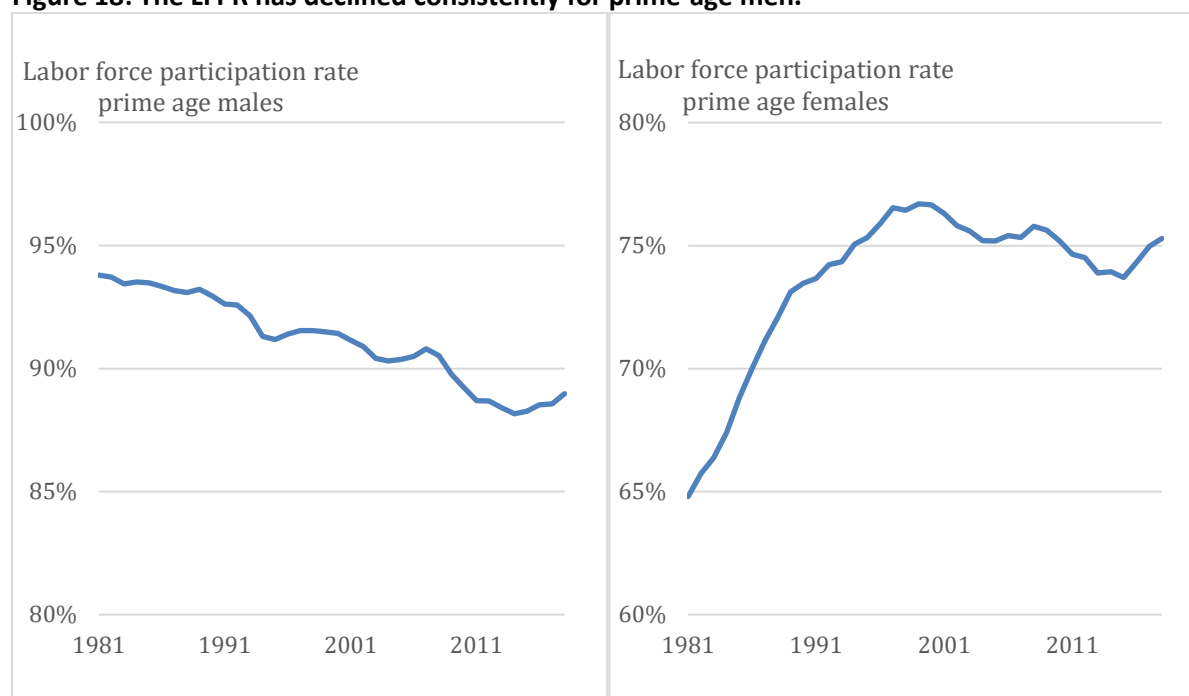
**Economics Recommendation 1.6: Labor force participation.** The Panel further recommends that labor force participation be better linked to changes in wages. Under current assumptions, a given percentage increase in the labor force raises payroll one-for-one, without accounting for the likely wages (and hours) of those whose participation is changing, whereas most of those changes are likely for low-education workers and teenagers.

#### *Prime-age Labor force participation*

Figure 18 shows the age-adjusted labor force participation rates for prime-age men and women. The participation rate for prime-age men has been declining for decades. It fell particularly sharply during the Great Recession and has recovered some in the past four years. For women, participation rose from

the 1950s through 2000, reflecting a variety of societal factors, including increased educational attainment and job opportunities for women and a reduction in childbearing. Participation for prime-age women declined on average from 2000 to 2008, declined sharply during the Great Recession, and has picked up since then. For both men and women, the declines have been especially concentrated among those with lower educational attainment (**Figure 19**). Nonetheless, because of the increases in participation for women through 2000, it is difficult to discern long-term trends for women. We view the evidence of underlying long-term downward trends in prime-age male participation as much stronger.

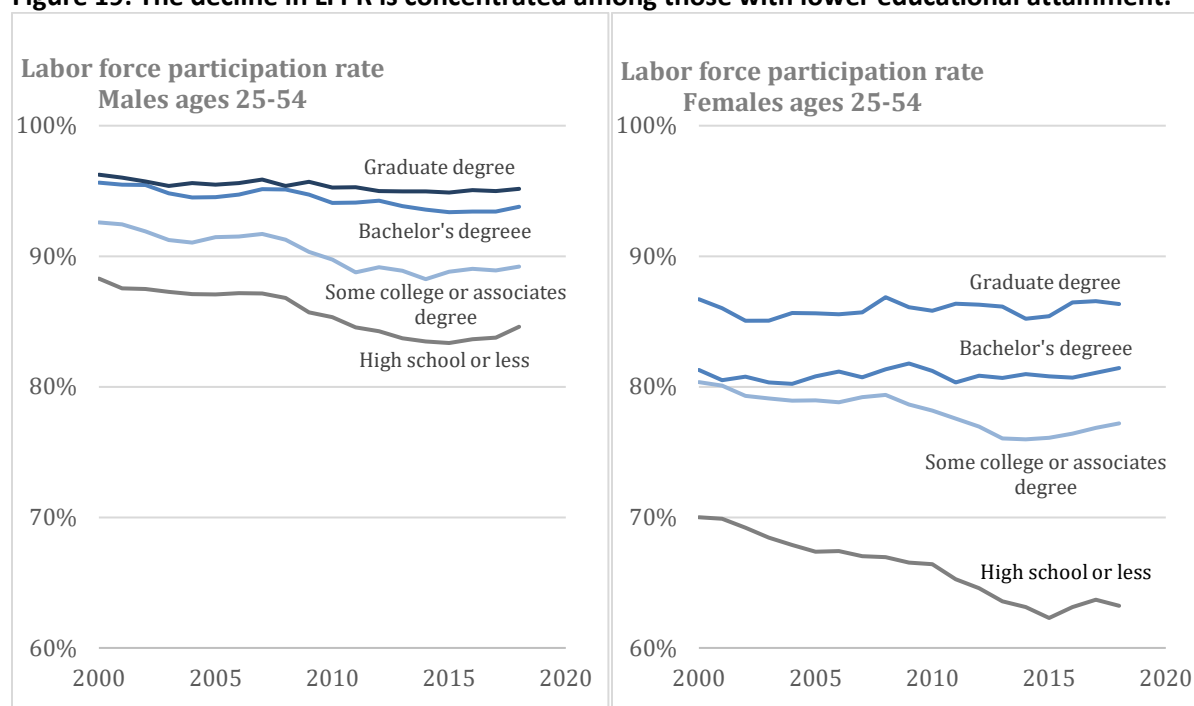
**Figure 18: The LFPR has declined consistently for prime-age men.**



Source: Data provided by the Office of the Chief Actuary



**Figure 19: The decline in LFPR is concentrated among those with lower educational attainment.**



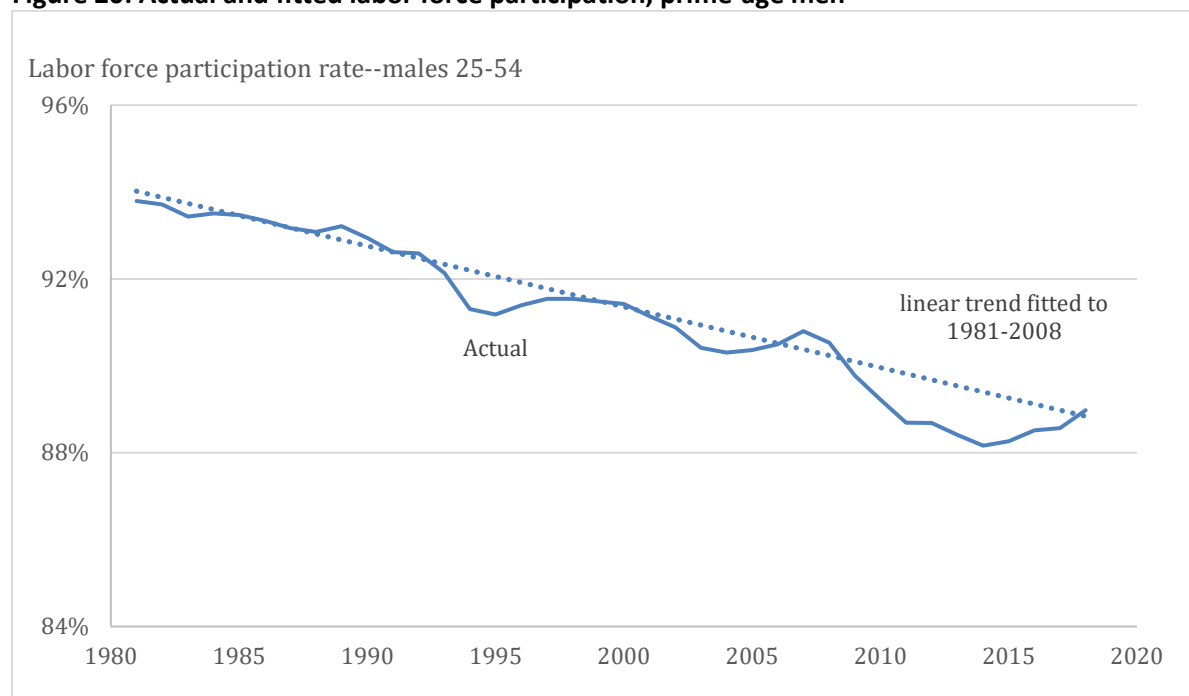
Source: The Hamilton Project, Current Population Survey 2000-2018. 2018 data includes values through May 2018

A key question is how to interpret the recent increases in prime-age participation. It now seems clear that much of the sharp downturn in participation from 2009 to 2015 was a cyclical effect reflecting the very high unemployment rates during the Great Recession and that the recent upturn should be viewed as a cyclical recovery. But could the recent upturn also suggest that the long-term trend of declining participation for prime-age men has ended? We think not, for several reasons.

First, the labor force participation of prime-age men is just slightly above where one would have expected given pre-recession trends. **Figure 20** shows the fitted values from a regression of age-adjusted prime-age participation (five-year participation rates age standardized to the 2011 population) on a time trend, where the regression is estimated from 1981 to 2008.<sup>14</sup> That time trends shows prime-age male participation declining 0.14 percentage points per year over this time period. As shown in **Table 3**, grouping prime-age males together seems reasonable, as the time trends are similar across five-year age groups.

<sup>14</sup> The participation rates for each age group are weighted by the 2011 population shares to create an age-adjusted prime-age participation rate.

**Figure 20: Actual and fitted labor force participation, prime-age men**



Source: Data provided by the Office of the Chief Actuary; Panel calculations

**Table 3: The time trends are consistent among five-year age groups for prime-age men.**

Regression of Labor force participation rates of prime age men on a time trend: 1981-2008						
	25-29	30-34	35-39	40-45	45-49	25-54 (age adj)
Percentage point change per year	-0.14**	-0.10**	-0.13**	-0.15**	-0.17**	-0.14**
R-squared	0.87	0.83	0.82	0.91	0.93	0.93

\*\* =  $p < 0.05$

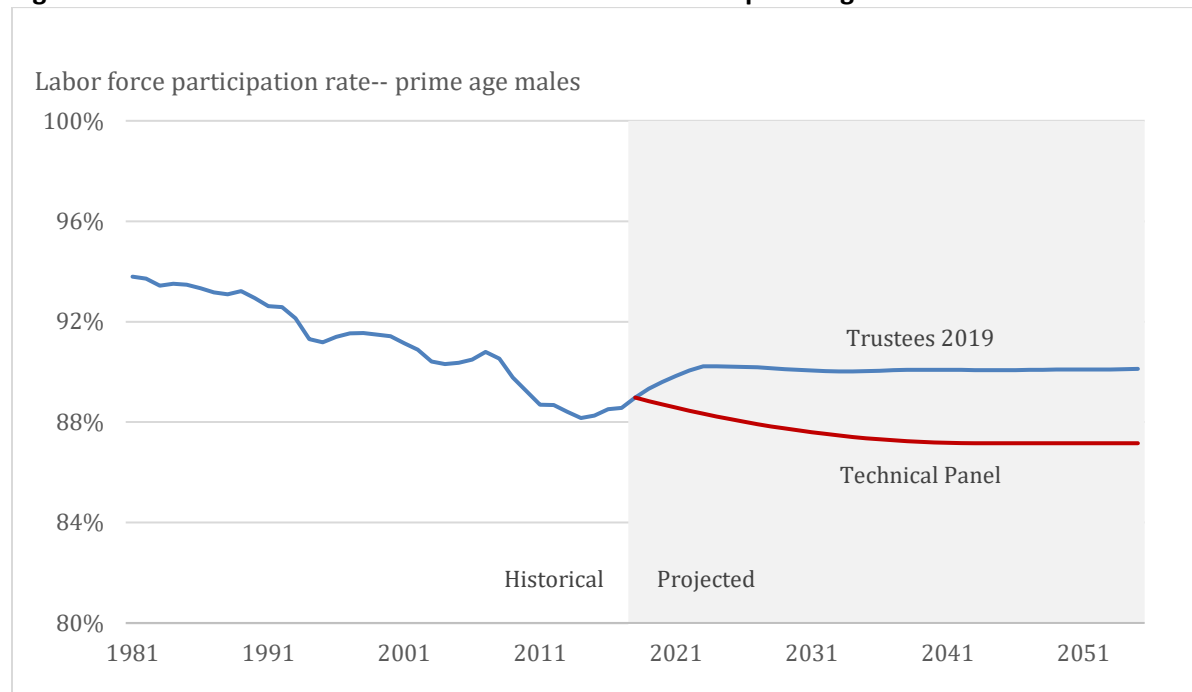
The current level of prime-age participation may be slightly above its cyclically adjusted average, if one believes that the unemployment rate is below its long-run average (see more about the unemployment rate below). However, given the lack of inflationary pressure at the current unemployment rate, and some evidence that participation might have room to increase (Tedeschi, 2019), we believe a reasonable assumption is that the current rate is back to its underlying trend.

Thinking about whether previous trends will resume once the cyclical recovery is complete requires understanding the reasons for the secular decline in prime-age participation and employment. In a review of the evidence, Abraham and Kearney (2018) conclude that labor demand factors, in particular trade and automation, are the most important factors, although a variety of other factors, including increases in disability and share of the population with prison records, also may be important. The Panel agrees with the 2017 Technical Panel on Labor Force Participation that there is little reason to believe that these factors are fully played out. However, we don't believe there is good reason to believe that these trends will go on indefinitely, and it seems likely that participation might stabilize at some point.

Thus, we suggest allowing these trends to abate slowly over 25 years and then allowing participation to stabilize.

**Figure 21** contrasts our recommendation for age-adjusted prime-age male labor force participation with that in the 2019 Trustees Report. As is clear, the Panel believes the Trustees assumptions are somewhat too optimistic for an intermediate projection. By 2043, under the Panel's recommendation, prime-age male labor force participation reaches 87.2, almost 3 percentage points below the participation rate in the Trustees' projection.

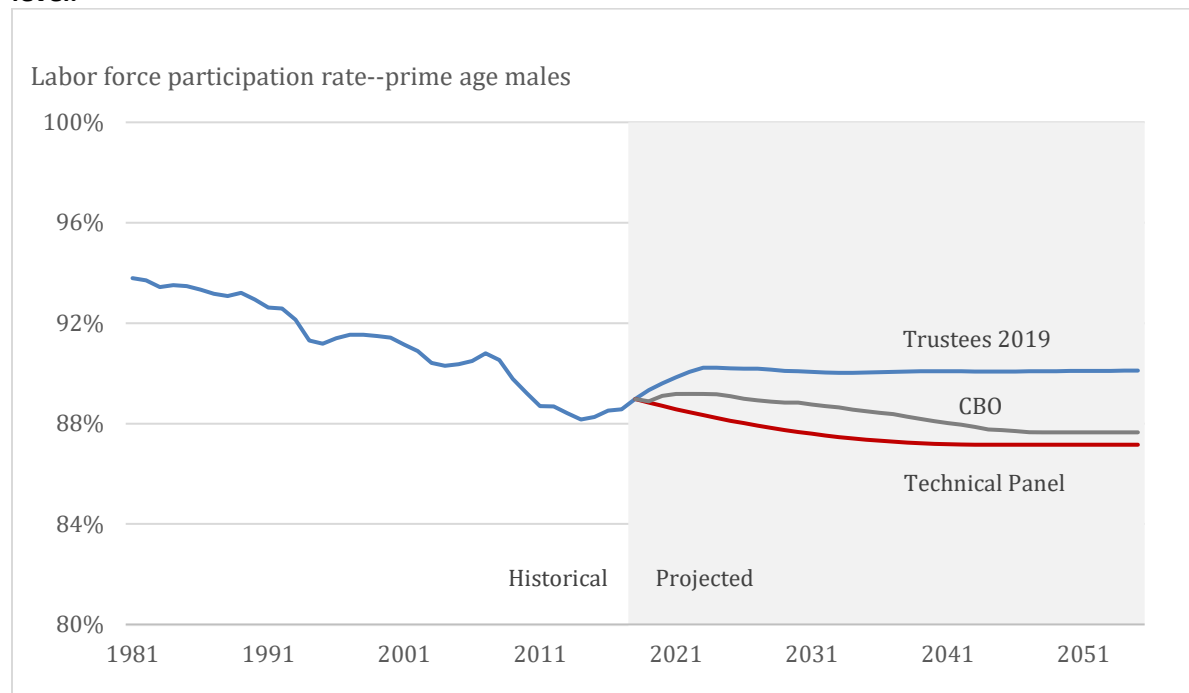
**Figure 21: The Panel recommends a lower ultimate LFPR for prime-age males.**



Source: Data provided by the Office of the Chief Actuary; Panel calculations

The CBO recently released its long-term projection for labor force participation by age group. We used its projection to calculate an age-adjusted prime age labor force projection (using constant 2011 population shares), shown in **Figure 22**. Relative to CBO, the Panel recommendations have slightly lower participation. Both CBO and the Panel have age-adjusted lower prime-age labor force participation than the Trustees.

