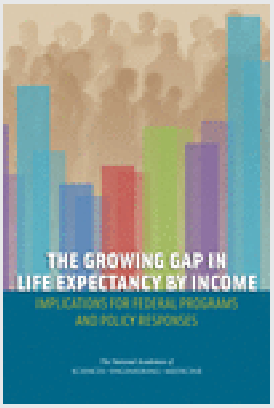

The Growing Gap in Life Expectancy by Income: Implications for Federal Programs and Policy Responses

DETAILS

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Committee on the Long-Run Macroeconomic Effects of
the Aging U.S. Population—Phase II

Committee on Population
Division of Behavioral and Social Sciences and Education

and

Board on Mathematical Sciences and Their Applications
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Preface

In 2010, Congress asked the National Research Council (NRC), the operating arm of the National Academy of Sciences, to undertake a study of the long-run macroeconomic effects of the aging U.S. population. This study was divided into two phases. Phase I began in September 2010 and culminated in the 2012 report *Aging and the Macroeconomy: Long-Term Implications of an Older Population* (National Research Council, 2012), which summarized existing knowledge in relevant domains, discussed various policy implications, and offered a set of research recommendations.

In the course of the Phase I work, it became clear that a useful next step would be to further consider the policy implications of certain macro-level changes in the U.S. population through the use of quantitative modeling and projections. To do so, the NRC appointed an ad hoc Phase II committee in late 2012 under the auspices of the NRC's Committee on Population and the Board on Mathematical Sciences and their Applications. The Phase II committee investigated the steepening U.S. mortality gradient by income and focused on the intersection of mortality changes and government entitlement programs, with an eye toward potential policy responses that would help programs meet the fiscal challenges posed by an aging population.

No committee could perform a task such as this without the assistance and close cooperation of many people. We would like to thank, first and foremost, our fellow committee members. Despite having many other responsibilities, committee members generously donated their time and expertise to the project. The committee met six times over the course of the project. Members contributed to the study by providing background

readings, leading discussions, making presentations, drafting and revising chapters, and critically commenting on the various report drafts. The perspectives that members brought to the table were instrumental in synthesizing ideas throughout the committee process.

Several members of the Phase I committee provided valuable comments regarding the direction of the Phase II project. For their suggestions, we thank Axel Boersch-Supan, Max Planck Institute for Social Law and Social Policy; Deborah J. Lucas, Massachusetts Institute of Technology; William D. Nordhaus, Yale University; and James M. Poterba, Massachusetts Institute of Technology.

We very much appreciate the ideas and research of scholars who are working on issues that the committee examined. For their presentations and/or related input to the committee, we thank Barry P. Bosworth, Brookings Institution; Joyce Manchester, Congressional Budget Office; Samuel Preston, University of Pennsylvania; and Hilary Waldron, Social Security Administration.

An integral part of this project involved modifications to the Future Elderly Model and the subsequent production of data and graphs. This was a collaborative enterprise in