**Figure 22: The Panel’s recommendation for prime-age males is slightly lower than CBO’s projected level.**

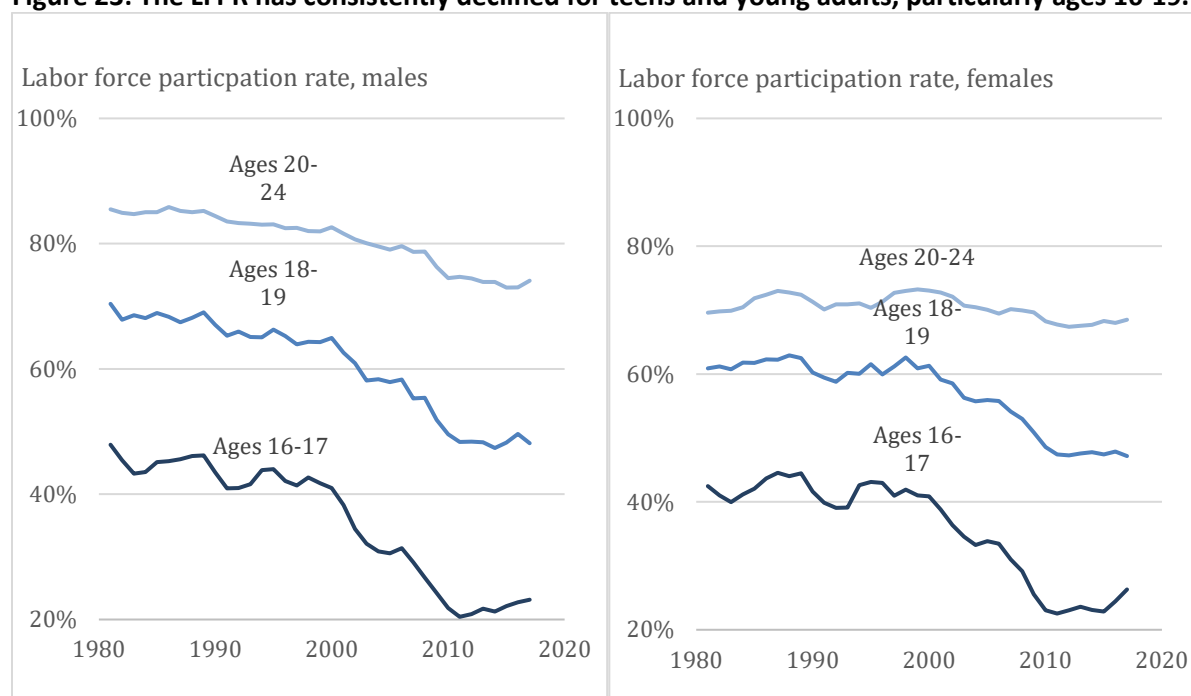


Source: Data provided by the Office of the Chief Actuary, CBO (2019b); Panel calculations

### **Teenage and young-adult labor force participation**

**Figure 23** shows the history of teen and young adult labor force participation. For both men and women, participation has been declining across all three age groups, although the decline in participation is sharpest for those ages 16–19 and less clear for women ages 20–24. The declines for younger workers began later than for prime-age men: participation was relatively flat during the 1980s but began declining in the 1990s. The 2015 Technical Panel on Labor Force Participation noted that the decline in teenage participation mostly represented a decline in the likelihood that teenagers worked while in school.

**Figure 23: The LFPR has consistently declined for teens and young adults, particularly ages 16-19.**



Source: Data provided by the Office of the Chief Actuary

As with the trends in prime-age men, we believe there is little reason to assume that the forces underlying these trends have stopped. We recommend assuming that, as with prime-age men, they abate gradually over time. **Table 4** presents the results of regressions of young participation for various time periods. We recommend that the Office of the Actuary incorporate some downward trends in their forecast. Our reading of the evidence is that the underlying trends for teens are roughly a decline of about 0.5 percentage point per year; for men ages 20–24, the decline is smaller, perhaps 0.35 percentage point per year. We believe the evidence for women ages 20–24 is too murky to conclude that there is any strong underlying trend.

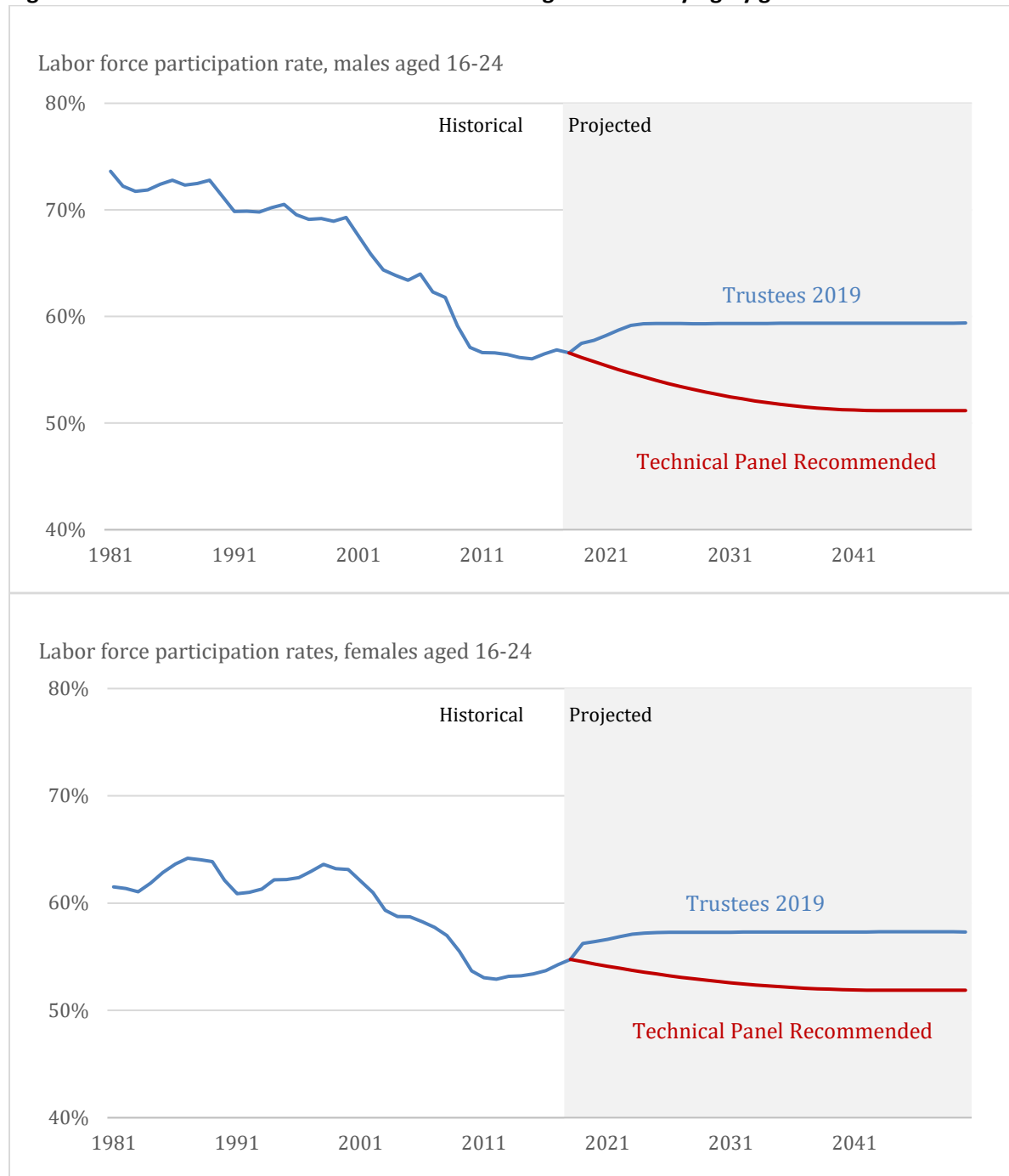
**Table 4: The regression results support a forecasted decline in LFPR for teens and young male adults**

Regression of labor force participation of teens and young adults: males and females, various periods									
	1981-2008			1990-2008			2001-2018		
	16-17	18-19	20-24	16-17	18-19	20-24	16-17	18-19	20-24
<u>Males</u>									
Percentage point change per year	-0.64**	-0.49**	-0.26**	-0.92**	-0.64**	-0.31**	-0.90**	-0.91**	-0.51**
R-squared	0.76	0.86	0.92	0.78	0.85	0.93	0.76	0.85	0.89
<u>Females</u>									
Percentage point change per year	-0.40**	-0.25**	-0.0**	-0.63**	-0.36**	-0.0**	-0.87**	-0.77**	-0.24**
R-squared	0.57	0.57	-0.04	0.66	0.53	-0.04	0.71	0.87	0.63

\*\* = p<0.05

In contrast, the current Trustee projections assume that labor force participation continues to increase over the next several years. **Figure 24** compares the OCACT projections with the Panel's recommendation; it uses the 2011 population share to combine the three age groups into one age-adjusted rate for those age 16–24.

**Figure 24: The Panel recommends lower LFPRs for ages 16-24 varying by gender.**

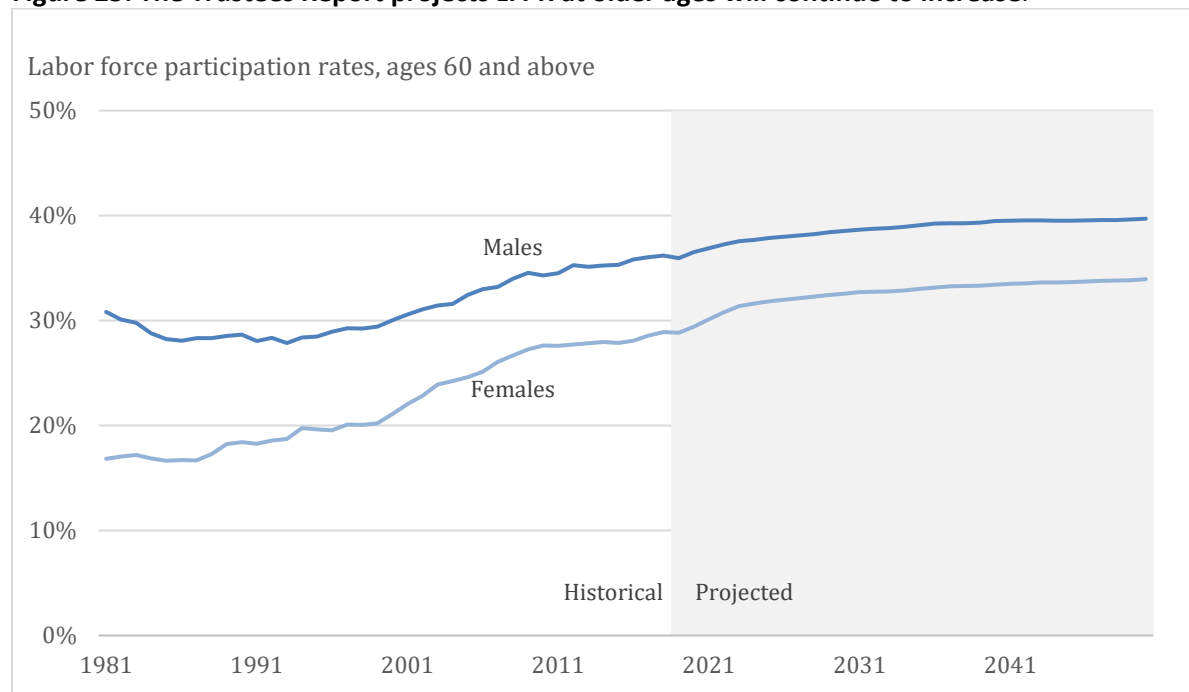


Source: Data provided by the Office of the Chief Actuary; Panel calculations

## Older Workers

The labor force participation for workers 60 and older has been increasing for both men and women since the early 1990s. The Trustees Report assumes participation at older ages will continue to increase over time, albeit at a somewhat reduced rate, as shown in **Figure 25**. In the OCACT model, labor force participation rates of older workers depend on education (this allows for women’s labor force participation to be increasing over time in a way that seems sensible) and with life expectancy. In particular, roughly 40 percent of the increase in longevity at age 40 is assumed to be offset with an increase in labor supply. Whether this assumption makes sense is difficult to know. But the net result, that recent trends abate slowly over time, seems reasonable and in keeping with the recommendations the Panel has made for other age groups.

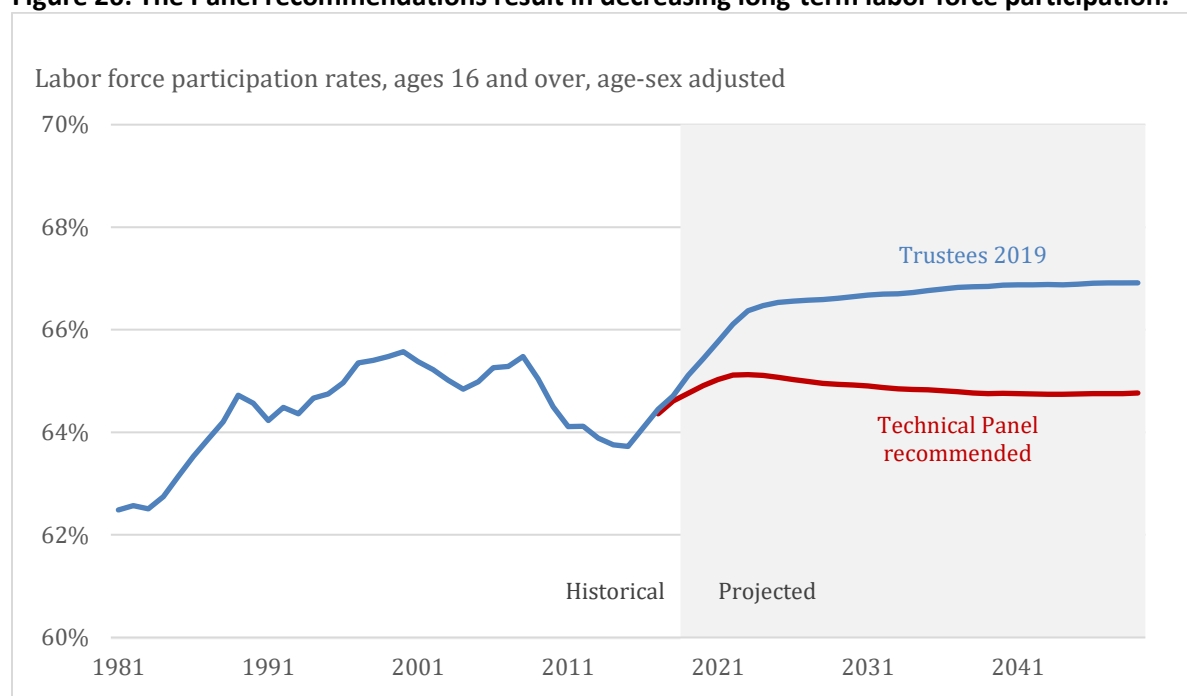
**Figure 25: The Trustees Report projects LFPR at older ages will continue to increase.**



Source: Data provided by the Office of the Chief Actuary

**Figure 26** shows the implications of the Panel recommendations. Rather than increasing from 64.8 percent in 2018 to 66.9 percent in 2045, as in the 2019 Trustees projection, the age-and-sex-adjusted labor force participation increase falls slowly over time and is 65.1 percent in 2045.

**Figure 26: The Panel recommendations result in decreasing long-term labor force participation.**



Source: Data provided by the Office of the Chief Actuary; Panel calculations

## 5.2 Unemployment Rate

**Economics Recommendation 2: Unemployment.** The Panel recommends lowering the ultimate assumed value for the unemployment rate in the intermediate scenario from 5.5 percent to 4.8 percent and to 3.8 percent and 5.8 percent in the low-cost and high-cost scenarios, respectively.

A lower unemployment rate improves Social Security finances because it increases the level of earnings and only eventually increases benefits. In the Trustees intermediate projection, the ultimate, long-run, age-sex-adjusted unemployment rate is 5.5 percent, about the average unemployment rate over the last four business cycles. The ultimate unemployment rate is 4.5 percent and 6.5 percent in the low-cost and high-cost scenarios, respectively.

The unemployment rate in June of 2017 was 3.7 percent—well below these long-run estimates. There is much debate among policymakers and academics about the natural rate of unemployment: essentially the rate of unemployment that can be sustained without causing inflation (Abraham and Haltiwanger 2019). Given how low the current unemployment rate is, and given that inflation has, if anything, been below the Fed's 2 percent target, most analysts have marked down their estimate of the natural rate of unemployment.

In contrast, the Trustees assume that the current unemployment rate is only temporarily low and will increase gradually to 5.5 percent over the next four years, even while they also project that employment will rise as a share of the population. They argue that as discouraged workers slowly come back into the



labor force, this will increase the labor force more than it increases employment, thereby allowing both the unemployment rate and the employment-to-population ratio to increase.

The Panel views this as an unlikely scenario. First, as noted, labor force participation tends to move in an opposite direction from the unemployment rate—it increases during booms when the unemployment rate is falling and decreases during recessions when the unemployment rate is rising. In the Trustees’ projection, participation and the unemployment rate both are moving up over the next few years. Second, mathematically, it likely would require that discouraged workers enter the labor force at high rates of unemployment; it seems more likely that transitions from out-of-the-labor force to into-the-labor force mostly occur because someone finds a job, rather than because someone decides to start looking for a job but can’t find one.

The Panel believes that the recent experience is better interpreted as a lower natural rate of unemployment than in the past. Of course, exactly what the natural rate is—and how close the economy is to full-employment—is difficult to know. But some markdown of the unemployment rate seems warranted. We suggest an ultimate assumption of 4.8 percent; this puts some weight on the possibility that the economy will return to the unemployment rates of previous history and the possibility that the current unemployment rate is about equal to the new natural rate. We believe that an unemployment rate of plus or minus one percent is reasonable for the low-cost and high-cost scenarios. As noted earlier, consistency among assumptions is critical within the Trustees Report; thus, a change in the unemployment rate necessitates a change to the disability incidence rate.

In comparison to other forecasts, CBO’s 2019 long-term unemployment rate varies by year, but averages at about 4.6 percent over the next 30 years (CBO, 2019b). In the most recent Economic Projections from the Federal Open Market Committee, the medium longer-run unemployment rate was 4.2, with estimates ranging from 3.6 to 4.5 percent (FOMC, 2019). IHS Markit projects an unemployment rate of 4.6 in 2028 and 4.8 in 2048 (Social Security Long-Range Economic Assumptions 2019).

### 5.3 Real Wage Growth

The rate of real earnings growth is one of the most important assumptions in the Social Security projections. While higher earnings growth eventually leads to higher benefit growth for current and future workers, it has no effect on the benefits of the currently retired. Thus, the higher the rate of real earnings growth, the smaller the actuarial imbalance in the system.

The Trustees break down the real earnings into five components: (1) economy-wide productivity growth; (2) the labor share of output; (3) Social Security earnings as a share of total compensation; (4) average hours per worker; and (5) the ratio of the GDP price deflator to the CPI.<sup>15</sup>

$$\text{Real earnings per worker} = \frac{(1) \frac{\text{Nominal GDP}}{\text{GDP Deflator}}}{\text{Hours}} \times \frac{(2) \text{Compensation}}{\text{GDP}} \times \frac{(3) \text{Earnings}}{\text{Compensation}} \times \frac{(4) \text{Hours}}{\text{Employment}} \times \frac{(5) \text{GDP deflator}}{\text{CPI}}$$

<sup>15</sup> This final term (5) is necessary because, although productivity growth typically is measured by deflating nominal GDP by the GDP deflator, Social Security benefits are indexed using the CPI. The wedge between the GDP deflator and the CPI, and its implications for Social Security, are discussed below.

**Economics Recommendation 3: Real wage growth.** For the intermediate projection, the Panel recommends the Trustees assume that average real earnings per worker increase 1.08 percent per year from 2028 to 2093, down from the 1.18 percent assumed in the 2019 Trustees Report. For the low-cost and high-cost scenarios, we recommend average increases of 1.68 percent and 0.49 percent per year, respectively, down from 1.77 and 0.6 in the 2019 Trustees Report.

These recommendations come from recommended changes in many of the components detailed above; the rationales for each of these changes are discussed below.

### 5.3.1 Productivity growth

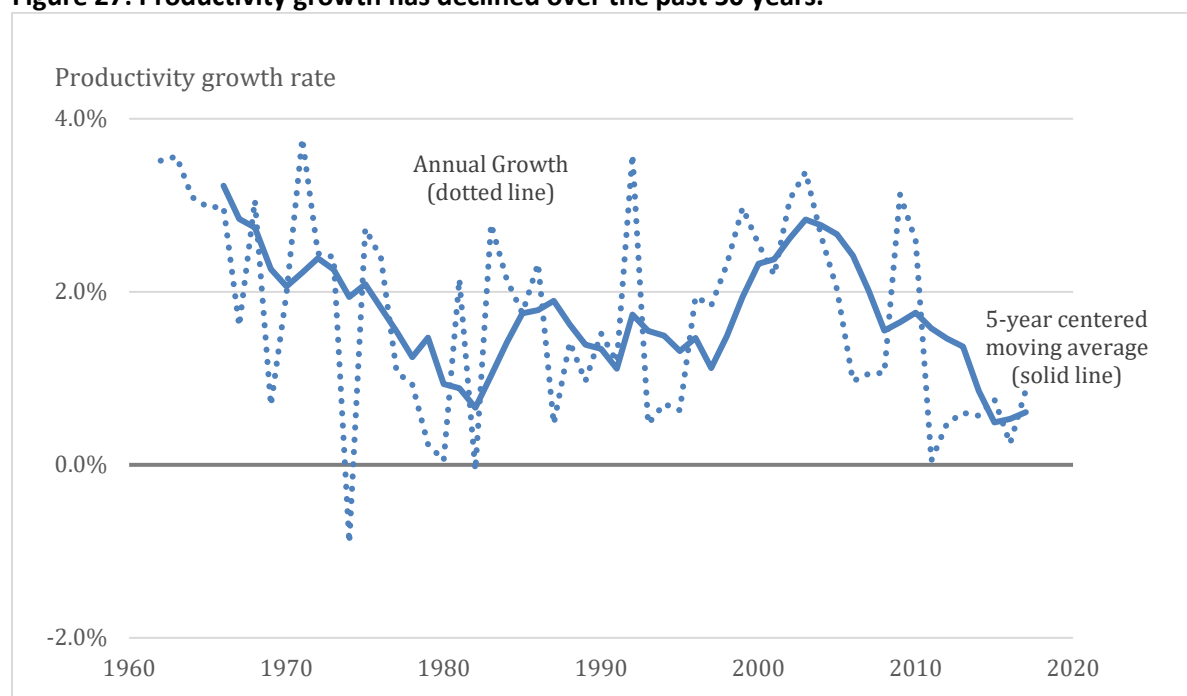
#### ***Economy-wide productivity growth***

**Economics Recommendation 3.1.1: Real wage growth: productivity growth.** The Panel recommends that the Trustees lower their long-run assumption for non-farm business productivity growth to 1.9 percent and for economy-wide productivity growth to 1.55 percent.

**Economics Recommendation 3.1.2: Real wage growth: productivity growth.** The Panel recommends maintaining a 0.3 percentage point difference for the high- and low-cost scenarios, so that non-farm business productivity growth is 1.5 percent in the high-cost scenario and 2.1 percent in the low-cost scenario and economy-wide productivity growth is 1.25 percent in the high-cost scenario and 1.85 percent in the low-cost scenario.

Productivity growth—the increase in real output per hour worked—is the main driver of real earnings growth. **Figure 27** shows the history of productivity growth, with the dashed line showing annual values and the solid line showing a five-year moving average of annual values. Productivity growth was very high in the 1960s but has been much lower since, apart from a burst in productivity in the late 1990s and early 2000s. Productivity growth began falling in 2004 and has been particularly weak since then.

**Figure 27: Productivity growth has declined over the past 50 years.**



*Source: OCACT, the Long-Range Economic Assumptions for the 2019 Trustees Report and Panel calculations*

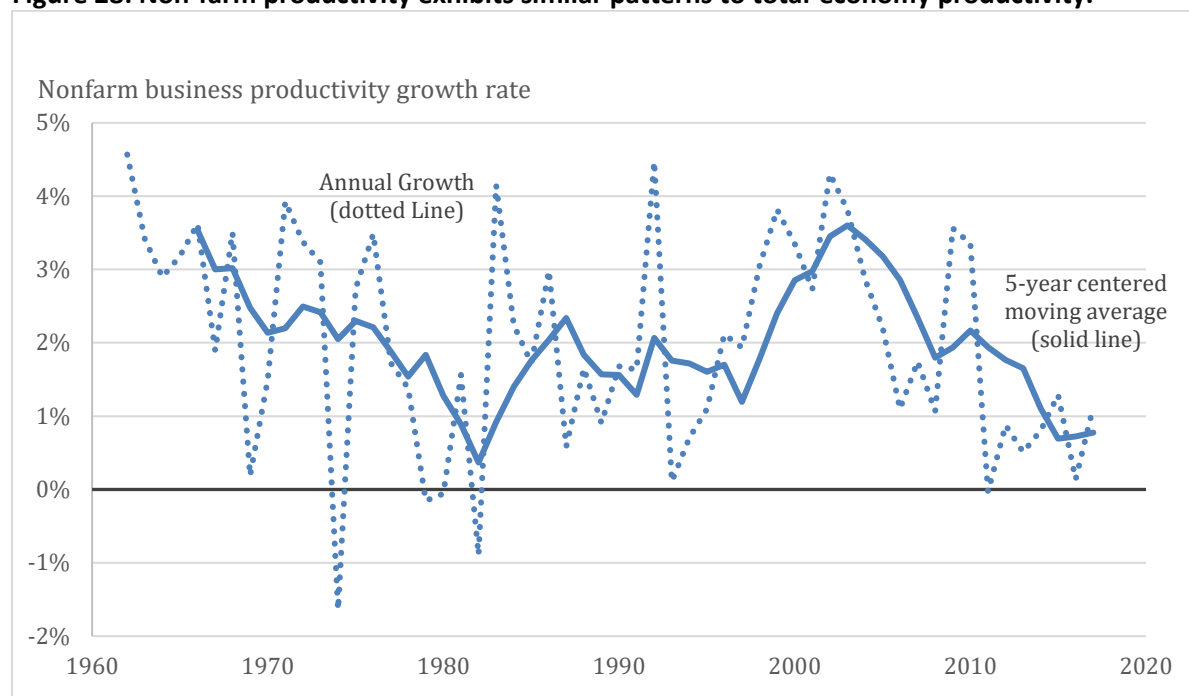
One characteristic of productivity is that it can be quite variable over the short term, but the amount of variation falls the longer the time horizon (Müller and Watson, 2016). Thus, for very long-term predictions, assuming that productivity returns to long-run trends might be justifiable. However, while the Social Security projection is a 75-year projection, many of the important policy questions, such as when the trust fund will be exhausted or what is the present value of costs and income, place more weight on nearer-term trends. Thus, the Panel views it important that the projection of productivity growth consider the likely path over the near term and medium term.

Productivity growth can be affected by sectoral changes in the economy that may not be repeated again, or at least, not for a very long time. For example, the shift out of agriculture into sectors of the economy with higher productivity lifted productivity growth through the mid-1970s or so. In putting together its productivity projection, OCACT projects productivity separately for each major sector (non-farm business, farm, and household) and then calculates the total as a weighted average across the sectors using a fixed employment share for each sector. The growth rates in productivity for the non-profit and government sectors are assumed to be zero.<sup>16</sup>

The sector that drives most total-economy productivity growth is the non-farm business sector, shown in **Figure 28**. It shows the same variation and patterns as total-economy productivity but on average is about 0.2 percentage point higher.

<sup>16</sup> In the National Income and Product Accounts, the output of these sectors is set equal to the inputs, with capital services output set equal to depreciation. Thus, the assumption is that there is no total factor productivity growth (no output beyond the inputs) and almost no labor productivity growth for any given activity. However, compositional shifts (movements across types of activities within a sector) can yield small changes in productivity in practice.

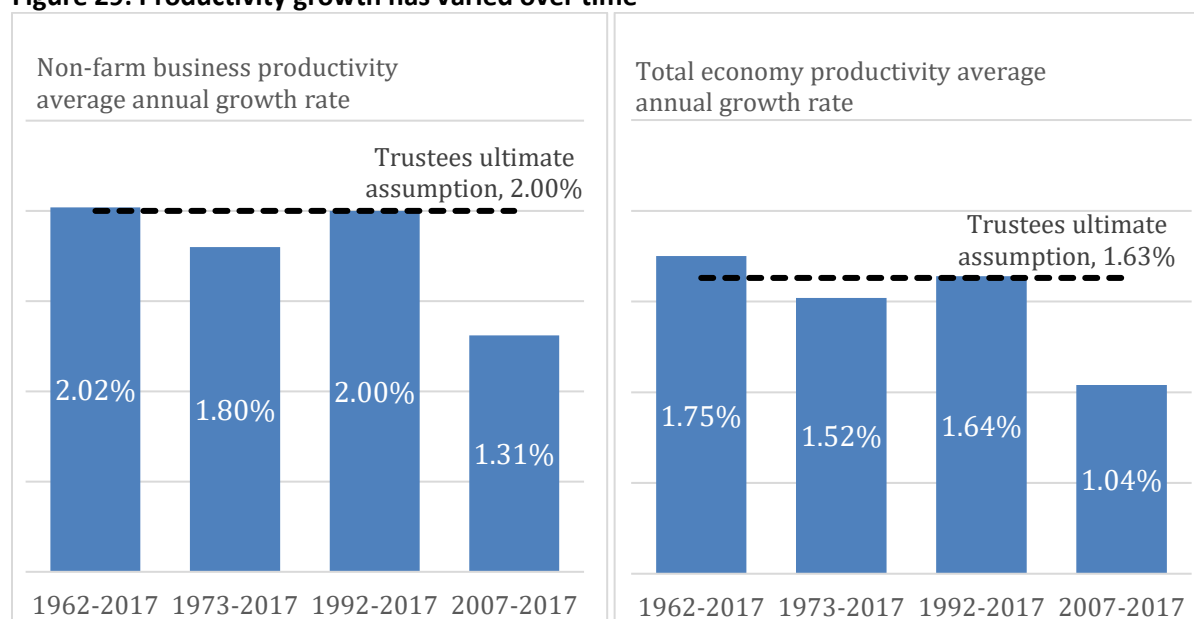
**Figure 28: Non-farm productivity exhibits similar patterns to total-economy productivity.**



Source: OCACT, the Long-Range Economic Assumptions for the 2019 Trustees Report and Panel calculations

One key question when projecting productivity growth is how to use the historical data to project into the future: how much weight should be placed on more recent data and how much on developments in the past? What difference does it make? **Figure 29** presents simple annual averages of productivity growth in the non-farm business and total economy, respectively, and growth over different periods, along with the ultimate assumption in the 2019 Trustees projection. For non-farm business productivity, productivity growth was 1.83 percent, on average, over the past 44 years, but about 2 percent over the past 55 years.

**Figure 29: Productivity growth has varied over time**



Source: OCACT, the Long-Range Economic Assumptions for the 2019 Trustees Report and Panel calculations

Another way to look at the data is to place more weight on recent data and less on older data, with the implicit assumption that the economy might have changed over time and the more recent data may be more informative, but the older data still contains some useful information. This type of analysis is a feature of the type of exponential models contemplated in the methods section. **Table 5** compares different weighting schemes and looks at the period beginning in 1962 (the period that OCACT uses) as well as the period beginning in 1973.

**Table 5: Examples of exponential and unweighted model outcomes for projecting productivity growth.**

		Weighted Averages of Productivity Growth			
		Most recent observation gets twice the weight as ...			
Historical interval	Unweighted	...10 years ago	...20 years ago	...30 years ago	...40 years ago
<b>Nonfarm Business Productivity Growth</b>					
1962-2017	2.02%	1.71%	1.86%	1.91%	1.94%
1973-2017	1.83%	1.68%	1.79%	1.81%	1.82%
<b>Total Economy Productivity Growth</b>					
1962-2017	1.75%	1.41%	1.57%	1.63%	1.66%
1973-2017	1.54%	1.38%	1.48%	1.51%	1.52%

Source: Data provided by the Office of the Chief Actuary; Panel calculations

Looking at the 1962 to 2017 period, when more recent data get more weight than older data, non-farm business productivity growth is below 2 percent; the less weight is put on older values, the lower the weighted average. Restricting the series to the 1973–2017 period, the average productivity growth depends less on the weights: it is about 1.8 percent per year for most of the different weighting schemes.

The bottom of the table examines weighted averages of total economy productivity growth. For the 1962–2017 period (which includes some of the boost from the transition away from agriculture), growth is below the Trustees’ 1.63 percent ultimate assumption for some weights but not for all. Restricting the sample to the post-1972 period, total economy-wide productivity growth is below 1.63 percent regardless of the weights, ranging from 1.38 percent to 1.52 percent.

One reason to focus on the post-1972 period is that it generally has been taken as the beginning of the productivity slowdown that has lasted for more than 45 years, apart from the information technology-led period of high productivity growth from 1995 to 2004. One question is whether the slowdown in productivity since 1972 reflects structural changes in the economy that will persist.

One view is that productivity varies randomly from year to year, so that long-term averages are more informative than averages that weight more heavily recent experience. In this view, productivity is unusually low now but is expected to recover to long-run averages. This is basically the view taken by the Trustees. This view is bolstered by those like Brynjolfsson, Rock, Syverson (2017), who argue that major advancements have been made in artificial intelligence and machine learning that have not yet diffused widely through the economy, suggesting that a productivity surge is likely to materialize in the future. Similarly, Branstetter and Sichel (2017) argue that while business investment in physical capital has been weak, investment in intangibles has been strong, suggesting that firms have been making the investments that should eventually lead to higher productivity growth. They also note that the growing number of researchers in places like India and China could provide a boost to productivity growth in the future. How large a productivity surge, what the timing is likely to be, and whether it will be captured in the official statistics are open questions.<sup>17</sup>

Another view is that productivity growth has fallen for systemic reasons that are likely to persist. Robert Gordon (2018) argues that the inventions that have been created since the 1970s and those that are likely to be created in the future, even with AI and machine learning, simply won’t have the same effect on productivity as those that came before, like electrification and the discovery of the internal combustion engine. In other words, all the best ideas already have been found. Others point to structural changes in the economy, like increasing costs of discoveries (Bloom, 2017), changes in the age distribution of the workforce (Maestas, Mullen, and Powell, 2016; Feyrer, 2008), a decline in business dynamism (Karahn, Pugsley, Sahin, 2019), a slowdown in the dispersion of new technologies across firms (Andrews, Criscuolo, and Gal, 2015), and continued movement of labor toward the service sector, which tends to have lower (measured) productivity (McKinsey Global Institute, 2018).

The Panel recognizes that predicting productivity growth is extremely difficult, as it necessitates predicting what new ideas will be discovered in the future and how they will affect the economy. We see the main question being whether productivity growth is best measured by long-term averages, in

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<sup>17</sup> As discussed in Dynan and Sheiner (2018), productivity improvements that manifest themselves through the introduction of new goods and services are not likely to be fully captured in the official statistics and will instead show up as higher inflation. Because Social Security benefits are indexed to the official CPI, productivity improvements that lead to the overstatement of inflation will boost both benefits and tax revenues in equal measure and will not affect the solvency of the system as a whole. Of course, the mismeasurement of productivity is a long-standing problem, but it is possible that many of the innovations going forward will be difficult to capture. Some, like the use of autonomous vehicle to replace truck drivers and the use of AI instead of call centers will lower the costs of production and improve measured productivity. But others, like the use of big data to improve the quality of health care and the use of AI to improve e-learning, may not boost measured productivity and GDP (Brynjolfsson, Rock, and Syverson, 2017).

which case the Trustees' assumption seems fine, or whether structural changes in the economy have occurred that make more recent information about productivity growth more informative. In our view, a balanced forecast would place more weight on recent information. Finally, we note that other forecasters, including private forecasters and the CBO, have notably lower productivity growth projections than the Trustees, as shown in **Table 6**.

**Table 6: Other forecasters project lower productivity growth than the Trustees Report.**

	Comparison of productivity growth assumptions with outside forecasts: average 2028-2048				
	CBO* (2019a,b)	IHS Markit	Moody's Analytics	Trustees 2019	Panel
Non-Farm Business	1.75	1.50	1.58	2.00	1.90
Economy-wide	1.49	--	--	1.63	1.55

\*Non-farm business from CBO 2019a; Economy-wide from CBO 2019b; OCACT (2019)

We recommend that the Trustees lower their ultimate growth rate for non-farm business sector productivity to 1.9. We agree with OCACT that the projection should assume that farming has the same productivity growth as non-farm business, the household has the average economy-wide growth, and that the productivity growth assumption should be 0 for government and non-profits. Using today's sectoral weights, and our assumption for non-farm business, this translates into a projection for total economy productivity growth of 1.55.

### 5.3.2 Labor share

Increases in the labor share, holding all else constant, increase real earnings per worker, and, as discussed above, improve the financial condition of the Social Security system.

**Economics Recommendation 3.2.1: Real wage growth: labor share.** The Panel recommends that the Trustees assume that the labor share of GDP be 61.5 from 2028 on. This means lowering the growth in the compensation share of GDP over the first ten years of the projection (2019 to 2028) from an average of 0.384 percent per year as in the 2019 Trustees Report to 0.114 percent per year.

**Economics Recommendation 3.2.2: Real wage growth: labor share.** The Panel recommends retaining the Trustees' assumption of no change in the ratio of compensation to GDP after 2028 in the intermediate scenario.

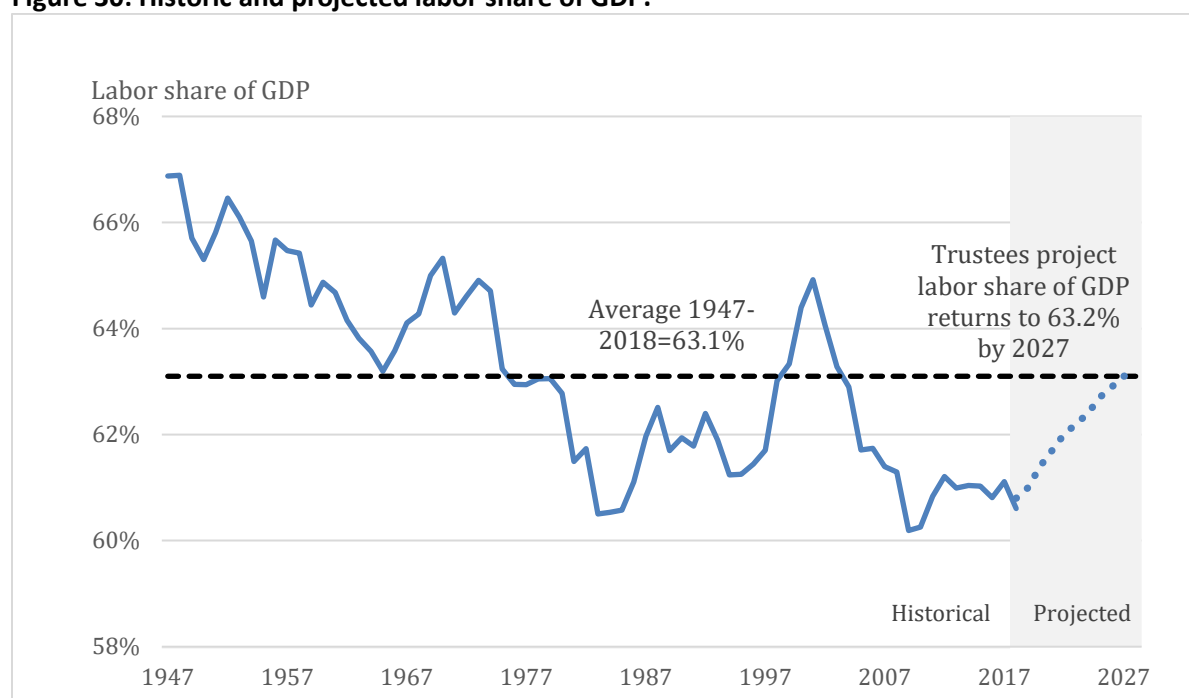
**Economics Recommendation 3.2.3: Real wage growth: labor share.** The Panel recommends incorporating uncertainty in the trajectory of the labor share, with the low- and high-cost scenarios having a labor share that trends 0.05 percentage point per year up and down, respectively, over the intermediate 25-year horizon before stabilizing. Under these scenarios, the labor share at the end of 25 years would be 60.3 percent of GDP under the high-cost scenario and 62.8 of GDP under the low-cost scenario.

**Economics Recommendation 3.2.4: Real wage growth: labor share.** The Panel recommends that OCACT analyze net labor shares by economic sector: non-housing non-farm private, housing, government and non-profit institutions.

The labor share that matters for Social Security finances is the share of GDP that is part of the Social Security tax base, which includes all compensation and all self-employment income. As shown in **Figure 30**, this share declined sharply between 1947 and 1982 and has averaged 61.7 percent since then. The Trustees assume that the labor share will increase over the next decade, from 60.8 percent of GDP in 2018 to 63.2 percent of GDP in 2028, and then remain at that level over the remainder of the projection period.

The assumption that the labor share returns to its post-war average only seems reasonable if the factors that drove down the labor share are likely to reverse themselves. While the decline in the labor share is not well understood, the literature suggests that the following explanations are likely to be important.<sup>18</sup>

**Figure 30: Historic and projected labor share of GDP.**



Source: Data provided by the Office of the Chief Actuary

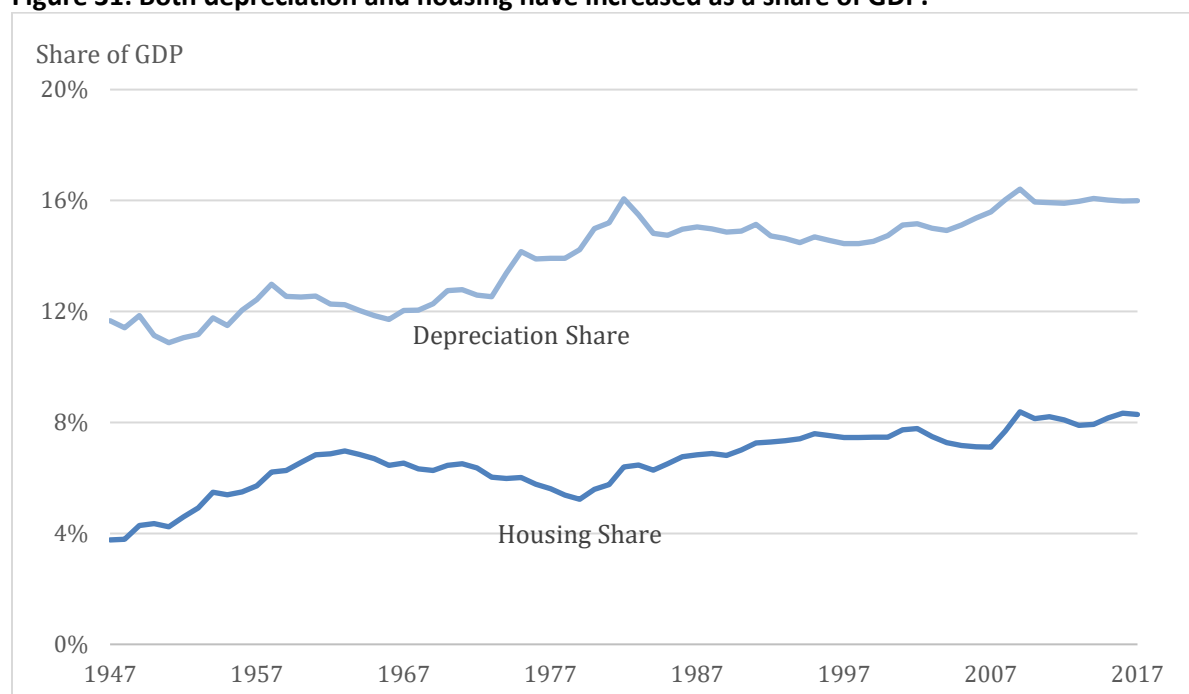
**(1) Depreciation:** The share of output that is accounted for by depreciation has been growing over time, as shown by the light blue line in **Figure 31**, likely reflecting the shifting mix of investment toward rapidly depreciating types of equipment like computers and other forms of information technology (Bridgman, 2014). As shown in **Figure 32**, the share of net output that goes to labor has been much more stable.

<sup>18</sup> The labor share important for Social Security differs somewhat from the various measures of the labor share examined by the academic literature. Papers examining the total economy labor share, like Karabarbounis and Neiman (2013), for example, typically split self-employment income into capital and labor; other papers, like Rognlie (2015) examine the labor share of value added in the corporate sector alone.



**(2) Housing services:** As noted in Rognlie (2016), housing services have increased as a share of GDP in recent decades, perhaps because of the increasing scarcity of land (dark blue line in **Figure 31**). Because the compensation component of housing services is extremely low (labor contributed by homeowners to maintain their own home is not captured in GDP and is not taxable), this increasing share of housing services in GDP has lowered the labor share of GDP.

**Figure 31: Both depreciation and housing have increased as a share of GDP.**



Source: Bureau of Economic Analysis, National Income and Product Accounts, and Panel calculations

**(3) Declining worker power.** Increasing globalization (Elbsy, Hobjin, and Sahin, 2013) and declining unionization (Bivens and Shierholz, 2018), particularly in the private sector, may have reduced labor's bargaining power, contributing to the decline in the labor share.

**(4) Technology:** Others point to labor-saving technological change as an explanation of the decline in the labor share (e.g., Abdi and Danninger, 2017; Autor and Salomons, 2018; Acemoglu and Restrepo, 2017), with some worrying that future improvements in artificial intelligence, machine learning, and advanced robotics will lead to an ever-declining labor share (McKay, Pollack, and Fitzpayne, 2019).

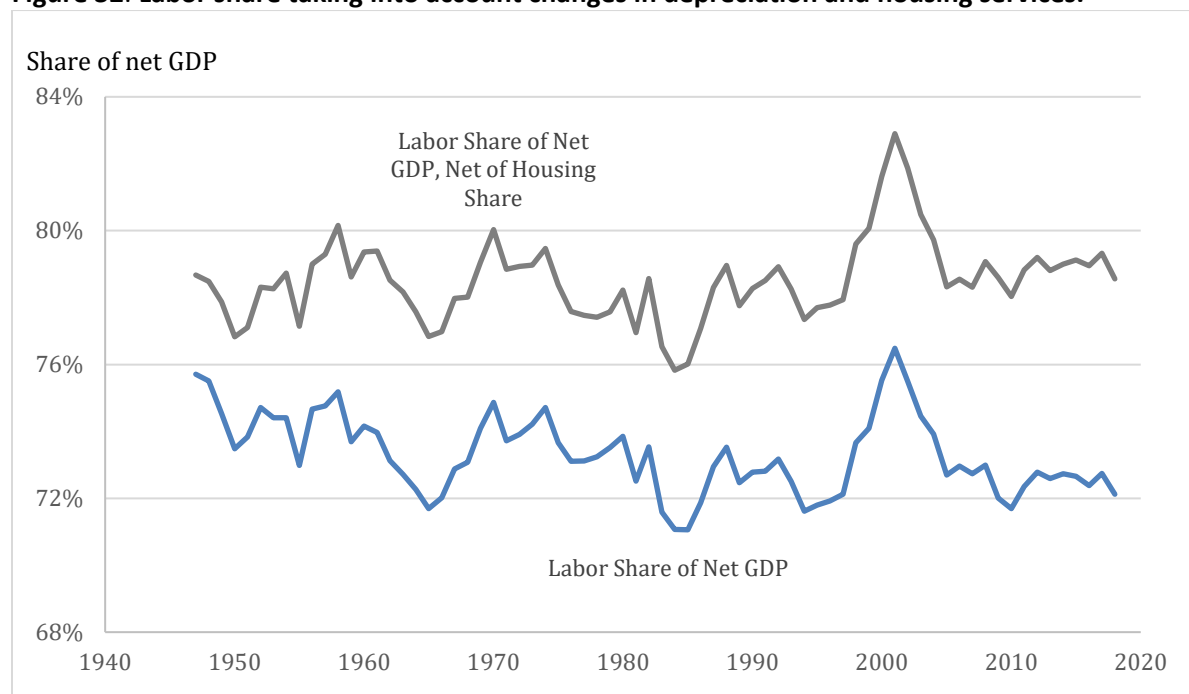
**(5) Measurement:** Part of the decline in the labor share may represent tax-law induced changes in reporting, rather than changes in the underlying production function. Smith, Yagan, Zidar, and Smith (2018) show that the 1986 tax reform and subsequent tax changes made it advantageous for firms to report less in compensation and more in profits, leading to a lower labor share.

Most of these explanations suggest that the decline in the labor share reflects structural changes in the economy that are likely to persist. One possible exception is the effect of declining worker power, some of which may be reversed in a hot economy, and some of which could change overtime with changes in regulation (Bivens, 2017). On the other hand, other factors, like increasing depreciation and

technological change, should be viewed as possibly leading to continued declines in the labor share over time. We view both of these as offsetting risks to the projection.

**Figure 32** shows measures of the labor share that account for changes in depreciation and changes in housing services. Both of these measures are much more stable than the gross labor share. If these changes in depreciation and housing services are permanent, then the labor share is likely to remain low. In **Table 7**, we report averages for adjusted labor shares, where the adjustments hold the GDP share of depreciation and housing services fixed at their average level over the past five years.

**Figure 32: Labor share taking into account changes in depreciation and housing services.**



Source: Bureau of Economic Analysis, National Income and Product Accounts, and Panel calculations

**Table 7: Summary of values used to determine Panel's labor share of GDP recommendation of 61.5.**

Historical interval	Labor share of GDP	Adjusted for depreciation	Adjusted for Housing
1958-2018	62.6%	61.4%	60.6%
1968-2018	62.3%	61.4%	60.6%
1978-2018	61.8%	61.2%	60.6%
1988-2018	61.9%	61.3%	61.0%
1998-2018	61.9%	61.6%	61.3%
2008-2018	60.9%	60.9%	60.8%

Source: Bureau of Economic Analysis, National Income and Product Accounts, and Panel calculations

While it is obviously difficult to pick one number, the Panel believes that an ultimate assumption of 61.5 is reasonable, as it places more weight on recent experience but allows for some increase from the very low levels observed over the past decade.

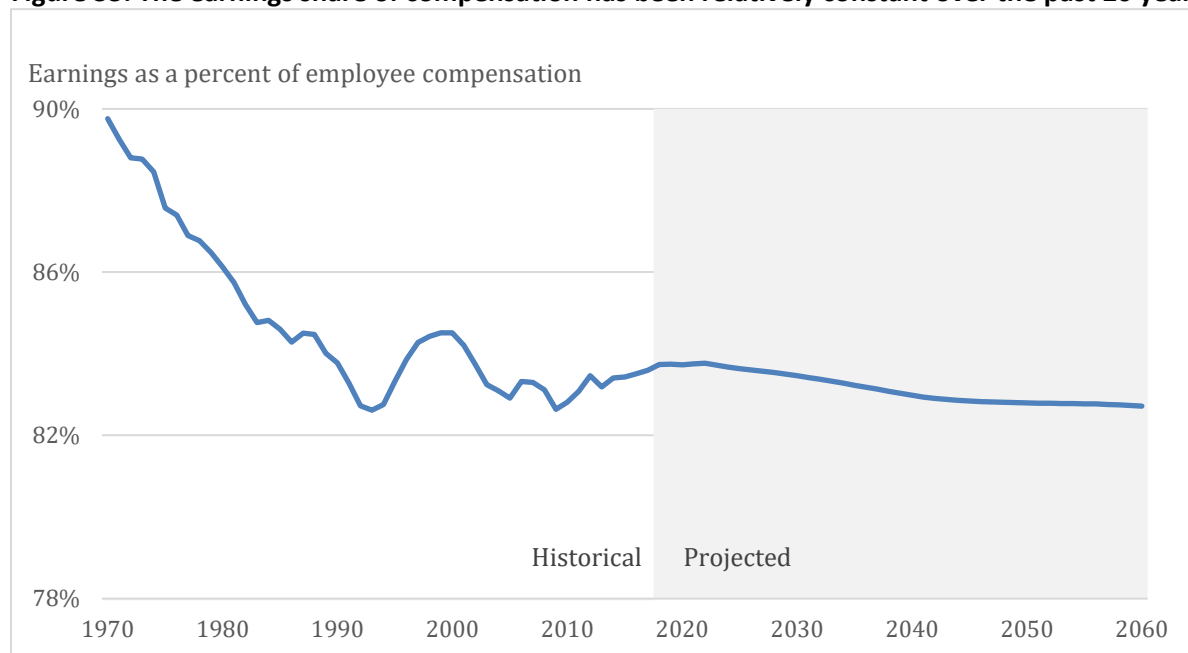
OCACT examines productivity growth by sector to account for structural changes in the economy that have contributed to changes in productivity growth and are unlikely to revert or be repeated. The Panel recommends a similar procedure with respect to the labor share. In particular, we recommend that OCACT consider analyzing the net labor share for the non-farm non-housing sector, the housing sector, and the government and non-profit sector.

We recommend that OCACT include uncertainty about the path of the labor share in the analysis. As this discussion makes clear, the path of the labor share going forward is uncertain. On one hand, some of the factors that have held down the labor share, including changes in worker power and changes in technology, and possibly globalization, could unwind over time. Similarly, the factors that have led to the labor share increasing—automation, globalization, depreciation, housing value—could accelerate going forward. For the low-cost scenario, we recommend that OCACT increase the labor share to 63, roughly the 1948–2018 average. For the high-cost scenario, we recommend allowing the labor share to decline to 59 percent.

### 5.3.3 Earnings to compensation

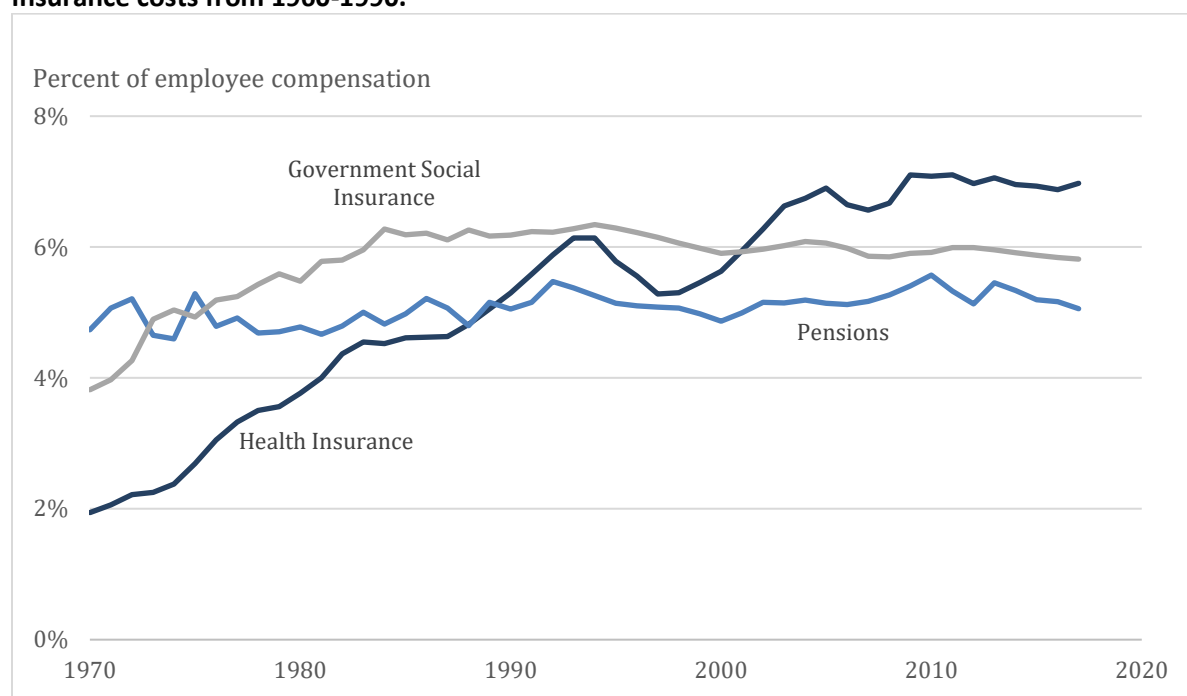
Total compensation includes many employer-provided benefits that are not subject to the Social Security tax and do not affect benefit calculations. These include pension benefits, health insurance, workers' compensation insurance, unemployment taxes, and the employer-share of Medicare and Social Security taxes. As shown in **Figure 33**, the share of earnings to compensation fell about 9 percent from 1960 to 1990, but has not changed much, on average, since then. The decline in the share of earnings to compensation over the 1960–1990 period mostly reflected increases in social insurance taxes and increasing expenditures on group health insurance, as shown in **Figure 34**.

**Figure 33: The earnings share of compensation has been relatively constant over the past 20 years.**



Source: Data provided by the Office of the Chief Actuary

**Figure 34: The share of earnings to compensation decline was due to increasing health and social insurance costs from 1960-1990.**



Source: Bureau of Economic Analysis, *National Income and Product Accounts*, Tables 2.1 and 7.8

Going forward, it seems likely that the share of compensation going to pensions will remain roughly constant, as it has over the past 25 years or so. The share of compensation accounted for by payroll taxes may drift down over time if earnings inequality increases, because (as discussed below), Social Security taxes are levied on earnings up to a cap. The more compensation is above that cap, the lower are employer-paid Social Security taxes.<sup>19</sup>

The larger source of variation and uncertainty going forward is with respect to the share of compensation accounted for by employer-paid health insurance. Health insurance increased rapidly as a share of compensation through about 1983, but the increase slowed after that. **Table 8** shows the difference between the growth of employer-paid health insurance spending and the growth of total compensation, a variant of what is typically known as excess cost growth, over various time periods.<sup>20, 21</sup>

<sup>19</sup> We have not included the effects of continued increases in inequality in our recommendation for the earnings share of compensation, but these are likely to be relatively small.

<sup>20</sup> Excess cost growth is generally defined as the difference in growth rates between per capita health spending and per capita GDP.

<sup>21</sup> What ultimately matters for the Social Security projections is benefits as a share of total Social Security compensation (employee compensation plus self-employment income). But only employer-paid benefits are excluded from the Social Security tax base, so to examine historical trends, we look at benefits as a share of employee compensation.

**Table 8: Excess cost growth decelerated over time.**

Historical interval	Difference between growth rates in employer-paid health insurance and total compensation
1975-2017	2.37%
1975-1992	4.76%
1992-2017	0.74%
1992-2007	0.81%
1982-2017	1.40%
1982-2007	1.60%
2007-2017	0.64%

*Source: Bureau of Economic Analysis, National Income and Product Accounts, and Panel calculations*

Looking forward, most analysts expect the rise in health spending relative to compensation to continue, fueled by increases in medical technology that increase the demand for health care. Projecting excess cost growth over the near-term requires deciding how much weight to put on recent experience, which shows relatively little excess cost growth, and how much to put on longer historical experience. While some of the muted rise in health spending over the past decade may be attributable to the effects of the Great Recession and the Affordable Care Act (ACA), a reason to put less weight on it, it is also quite possible that it is indicative of a slowdown that will persist. In our view, a reasonable reading of the historical evidence would assume that private health spending growth will exceed the growth rate of compensation by about 1 percentage point in the near-term. This is above the 25-year average excess cost growth rate of 0.75 percentage points, putting some weight on the possibility that more rapid health spending growth will resume in the future.

It also is clear that excess cost growth will abate over time, as the share of compensation accounted for by health insurance continues to rise.<sup>22</sup> The Centers for Medicare and Medicaid Services (CMS) assumes excess health spending growth will slow gradually over 75 years, reaching 0.5 percentage point per year after 75 years.

With excess cost growth beginning at 1 percent, and ending at 0.5 percent, the average annual increase in health spending over compensation growth from 2028–2093 would be 0.07 percentage point per year, just above the 0.06 percentage point assumed in the Trustees Report.

One important difference between the Trustees' assumption and the Panel's recommendation involves expectations about implementation of the "Cadillac tax" —the excise tax on high-cost health insurance plans that was enacted as part of the ACA and is scheduled to go into effect in 2022. Although the tax would initially apply only to very generous health plans, the Trustees expect it will become increasingly binding over time as the threshold, which is indexed to the CPI, fails to keep up with the growth in health spending.<sup>23</sup> They assume it will increasingly restrain the growth of health insurance costs over time. Under the same circumstances, the Panel believes health insurance costs will grow more slowly

<sup>22</sup> Health spending cannot rise faster than GDP forever, because eventually it would reach 100 percent of GDP. Clearly, excess cost growth will end well before that point.

<sup>23</sup> Note that even if there is no excess cost growth, health spending growth would equal GDP growth, which is above inflation.

than do the Trustees; but the Panel also expects the “Cadillac tax” provisions of the ACA will eventually be repealed.<sup>24</sup> The Panel’s recommendation to assume faster growth of health insurance costs than do the Trustees, then, is due to our different expectations about the fate of the Cadillac tax. That means we don’t recommend that the Trustees increase their excess cost growth assumptions much if the Cadillac tax is repealed.

**Economics recommendation 3.3.1: Real wage growth: earnings to compensation.** The Panel recommends that the Trustees use an average of 0.07 percentage point increase in the health spending share of compensation as a pre-excise tax value for 2028–2093, which is the result of assuming an excess cost growth rate of 1 percent gradually declining to 0.5 percent over 75 years. This assumption translates into a decline in the earnings share of compensation of 0.07 percentage point per year from 2028–2093.

**Economics recommendation 3.3.2: Real wage growth: earnings to compensation.** The Panel recommends that the Trustees maintain the range of plus or minus 0.1 percentage point for the average change in the high-cost and low-cost scenarios, so that earnings to compensation would decline 0.17 percentage point per year in the high-cost scenario and increase 0.03 percentage points per year in the low-cost scenario.

We also recommend that the Trustees continue to monitor trends in private health insurance; the longer the trends remain muted, the more weight should be put on the possibility that there has been a structural shift that is likely to persist.

#### 5.3.4 Average Hours Worked

**Economics recommendation 3.4.1: Real wage growth: hours worked.** The Panel thinks that the assumption of continuing declines in average hours worked of 0.05 percent per year is reasonable. We also think the changes in hours under the high- and low-cost scenarios, -0.15 percent per year and 0.05 percent per year, respectively, are reasonable.

**Economics recommendation 3.4.2: Real wage growth: hours worked.** Given the changes in labor force participation the Panel is recommending, the Panel recommends OCACT investigate more fully the impact of changing the sex/age mix of the workforce on hours. As noted in the methodology section, a microsimulation model would account for these changes automatically, but, short of that, OCACT should perform some analysis to see if these effects are likely to be important.

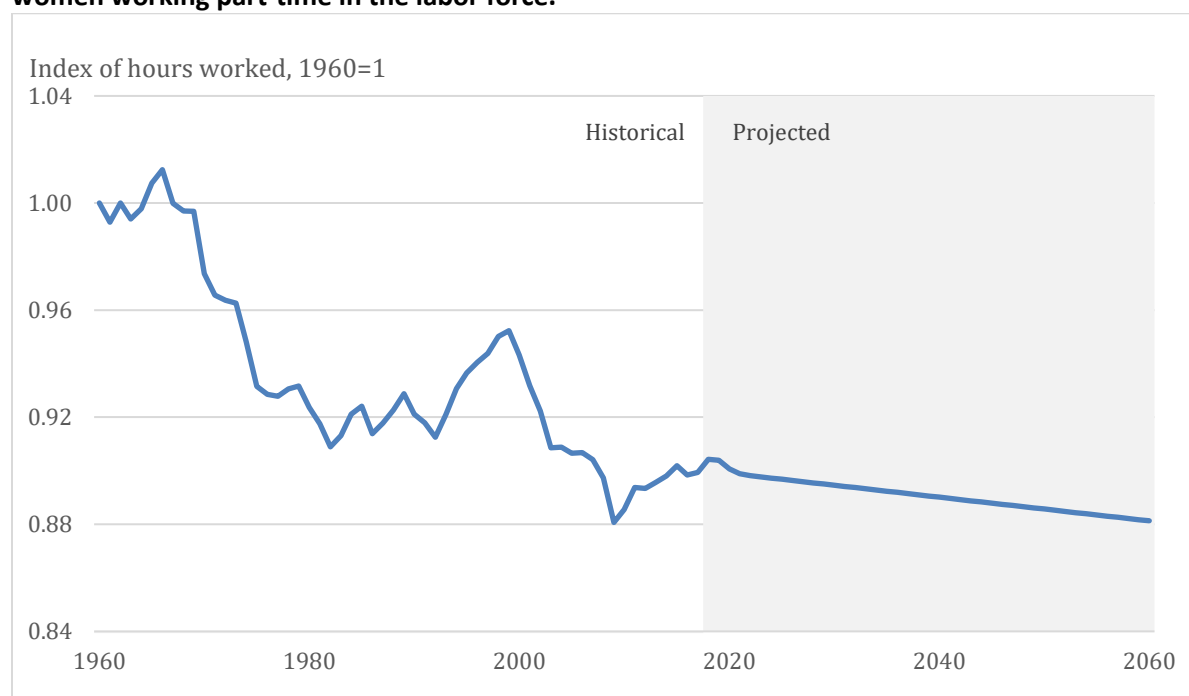
**Figure 35** shows an index of average hours worked from 1960–2017 using data for the whole economy from the Bureau of Labor Statistics and the Trustees projections for 2018 through 2060. Average hours worked fell sharply from the mid-1960s through the early 1980s, perhaps reflecting the increasing labor force participation of women through part-time employment. Since the early 1980s, hours have fallen by an average of -0.06 percent per year.

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<sup>24</sup> Originally intended to start in 2018, implementation has already been twice delayed by legislation. As of this writing, the House has passed a bill to repeal the tax which is expected to pass the Senate as early as this year. Section 2.6 of this report discusses whether the Trustees projections should abide by current law in cases where it is not likely to occur.

Going forward, continued increases in productivity might allow workers to reduce hours while still allowing real income and consumption to rise. Increased life expectancy also could affect average hours, although the direction is unclear. More older Americans may choose to stay in the workforce but work part-time, while older Americans who currently only work part-time may choose to work full-time instead. The Trustees say that projected changes in the sex-age mix of the workforce are not expected to significantly affect the rate of change of average hours worked in the future.

**Figure 35: Average hours decreased sharply from the 1960s to 1980s possibly due to an increase of women working part-time in the labor force.**



Source: OCACT, the Long-Range Economic Assumptions for the 2019 Trustees Report

### 5.3.5 Differential between the GDP deflator and CPI

**Economics recommendation 3.5: Real wage growth: PGDP-CPI price differential.** The Panel recommends no changes to the Trustees assumptions about the wedge between the GDP deflator and the CPI.

Productivity growth is measured as the real output per hour worker where real output is nominal output deflated by the GDP price deflator (PGDP), but Social Security calculates real earnings growth using the CPI-W as the deflator. Any differences between the two inflation rates will affect Social Security finances. The intuition is as follows: The Social Security system is almost fully indexed for changes in inflation that affect both deflators equally. Holding productivity growth constant, an increase in PGDP inflation will raise wages, while an increase in CPI inflation will raise benefits. The effects will almost fully offset.<sup>25</sup> But if inflation using the CPI increases more than inflation using the PGDP, then benefits will

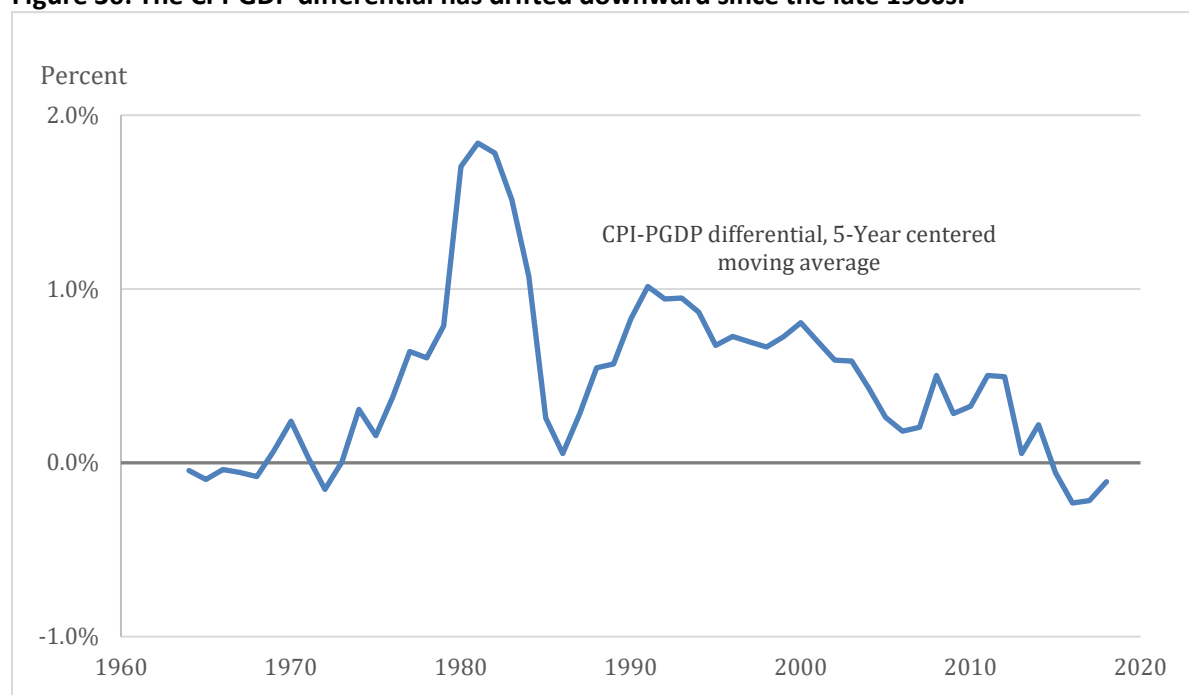
<sup>25</sup> One aspect of the Social Security system that is not indexed to inflation is the income threshold for the taxation of Social Security benefits. However, the Trustees do not include increased revenues from lower real thresholds over time in their projection.

rise more than wages, increasing the actuarial imbalance. Thus, the wedge between the PGDP and the CPI-W matters for Social Security finances.

The CPI-W and the PGDP often differ substantially. There are two main sources of differences. The first is coverage. The CPI is an index of prices of items purchased out-of-pocket by urban consumers, whereas the PGDP is an index of the prices of domestic goods and services purchased by consumers, business, government, and foreigners. Historically, the prices of items covered by the PGDP have not increased as rapidly as consumer items. A larger contributor to the difference between the two series is that they are computed differently. The GDP price index is a chained index, meaning that it accounts for the fact that purchasers can change their buying habits when prices change. The CPI prices a fixed basket of consumer goods, meaning that an increase in the price of one good has a larger impact on the CPI than it does on a chained price index.

**Figure 36** shows the five-year moving average of the difference between CPI and PGDP inflation. The differential appears to have drifted down gradually since the late 1980s, although the recent readings are unusually low.

**Figure 36: The CPI-GDP differential has drifted downward since the late 1980s.**

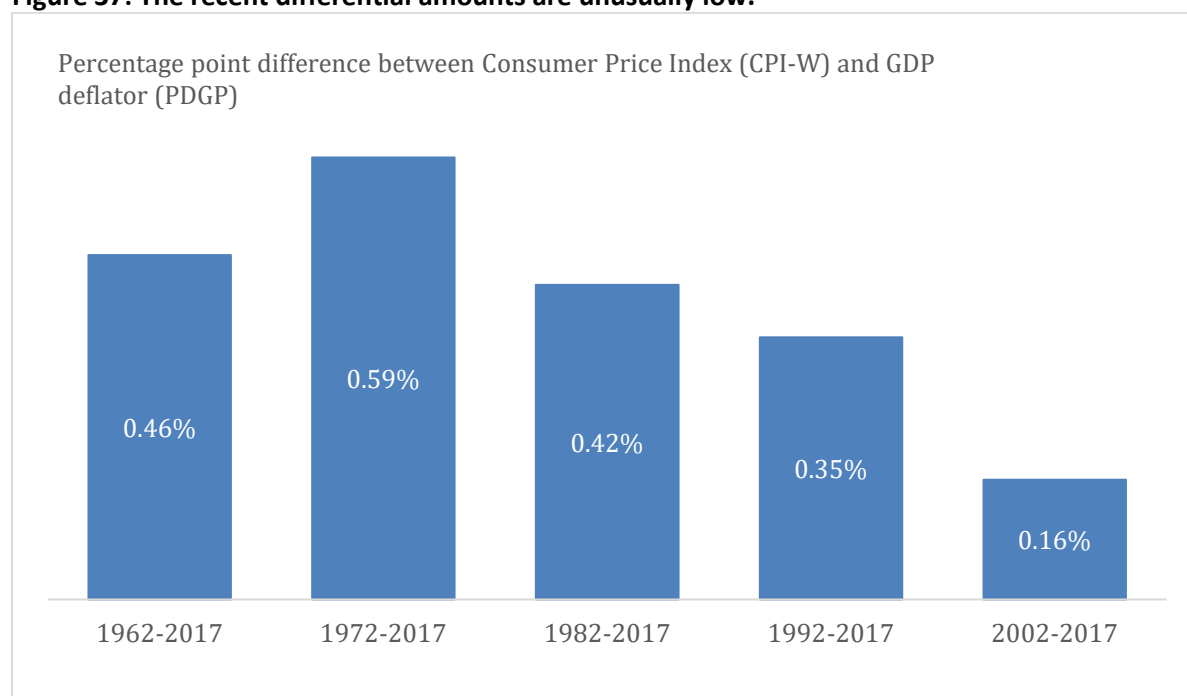


Source: Trustees Report 2019, Supplemental single-year tables; Panel calculations

**Figure 37** shows the average wedge over different time periods. The Trustees assume the wedge between the GDP deflator and the CPI is -0.35 for the intermediate projection, -0.25 percentage point the low-cost projection, and -0.45 for the high-cost projection. The Panel recommends that the Trustees maintain these assumptions.



**Figure 37: The recent differential amounts are unusually low.**



*Source: Trustees Report 2019, Supplemental single year tables; Panel calculations*

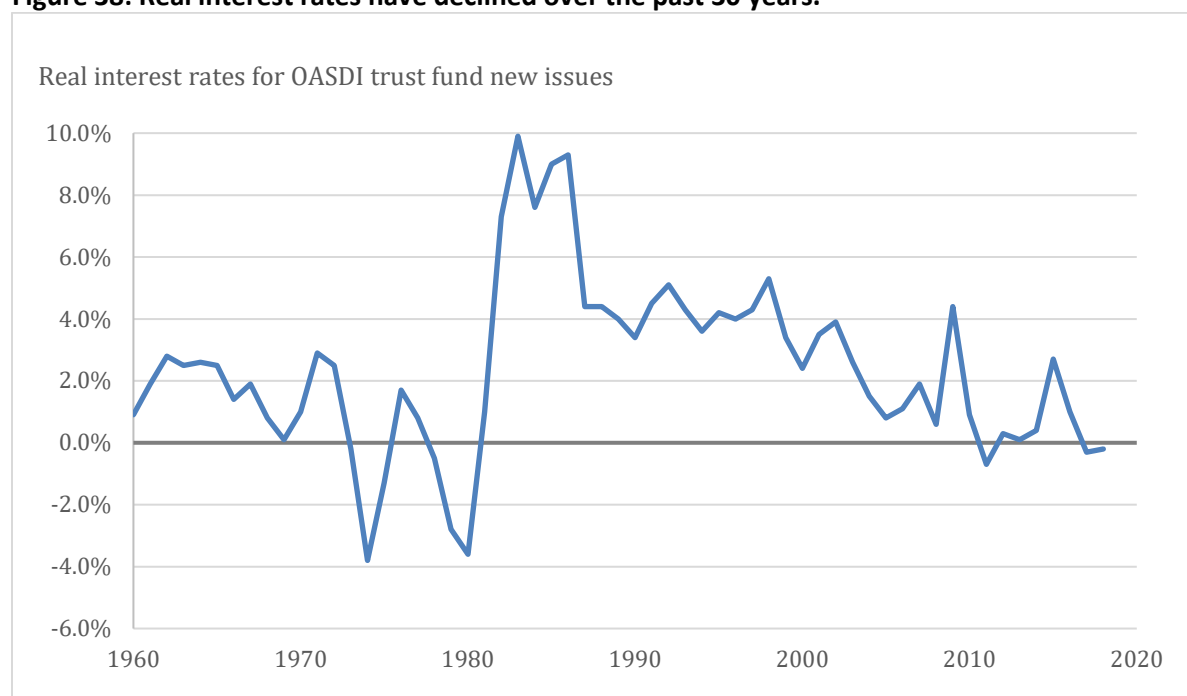
## 5.4 Real Interest rate

**Economics recommendation 4.1: Interest rate.** The Panel recommends allowing real interest rates to rise gradually over the medium term (25 years to 2.3 percent, a level closer to, but still below its average since 1962. That would mean that the real interest rate would average about 1.2 percent over the next 25 years.

**Economics recommendation 4.2: Interest rate.** The Panel recommends that real interest rates rise gradually over 25 years in both the low-cost and high-cost scenarios, reaching 1.5 percent in the high-cost scenario and 3 percent in the low-cost scenario. Under the 2019 Trustees' projections, these values were 2 percent and 3 percent, respectively. We believe that the magnitude of uncertainty is larger than encompassed by the current range of ultimate values.

Real interest rates have been declining over the past three decades, as shown in **Figure 38**. Empirical estimates of the natural rate (the rate consistent with stable inflation and output at potential) show a 3 percentage point decline since the mid-1980s (Laubach and Williams, 2003, updated by Federal Reserve Bank of New York, <https://www.newyorkfed.org/research/policy/rstar>). Rachel and Summers (2019) analyze the forces driving down interest rates and are able to explain about 1.7 percentage points of the decline. The decline in productivity growth, the aging populations around the world, and increasing inequality are key factors behind the decline in interest rates. Others point instead to an increased demand for safe assets, leading to lower rates on Treasuries relative to other kinds of investments (e.g., Caballero, Farhi, and Gourinchas, 2016).

**Figure 38: Real interest rates have declined over the past 30 years.**



*Source: Trustees Report, supplemental single year tables*

According to projections by Rachel and Summers, without increases in debt relative to GDP, interest rates are likely to remain low. (See section 2.4 of this report for a discussion of modeling dynamic macroeconomic effects) Other forecasts (CBO, Macroeconomic Advisers, IHS Markit) also expect interest rates to stay low for a long time to come, even given the projected increases in the ratio of debt to GDP expected over the next few decades. As of July 12, 2019, the 30-year nominal Treasury rate was just 2.64 percent, suggesting that market participants expect real interest rates to be less than 1 percent for a long time.

The view of interest rates in the Trustees projection is that the fundamental drivers of interest rates are unchanged and thus a long-run average is the best guide to future interest rates. The projections assume that real interest rates rise from their level of -0.2 percent in the first half of 2018 to 2.5 percent over the next ten years, the average real interest rate from 1962 to 2017. This projection puts no weight on the possibility that the world has changed in structural ways that will keep interest rates low.

The Panel finds this view unbalanced. We acknowledge that interest rates are very hard to predict but think the weight of the evidence—the structural explanations provided in Rachel and Summers (2018), among others; market expectations; and the judgment of other forecasters—suggests that the world has changed and that interest rates in the future are likely to be lower than in the past, especially over the medium term. While it is very unlikely that interest rates will remain as low as they are now, a more balanced projection would put weight on the possibility that rates will remain quite low.<sup>26</sup> The Panel

<sup>26</sup> In theoretical models, interest rates depend on productivity growth, and, as noted above, we are recommending that OCACT lower its productivity growth assumption, so the two recommendations are consistent. Of course, the exact relationship between interest rates and productivity growth is unclear. Some estimates suggest that the interest rate should move 2-for-1

therefore recommends allowing interest rates to rise gradually over the medium term (25 years) to 2.3 percent, a level closer to, but still below its average since 1962. That would mean that the real interest rate would average about 1.2 percent over the next 25 years.

Why does the interest rate matter for Social Security finances? The interest rate does not matter nearly so much as would be suggested by an examination of the effects of interest rates on measures of long-run solvency. For example, in a pure pay-as-you-go system, the interest rate does not matter at all, because taxes equal benefits in each year, so that the present value of the taxes is equal to the present value of the benefits, regardless of the interest rate. When there is an imbalance between future taxes and benefits, as there is with Social Security, the interest rate does matter. Low interest rates make the program seem in worse financial shape because the lower the interest rate, the larger the present value of any imbalance between future taxes and benefits. Thus, were OCACT to lower its interest rate along with our recommendation, some measures of imbalance would appear larger, although others (e.g., what share of benefits are payable with current taxes) would not.

Low interest rates reduce the return on trust fund assets, which has some effect on system solvency but not much. They also mean that changes made now to shore up the trust fund would have less effect on solvency. Economists disagree over the implications of low interest rates for optimal fiscal policy, with some suggesting that low interest rates mean that greater action should be taken now and others suggesting that changes should be made later (Elmendorf and Sheiner, 2016; Auerbach, Gale, and Krupkin, 2018).

## 5.5 Consumer Price Index (CPI-W)

**Economics recommendation 5.1: CPI.** The Panel recommends lowering the assumed rate of CPI-W inflation from 2.6 percent to 2.4 percent.

**Economics recommendation 5.2: CPI.** The Panel recommends maintaining a 0.6 percentage point difference between the intermediate and low- and high-cost scenarios, so that the CPI-W is 1.8 percent in the high-cost scenario and 3.0 percent in the low-cost scenario.

The Trustees assume a CPI inflation rate of 2.6 percent in their intermediate projection, which, given the wedge between the CPI deflator and GDP deflator described above, implies a GDP deflator of 2.25 percent.

Since 2012, the Federal Reserve has had an official target of 2 percent for personal consumption expenditures (PCE) inflation. Since then, inflation has been below target on average, although the Fed's official position is that the target is a symmetric one (i.e., it is not a 2 percent inflation ceiling). While there may be periods where inflation is above or below the target, it seems sensible to assume that the Fed will reach its target on average. Because of this regime shift in the monetary policy process, the Panel doesn't believe that historical inflation rates are useful for predicting inflation going forward. Thus, we believe that the forecast for PCE inflation should be 2 percent. Inflation using the GDP deflator has been, on average, about 0.05 percentage point higher than the PCE deflator since 1992, and this is the wedge that OCACT uses in their assumptions. Thus, we believe the forecast for GDP inflation should

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with the productivity growth rate (Mehrotra, 2017). However, other evidence suggests this relationship might exist more in theory than in practice (Rachel and Summers, 2019).

be 2.05, and, using the 0.35 wedge between GDP inflation and CPI inflation, the projection for CPI inflation should be 2.4 percent.<sup>27</sup>

## 5.6 The Taxable Share of Earnings

**Economics recommendation 6.1: Taxable Share.** The Panel recommends that OCACT assume that the taxable share of covered earnings will continue to decline over the medium term. The Panel recommends allowing a 0.15 percentage point decline to abate slowly over 25 years. That would bring the taxable share down to about 80.8 percent by 2043.

**Economics recommendation 6.2: Taxable Share.** The Panel recommends using a similar 25-year trend for the low- and high-cost scenarios, beginning at -0.4 percentage point per year for the high-cost scenario (the time trend from 1982 through 2012) and +0.1 percentage point per year for the low-cost scenario to be symmetric and allowing these trends to abate over 25 years. Over the 2028–2093 period, this recommendation would lower the growth rate of taxable earnings by 0.04 percentage point per year for the high-cost scenario and increase it by 0.01 percentage point per year in the low-cost scenario.

The Social Security system only considers earnings below a cap when assessing taxes and computing benefits. In 2019, that taxable maximum was \$132,900. The cap is indexed to average wages.

The share of earnings above the taxable maximum is a measure of earnings inequality. Each year, about 6 percent of workers have earnings above the taxable maximum, so the measure of inequality that matters for computing the taxable share of wages is the share of earnings in the top 6 percent of the Social Security earnings distribution.<sup>28</sup> When wage inequality increases, more earnings are above the taxable maximum, and the taxable share falls. Eventually, a greater share of earnings above the taxable maximum also lower benefits, but, because of the progressivity of the benefit formula, this offset is relatively small.

With rising earnings inequality in the United States—particularly among the top 1 percent—the share of earnings below the taxable maximum has been declining. **Figure 39** shows the percentage of OASDI covered earnings below the taxable maximum from 1983 to 2017. As shown in the long-range economic assumptions for the 2019 Trustees Report, the average annual rate of decline slowed by 0.34 percent per year between 1983 and 2001 and only 0.08 percent per year between 2001 and 2017. The Trustees assume the decline in the taxable ratio will decline slowly over the next decade before reaching its ultimate value of 82.5 percent by the end of 2028 for the intermediate projection.

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<sup>27</sup> It seems very likely that the PCE inflation rate will remain close to 2 percent over the near term. Thus, beginning a trajectory of increasing inflation so that the GDP deflator hits 2.25 percent by the end of ten years, as the Trustees currently do, seems wrong. It is obviously impossible to predict how views on monetary policy will evolve over the very long term, so some very gradual path to a slightly higher inflation rate also might be reasonable. But given that the Social Security system is almost fully indexed to inflation, so that such a change would have barely any effect on its long-term finances, assuming that the Fed will hit its target and that the target will not change seems a better, more straightforward assumption.

<sup>28</sup> <https://www.ssa.gov/policy/docs/population-profiles/tax-max-earners.html>.

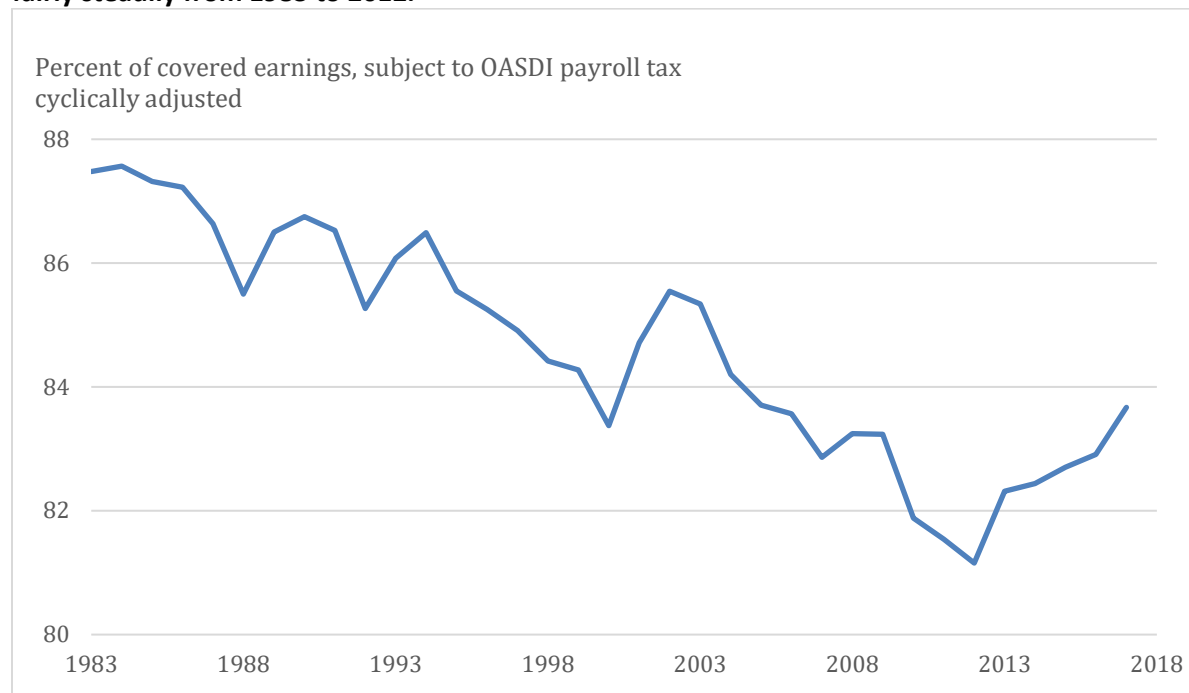
**Figure 39: The annual rate of decline of OASDI covered earnings below the taxable maximum has slowed over the past 15 years.**



Source: Data provided by the Office of the Chief Actuary

In order to analyze the underlying trends in the taxable ratio, however, it is important to account for the temporary effects of recessions. The taxable ratio is countercyclical, and the two recessions experienced since 2000 have led the taxable share to be above its underlying trend. To illustrate this, **Figure 40** plots a cyclically adjusted taxable share, coming from a simple regression of the taxable share on the unemployment rate and predicting what the trend would have been had the unemployment rate been 5.5 percent in all years. After this adjustment, the increase in the taxable share from 2012–2017 looks anomalous, but there is not any break in the data at 2001. Indeed, the average annual rate of decline of this series is -0.15% per year from 1983 to 2001, -0.32% per year from 2001 to 2012, and +0.5% per year from 2012 to 2017 (and -0.07% per year from 2001 to 2017 as a whole). While it is possible that the past few years signal a slowdown or even a reversal in the taxable share, it is also quite possible that these years are an anomaly and the share will resume its decline in time.

**Figure 40: Adjusted for changes in the unemployment rate, the share of taxable earnings declined fairly steadily from 1983 to 2012.**



Source: Data provided by the Office of the Chief Actuary; Panel calculations

**Table 9** reports the results of some simple regressions to test the proposition of a structural shift in 2001. For the period as a whole, after controlling for the unemployment rate, the taxable share declines 0.16 percentage points per year. Allowing different time trends pre-and post-2001, and also including returns on the S&P 500 to control for changes in the stock market (which affect measures of compensation like stock options), it does appear that taxable share declines more slowly after 2001. However, as shown in column 5, this is entirely because of the surprising increases in the taxable share from 2012 to 2017. Indeed, controlling for the unemployment rate and the stock market, the taxable share declined more quickly from 2001 to 2012 than it did from 1983 to 2001.

**Table 9: Results of regression indicates taxable share declines more slowly after 2001.**

	Regressions on taxable share of covered earnings				
	1983-2017				1983-2012
	(1)	(2)	(3)	(4)	(5)
Unemployment rate	0.52**	0.41**	0.30**	0.15*	0.51**
Year		-0.16**			
Year, if year<2001			-0.25**	-0.24**	-0.18**
Year, if year>=2000			-0.15**	-0.10**	-0.36**
Average return S&P 500 previous 3 years				-5.83**	-3.99**
Dummy for >2000			-189*	-276**	362**
Constant	82**	412**	582**	557**	436**
R-squared	0.14	0.86	0.88	0.91	0.95

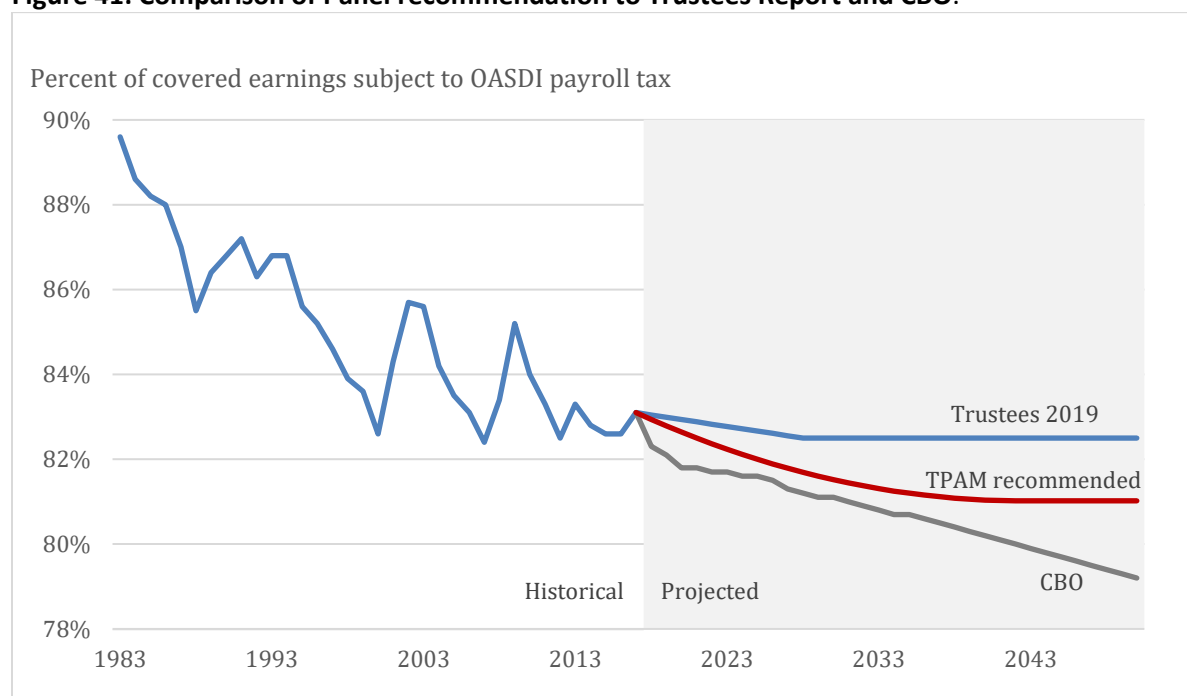
\*\*p<.05, \*= p<0.1

The assumptions in the Trustees Report assume that the taxable share will bottom out at 82.5, just 0.6 percentage points below the 2017 value. The Panel believes that a more balanced forecast would assume that the decline continues. First, from a statistical perspective, assuming that the decline is over based on only a few years of evidence seems premature.

Second, from an economic perspective, it seems unlikely that the forces that have given rise to increasing inequality over time have dissipated. While these forces are not fully understood, they likely mirror some of the factors pointed to as driving the decline in the labor share: technological changes that benefit highly skilled workers, globalization and an increasingly winner-take-all society, and increased market power by firms that could increase compensation of worker/owners while holding down compensation elsewhere in the income distribution (Furman, 2016). These forces seem likely to continue at least over the medium term. Indeed, CBO expects the taxable to continue decline over the next 30 years, as shown in **Figure 41**.

Some have pointed to increased enrollment in secondary education in recent years as a reason to expect inequality to decline somewhat over time: a higher supply of educated workers could lead to a lower college premium (Deming, presentation to committee). Evidence to date suggests the college premium has been about flat since 2000 (Gould, 2018), and, thus, the college premium cannot explain increases in earnings inequality since then. Furthermore, the implications of more highly educated workers for the share of compensation above the taxable maximum is unclear, but it could possibly lead to lower inequality.

**Figure 41: Comparison of Panel recommendation to Trustees Report and CBO.**



Source: Data provided by Office of the Chief Actuary, CBO long-term Budget Outlook, and Panel calculations

The Panel also encourages OCACT to investigate whether the taxable share has a demographic component, as older workers are more likely to have earnings that exceed the taxable maximum, and the age of the workforce has changed substantially over the 1983–2017 period, with the workforce becoming older from the mid-1980s to about 2010 and then becoming younger as the Baby Boom generation entered retirement.

## 6.0 PROGRAM-SPECIFIC ASSUMPTIONS AND METHODS

### 6.1 Overview of benefit model

OACT projections of the cost of the OASI portion of the program are based on the number of retired worker and dependent beneficiaries, as well as average benefit levels. Beneficiaries are projected by age, sex, and marital status. In each cohort, the number of individuals receiving retired worker benefits at age 62 is tied to labor force participation and the time to full retirement age. Additional individuals are assumed to claim benefits at ages 63–69 based on degree of actuarial reduction and the historical probability of claiming benefits at that age, with adjustments made to model scheduled changes in the full retirement age. Dependent and survivor beneficiaries, such as spouses and children, are projected using a series of probabilities to reflect their eligibility and the historical probability of claiming benefits at each age.

Projecting average worker benefit levels requires projecting AIME levels for a representative sample of workers reaching retirement age with enough career earnings to be insured. These projections are based on a 10 percent sample of recent new beneficiaries from the Master Beneficiary Record. These individuals' earnings histories become the basis for AIME distribution projections. OACT makes a series of adjustments to these earnings records from the sample to reflect the fact that future workers are likely to differ from workers in the sample in terms of their labor force participation and earnings. For example, to reflect increasing or decreasing labor force participation in covered employment, OACT randomly selects earnings records to add or delete years of earnings. Earnings levels are adjusted to reflect projected changes in relative taxable maximum levels and earnings distributions by age and sex. OACT also adjusts earnings histories to reflect increasing labor force participation at older ages by randomly selecting records and adding additional years of earnings at later ages.

**Benefit model recommendation 1: Model comparison.** In Methods Recommendation 2, the Panel recommends that OACT develop and maintain a core microsimulation model as part of an expanded projection toolkit. The Panel specifically recommends comparing benefit projections based on the current methodology against results from alternate models such as a microsimulation model. Any significant differences should be analyzed and appropriate action taken.

OACT adjusts historical data to reflect projected changes in working and claiming behavior. In general, the direction of these adjustments is sensible. People are working longer and claiming later. Claiming ages do tend to cluster around the full retirement age (Behaghel and Blau, 2012). The distribution of earnings by gender has been changing and can be expected to change in the future. However, the adjustments made are ad hoc, making it hard to impose (or verify) internal consistency across assumptions. The ad hoc nature of the adjustments also makes it hard for an outside observer to thoroughly evaluate them or determine whether there is systematic bias. As discussed in the methods recommendations, the microsimulation approach assures internal consistency of assumptions.

**Benefit model recommendation 2: Benefit claiming patterns.** In Presentation Recommendation 7, the Panel recommends expanding the Trustees Report's sensitivity analysis to key implicit assumptions. With respect to specific assumptions needed to project benefits, the Panel recommends that SSA conduct studies on the sensitivity of key financial outcomes (cost and income rates and the trust fund reserve depletion date) to benefit claiming age patterns.

An important implicit assumption in the benefit model is the distribution of claiming ages. The implicit assumptions are reasonable in that they are tied to historical claiming rates, as well as advances in the



full retirement age. Social Security retired worker benefits can be claimed at any age between 62 and 70, with an actuarial adjustment made for each month of delay. The adjustment initially was intended to be actuarially fair; that is, it was designed to provide the same expected present value of lifetime benefits for an individual with average mortality.

However, over the past two decades, improvements in mortality, increases in the delayed retirement credit (the adjustment applied for delaying beyond full retirement age), and persistently low real interest rates have substantially increased the expected present value of the gains from delay (see, e.g., Meyer and Reichenstein, 2010, 2012; Sass, Sun, and Webb, 2013; and Shoven and Slavov, 2014a, 2014b). Delaying Social Security is equivalent to purchasing a real annuity, as individuals forgo current benefits in exchange for higher real benefits for life. The increase in present value from delaying benefits is largest for primary earners in married couples, as the higher benefits are passed on to the widow. That is, a primary earner effectively purchases a joint and survivor annuity by delaying. However, singles too, particularly single women, can increase the present value of benefits through delay. Sun and Webb (2009) show that for singles and married men who are not liquidity constrained, utility maximization implies even longer optimal delays than present value calculations suggest due to the insurance value of the additional annuity.

Despite the large gains from delay, observed claiming behavior does not appear to follow predicted optimal behavior. Many people claim at the earliest eligibility age of 62, and very few people delay beyond full retirement age. Claiming is linked to reference points like the full retirement age (Behaghel and Blau, 2012; Siebold, 2019). Overall, OCACT's claiming age assumptions are a reasonable description of observed claiming behavior.

Examining sensitivity to these assumptions is warranted for several reasons. First, survey evidence suggests that some individuals may choose to claim early because they fear benefit cuts (Shoven, Slavov, and Wise, 2018). As the depletion date for the trust fund approaches, that motive for claiming early may strengthen, and an increase in early claiming may bring forward the depletion date. Second, as the potential gains from delaying benefits (or of strategic claiming more generally) have grown, the issue has gained public attention. For example, AARP has done much to draw attention to the issue, even providing a free online calculator to help people maximize their benefits. It may be reasonable to expect individuals to change their behavior as information spreads. Third, any changes in claiming behavior, regardless of their cause, could substantially affect the program's near-term finances and, therefore, the depletion date, even if there is a significantly smaller effect on the 75-year actuarial balance.

Given the uncertainty surrounding future claiming behavior, we recommend doing sensitivity analysis. The worst-case scenario for the trust fund depletion date is individuals accelerating claims shortly before the trust fund is exhausted. The worst-case scenario for the long-term finances of Social Security is individuals maximizing the expected present value of their benefits. We recommend that OCACT publish studies on its website on the importance of these claiming assumptions and present explicit sensitivity analysis in the Trustees Report if they turn out to be significant.

## 6.2 Disability assumptions and methods

The disability incidence rate was highlighted in the most recent Trustees Report due to a significant downward shift over the past ten years. Even when adjusted for declining unemployment rates, this shift has not been totally explainable. Discussions with experts in the insurance industry confirm their observation of a downward shift in disability insurance incidence rates that is being analyzed.

**Disability Recommendation 1: Incidence rates:** The Panel recommends lowering the ultimate age-sex adjusted disability incidence rate to 4.9, consistent with the Panel’s preferred assumption of 4.8 for the long-run unemployment rate and taking into account some of the recent observed downward shift in disability incidence. Because the incidence rate appears to have undergone rapid changes over the last decade, with some recent signs of reversal among the youngest age groups, the Panel recommends that SSA closely monitor trends in incidence rates as they evolve over time and explicitly linking the disability incidence and unemployment rate assumptions in its projections.

**Disability Recommendation 2: External consultation.** With respect to making judgments about the future evolution of disability incidence rates, in addition to closely monitoring trends in SSDI incidence rates, the Panel recommends that the SSA maintain regular contact with experts in the disability insurance industry to benefit from these experts’ insights into disability incidence rates experienced in the private market.

## Background

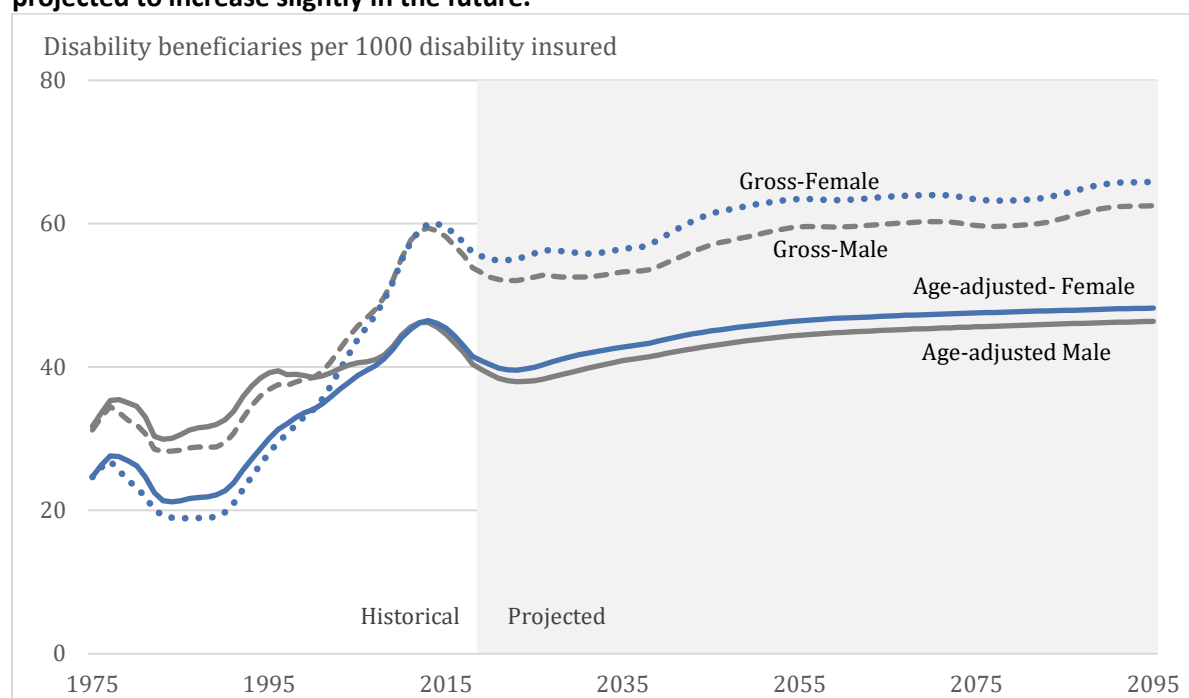
A key indicator of DI expenditures is the disability prevalence rate: the number of disabled worker beneficiaries in current payment status per 1,000 insured.<sup>29</sup> As **Figure 42** shows, the disability prevalence rate increased dramatically from the early 1980s until 2014—nearly doubling among men and tripling among women on a gross basis; adjusting to hold the age structure of the population constant, the rate of increase is less dramatic but still significant.<sup>30</sup> Since 2014, however, disability prevalence has been falling steadily among both men and women. In the Trustees’ projection, disability prevalence continues to fall until 2032; it then begins rising again, reflecting continued population aging and decreasing mortality rates among disabled beneficiaries. (The higher projected prevalence rate among women relative to men reflects the lower mortality rate of women, since incidence rates are projected to be similar, if not slightly higher among men.)

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<sup>29</sup> The SSDI program also makes payments to disabled widow(er)s and adult children, as well as dependents of disabled beneficiaries.

<sup>30</sup> Liebman (2015) decomposed the increase in program participation between 1985 and 2007 and found that 95 percent of the increase could be explained by the following factors: (1) secular increases in age-sex adjusted DI incidence rates following congressional reforms in 1984 expanding medical eligibility (50 percent); (2) population aging (20 percent); (3) the interaction between 1 and 2 (i.e., larger older cohorts aging into higher incidence rates) (13 percent); and (4) convergence of female insurance and incidence rates to those of men as a result of increased labor force participation among women (12 percent).

**Figure 42. Disability prevalence rose between the 1980s and 2014, fell between 2014 and 2019, and is projected to increase slightly in the future.**



Source: 2019 Trustees Report

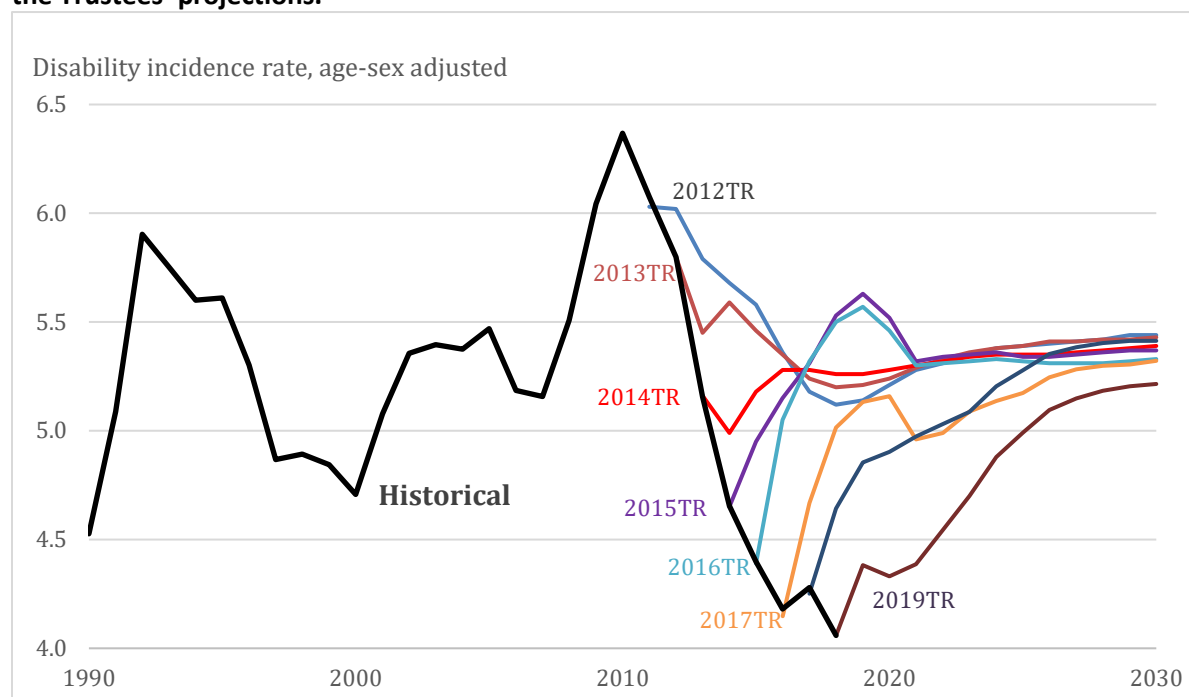
The disability *prevalence* rate is a measure of the stock of disabled worker beneficiaries and lags measures of the disability *incidence* rate—the rate of newly entitled disabled worker beneficiaries per 1,000 exposed (i.e., DI insured minus current beneficiaries)—and the disability termination rate, where termination can occur by one of three pathways: (1) conversion to retirement benefits upon reaching the full retirement age; (2) death; or (3) recovery. Though there has been an increase in recovery rates in recent years due to an increase in continuing disability reviews, the primary factor leading to declining prevalence rates since 2014 has been declining disability incidence, which peaked in 2010 at the height of the Great Recession and has been falling steadily since then, coinciding with the economic recovery (see **Figure 43**).<sup>31</sup>

From 2008 to 2011, the Trustees Report assumed an ultimate age-sex adjusted disability incidence rate of 5.2 for its intermediate projection. After reviewing disability incidence data through 2009 (a period of rising disability incidence), the 2011 Technical Panel recommended increasing the intermediate rate to 5.6. In 2012, the Trustees increased the intermediate rate to 5.4; between 2012 and 2018, the Trustees continued to assume an ultimate level of 5.4, as well as a somewhat rapid transition path from the current level, which continued to fall each year, contrary to the projections (**Figure 43**). Using data through 2014, the 2015 Technical Panel agreed with the Trustees' ultimate intermediate assumption of 5.4 and at the same time recommended that the Trustees closely monitor the evolution of disability incidence—particularly the award rate—for signs of a potential structural decline. In 2019, the Trustees reduced the intermediate ultimate disability assumption to 5.2 and assumed a slower transition path

<sup>31</sup> The Panel finds the Trustees' assumptions regarding disability termination rate plausible and sees no reason to recommend a change in this assumption.

from the current level of 4.1, averaging 5.0 over the next 20 years, compared with 5.3 in the 2018 Trustees Report.<sup>32</sup>

**Figure 43. The age-sex adjusted disability incidence rate has continued to fall since 2012, contrary to the Trustees' projections.**



Source: Data provided by the Office of the Chief Actuary. Also see "Social Security Actuarial Status: A Summary of Results from the 2019 Annual Report of the Board of Trustees of the OASI and DI Trust Funds," May 10, 2019, presentation

### Predicting Disability Incidence

The factors driving disability incidence remain somewhat elusive; however, the factor most clearly related to the disability incidence rate at any given point in time is the (contemporaneous) unemployment rate.<sup>33, 34</sup> **Table 10** presents regressions of disability incidence rates among men and women, respectively, reweighted to hold the age distribution of the exposed population constant at its observed distribution in 2000, on the unemployment rate. Model 1 (columns 1 and 4) mimics the specification used by the Office of the Chief Actuary to justify the disability incidence assumptions in the 2019 Trustees Report, which were estimated separately by five-year age group.<sup>35</sup> Fitted to 1995–2017 data, the model explains 55–63 percent of the variation in age-adjusted disability incidence rates and implies a strong relationship between disability incidence and business cycles. Assuming an

<sup>32</sup> This includes an initial projected temporary increase in DI incidence in 2019 due to processing of a large backlog of SSDI appellate claims.

<sup>33</sup> The cyclical pattern in DI claiming has long been recognized. See, e.g., Stapleton, Coleman, Dietrich and Livermore (1988), Black, Daniel and Sanders (2002), Autor and Duggan (2003), Duggan and Imberman (2009), Cutler, Meara and Richards-Shubik (2012), Liebman (2015), Maestas, Mullen and Strand (2014, 2018), Charles, Li and Stephens (2018).

<sup>34</sup> There has been speculation that some of the observed increase in DI claims during the Great Recession were not new claims but merely accelerated; that is, absent the economic downturn, they would have occurred a year or two later anyway. In a recent working paper, Maestas, Mullen and Strand (2018) test this hypothesis directly by estimating a distributed lag model specification on SSA administrative data and find that at most one-third of SSDI applications were accelerated by several months and 20 percent of SSDI claims were accelerated by a few months.

<sup>35</sup> See OCACT (2019) Long-Range Disability Assumptions for the 2019 Trustees Report.

unemployment rate of 5.5, consistent with the Trustees' intermediate ultimate assumption, implies an ultimate disability incidence rate of 5.2 for men and 5.0 for women (5.1 overall, since the share of men in the 2000 exposed population is 0.54). As discussed in the economics section, however, the recent experience of historically low unemployment rates combined with low inflation has convinced many experts that the natural rate of unemployment is falling, and therefore the long-run (average) unemployment rate is likely to be lower than the Trustees' assumption of 5.5. If we instead use the Panel's preferred unemployment rate assumption of 4.8 to project disability incidence, we obtain 5.0 for men, 4.8 for women and 4.9 overall.

**Table 10: Regressions of age-adjusted disability incidence rate on unemployment rate, and implied disability incidence rate, by gender, 1995–2017.**

Variables	Men		Women	
	Model 1	Model 2	Model 1	Model 2
Unemployment Rate (UR)	0.274 ***	0.434 ***	0.251 ***	0.314 ***
Post2008*UR		0.022		0.078
Post2008		-1.071 *		-1.114 *
Constant	3.682 ***	3.108 ***	3.636 ***	3.487 ***
R-squared	0.547	0.92	0.628	0.907
Implied incidence rate if UR=4.8				
...Temporary/no shift	5.0	5.2	4.8	5.0
...Permanent shift		4.1		4.0

\*\*\*=p<0.001, \*\*=p<.01, \*=p=0.05

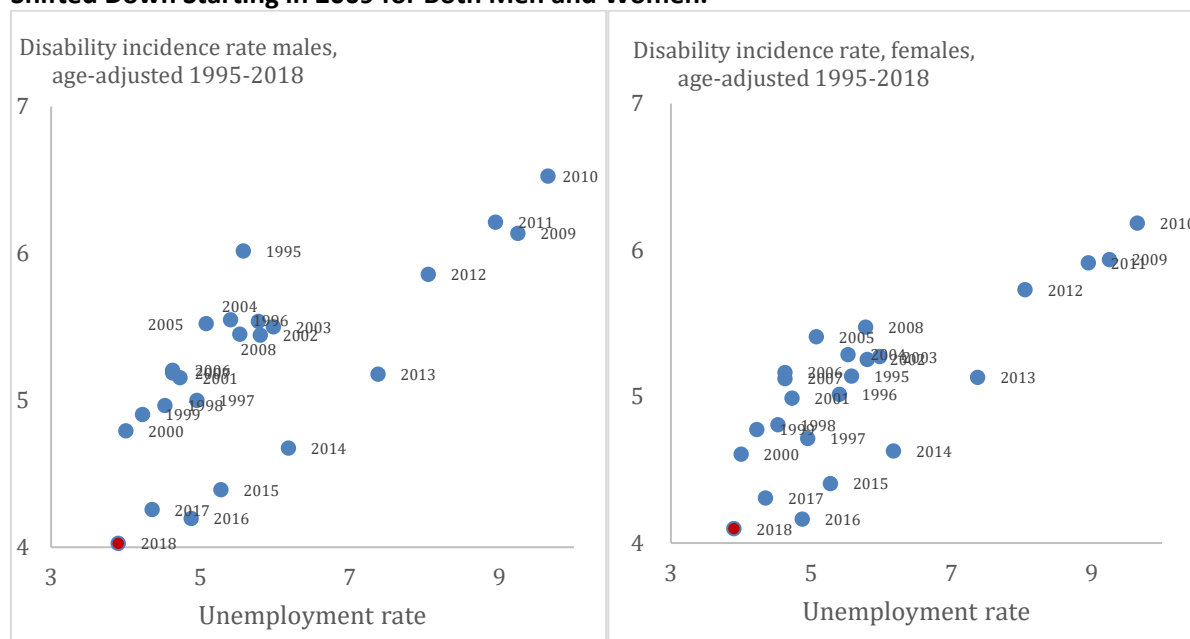
Model 1 assumes a constant relationship between disability incidence and unemployment over time and no secular changes in the baseline incidence rate.<sup>36</sup> **Figure 44** plots the age-adjusted disability incidence rates for men and women, respectively, against the unemployment rate over the same time period. From the figure it is apparent that, though the relationship between disability and unemployment rate is roughly the same over time, starting in 2009 there appears to be a level shift down in the disability incidence rate associated with a given level of unemployment. This level shift down in disability incidence appears for both men and women and persists through 2018, the last year of data available.

Model 2 adds interactions with a post-2008 indicator for both the unemployment rate and constant term. The results are displayed in **Table 11**. Note this model does a much better job of fitting the data, with R-squared terms of 0.92 for men and 0.91 for women. Though the interaction between unemployment rate and post-2008 is statistically insignificant, the post-2008 indicator is significant at the 5 percent level and implies just over a one percentage point drop in the age-adjusted incidence rate starting in 2009 for both men and women. Importantly, not accounting for this level shift in incidence

<sup>36</sup> One way to evaluate these assumptions is to estimate residuals from the regressions and plot them over time; if the model is correctly specified the predicted residuals should average out to zero for roughly any subperiod (by construction, they will average to zero over the entire time period). However, plotting the residuals over time shows that, for both men and women, the model consistently underpredicts disability incidence in the years before the Great Recession and overpredicts disability incidence in the post-recession years (not shown). This pattern suggests there may have been secular declines in disability incidence rates in recent years not captured in the Model 1 regression specification. The 2015 Technical Panel made a similar point regarding analyses of cyclical patterns in allowance rates published in OCACT Actuarial Note #153.

rates in Model 1 results in an *underestimate* of the sensitivity of disability incidence to the unemployment rate. This is consistent with previous papers that have found somewhat lower estimates of the effect of unemployment on disability insurance claims during the Great Recession compared to earlier recessions (e.g., Liebman, 2014; Maestas, Mullen and Strand, 2015).<sup>37</sup>

**Figure 44. The Age-Adjusted Disability Incidence Rate, Conditional on the Unemployment Rate, Shifted Down Starting in 2009 for Both Men and Women.**



Source: Data provided by the Office of the Chief Actuary

Understanding the drivers of the recent downward shift in disability incidence is important for projecting future incidence rates. Specifically, identifying the cause of the shift can shed light on whether it is likely to be long lasting or temporary. If temporary, and disability incidence rates revert to pre-2009 levels, then Model 2 implies that the ultimate disability incidence rate will be 5.2 for men and 5.0 for women (5.1 overall), assuming the unemployment rate is 4.8. If it represents a permanent shift to a new regime, then Model 2 implies ultimate disability incidence rates closer to 4.1 for men and 4.0 for women (4.1 overall). In the next section, we discuss potential explanations and try to assess whether the weight of evidence supports a temporary vs. permanent explanation for the secular shift in disability incidence.

### Potential Explanations and Implications for Future Incidence Rates

Several potential explanations for the recent decline in disability incidence have been posited. As OCACT notes in its memo on long-range disability assumptions for the 2019 Trustees Report, “possible explanations for the recent decline include the low unemployment rate, the drop in hearings allowance rates, and the greater availability of healthcare because of the Affordable Care Act.” Other potential explanations include the changing nature of work (making it possible for more people with disabilities to

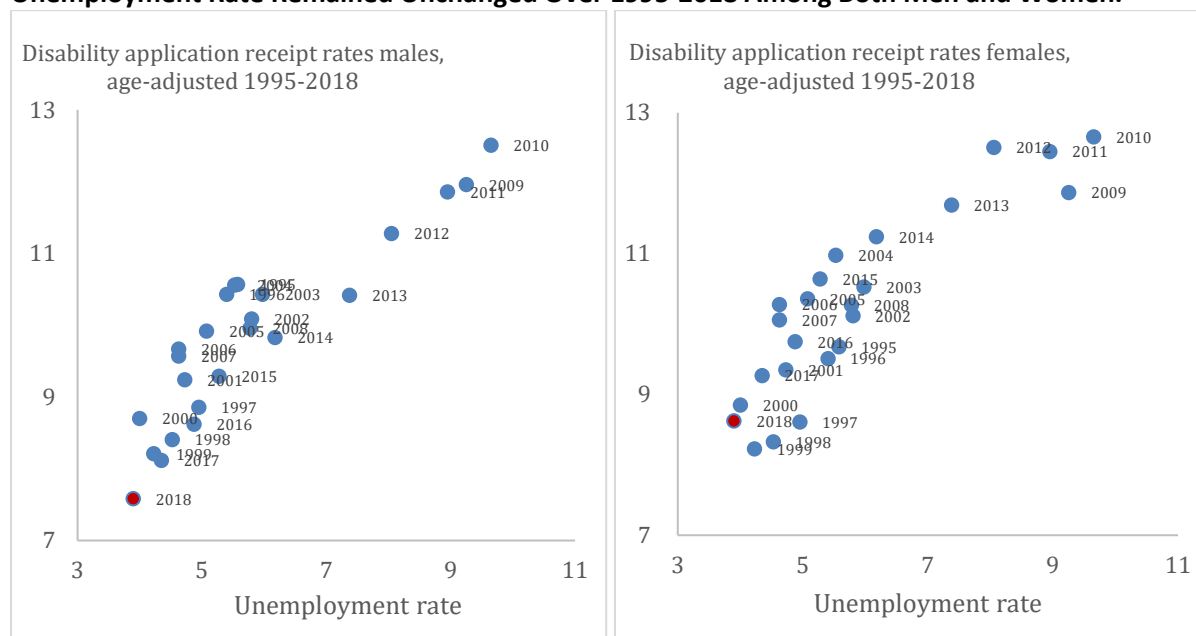
<sup>37</sup> Note also that estimating Model 1 on data from 1995–2007 (before the advent of the Great Recession) yields estimated coefficients on unemployment rate that are similar to the estimates in Model 2 using data from 1995–2017 (not shown).

remain in the labor force) and the 2008 Amendments to the Americans with Disabilities Act expanding employment protections for individuals with disabilities.

At the same time public disability incidence has fallen, disability incidence also has fallen in private insurance markets. However, without a large-scale study of multiple private insurers covering a time period pre- and post-Great Recession, it is unclear how much of the drop in private disability claims has deviated from the expected decline due to improving economic conditions, if at all. If private disability claims (conditional on the unemployment rate) also have fallen compared to their pre-recession levels, then this would support the hypothesis that the fall in public disability claims is due to structural (permanent) factors, such as the changing nature of work or decreased discrimination in the workplace. The Panel therefore recommends that the OCACT maintain regular contact with experts in the insurance industry to benefit from these experts' insights into disability incidence rates experienced in the private market in order to shed light on shared factors driving disability claims.

Since the disability incidence rate is a product of the application rate and the award rate conditional on applications, it is instructive to examine the relationship between the age-adjusted disabled worker application rate per 1,000 exposed (i.e., DI insured minus current beneficiaries) for men and women, respectively, and the unemployment rate. As **Figure 45** shows, the relationship between disability applications and unemployment is essentially unchanged over the 1995–2018 period. Regressions using the Model 2 specification above confirm that the interactions with a post-2008 indicator are statistically insignificant (and in fact, wrong-signed; not shown). This suggests a change in the award rate—not the application rate—is driving the decline in incidence.

**Figure 45. The Relationship between Age-Adjusted Disability Application Receipt Rate and Unemployment Rate Remained Unchanged Over 1995–2018 Among Both Men and Women.**



Source: Data provided by the Office of the Chief Actuary

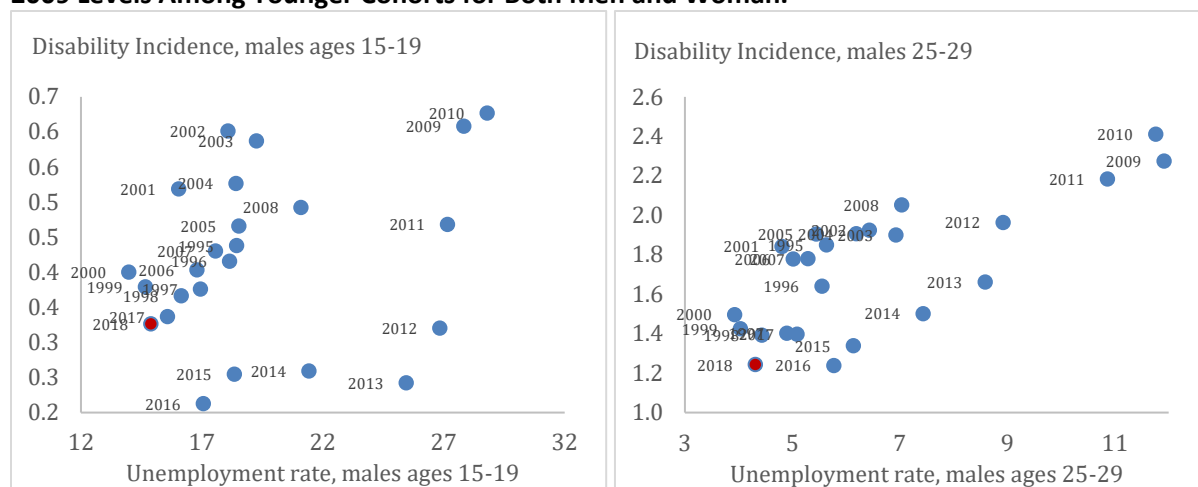
As noted, the decline in award rates—specifically at the appellate level—has been recognized, though the origins of the decline have been debated. In 2009, the Appeals Council designed and implemented a new interactive training program for administrative law judges (ALJs) based on a thorough analysis of



past decisions (Ray and Lubbers, 2014). However, the fact that the training program was implemented without a randomized controlled trial and coinciding with the Great Recession made it difficult to attribute the decline in award rates to the ALJ reform rather than the changing composition of applicants induced to apply for SSDI by the recession (see OCACT Actuarial Note 153). In a recent working paper, Maestas, Mullen and Strand (2018) analyzed SSDI applications and awards through the ALJ level of the appellate process during and after the Great Recession and used their findings to simulate the number of claims and allowances that were attributable to the Great Recession. They estimated the counterfactual allowance rate in the absence of the Great Recession and found that, in the absence of the Great Recession, the allowance rate would have started falling for applications initially filed near the start of 2010.<sup>38</sup> The 2015 Technical Panel also noted that the decline in allowance rates was greater for ALJs hired in 2009 or later, consistent with the idea that the 2009 training reform led ALJs to allow fewer cases.

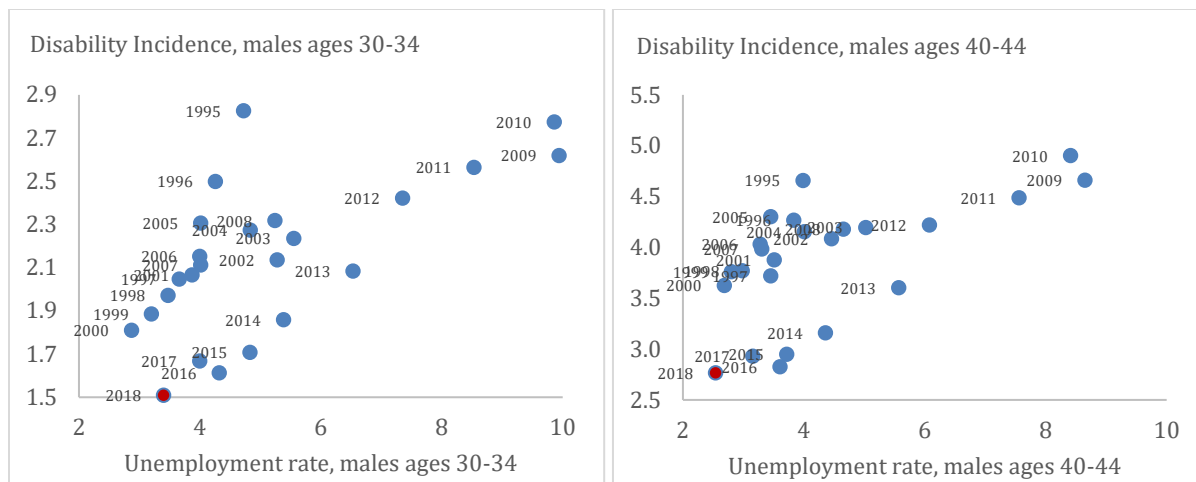
Finally, it is instructive to examine the relationship between disability incidence and unemployment within age group over time. **Figure 46** plots this relationship over the period 1995–2018 for select age groups among men. Interestingly, for the youngest age groups—under age 30—there are signs that disability incidence levels are reverting to previous levels, after adjusting for the effect of the unemployment rate. For example, among men ages 16–19, incidence rates in 2017 and 2018 are in line with incidence rates in the late 1990s when unemployment rates for men in this age group were similar to their levels in 2017 and 2018. These age patterns are similar for women. Though the post-2008 period remains distinctly different for older age groups than the pre-2008 period (for now), the fact that there are signs of reversal among younger age groups is worth further study and continued monitoring to see if trends in older age groups also start to reverse course.

**Figure 46. The Relationship between Disability Incidence and Unemployment Has Reverted to Pre-2009 Levels Among Younger Cohorts for Both Men and Woman.**



<sup>38</sup> The sometimes very long lags between initial filing date and appellate decision date make it difficult to disentangle the compositional effects of the Great Recession from appellate decisions in a given year. Specifically, applications initially filed in 2009 can sometimes take up to two years or more to appear at the appellate level.





Source: Data provided by the Office of the Actuary

In light of the available evidence, the Panel recommends placing more weight on the temporary scenario (about 80%) than the permanent scenario in setting the disability incidence assumptions. The Panel therefore recommends lowering the ultimate age-sex adjusted disability incidence rate assumption to 4.9, consistent with the Panel's preferred assumption of 4.8 for the long-run unemployment rate and taking into account some of the recent observed downward shift in disability incidence. Because the incidence rate appears to have undergone rapid changes over the last decade, with some recent signs of reversal among the youngest age groups, it will be important to closely monitor future trends in incidence rates as they evolve over time, particularly as economic conditions change, in order to determine whether the post-Recession decline in disability incidence is likely to reverse course or continue for many decades.

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## MEMBER BIO-SKETCHES

### 2019 Technical Panel on Assumptions and Methods

**Robert (Bob) Beuerlein [CHAIR]** is a consulting actuary with RM Beuerlein Consulting. He recently retired as Senior Vice President and Chief Actuary of AIG Life and Retirement Companies, one of the largest life insurance and retirement services organizations in the United States. Mr. Beuerlein has more than 40 years of experience in the life insurance industry working with the product and financial analysis of life, disability and retirement insurance. He is a fellow of the Society of Actuaries (FSA), a member of the American Academy of Actuaries (MAAA), and a Chartered Enterprise Risk Analyst (CERA). Mr. Beuerlein is a past president of the American Academy of Actuaries (2017) and the Society of Actuaries (2006).

**Ron Gebhardtsbauer**, is Faculty-in-Charge of the Actuarial Science Program at Penn State University. Before Penn State, Gebhardtsbauer was the Senior Benefits Advisor to the U.S. Senate Finance Committee. From 1997 to 2008, he was the Senior Pension Fellow for the American Academy of Actuaries. In that role, Gebhardtsbauer was the spokesperson for the profession on pensions, Social Security, and other retirement issues. Gebhardtsbauer has advised the governments of Canada, Bulgaria, Romania, Poland, Vietnam, and the United Kingdom. His public-sector experience includes tenures as the chief actuary of the federal Pension Benefit Guaranty Corporation (PBGC) and the chief pension actuary at the U.S. Office of Personnel Management, where he participated in creating the Federal Employee Retirement System. Gebhardtsbauer also held private-sector positions with the Wyatt Company and Acacia Mutual Life Insurance Company, and managed the New York City retirement practice of William M. Mercer, Inc. He is a fellow of the Society of Actuaries (FSA) and a member of the American Academy of Actuaries (MAAA).

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**Kathleen Mullen** is a senior economist at the RAND Corporation and director of the RAND Center for Disability Research. Her work addresses the economics of retirement, health, and disability, with an emphasis on the incentive effects of social insurance programs such as Social Security and Social Security Disability Insurance (SSDI). She has pursued research on, among other things, the effects of SSDI receipt on labor supply; the effects of long waiting times on the subsequent labor force participation and earnings of rejected SSDI applicants; how changes in eligibility requirements affect SSDI or Social Security claiming; and the effects of changes in Social Security or disability insurance incentives in other countries on labor supply for workers at older ages, and what those findings suggest about potential evaluations of reforms in the United States. Mullen received her Ph.D. in economics from the University of Chicago.

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**Sita Nataraj Slavov** is a professor of public policy and the director of the public policy Ph.D. program at the Schar School of Policy and Government at George Mason University. She is also a faculty research fellow at the National Bureau of Economic Research and a visiting scholar at the American Enterprise Institute. Before coming to the Schar school, she was a resident scholar at the American Enterprise Institute, an associate professor at Occidental College, and a senior economist at the Council of Economic Advisers. Professor Slavov's research focuses primarily on public finance and the economics of aging. She has published numerous articles and book chapters on Social Security, retirement, retiree health insurance, and health expenditures among older people. She received her Ph.D. in economics from Stanford University and her B.A. from the College of William and Mary.

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**Tom Terry** is CEO of the Terry Group, a healthcare, insurance and retirement consulting firm. Prior to founding The Terry Group, Mr. Terry was CEO of JPMorgan Compensation and Benefits Strategies, the successor organization to CCA Strategies, a firm he co-founded in 1991. Mr. Terry is chair of the Board of Actuaries which has actuarial oversight responsibility for the U.S. government’s Civil Service Retirement System and the Federal Employees Retirement System. He is also board chair for the Global Aging Institute, a Washington D.C.-based research organization. Mr. Terry is a Fellow of the Society of Actuaries (FSA), a member of the American Academy of Actuaries (MAAA), a Fellow of the Conference of Consulting Actuaries (FCA) and an Enrolled Actuary (EA). He is a past president of the Conference of Consulting Actuaries (2007), the American Academy of Actuaries (2014) and the International Actuarial Association (2017).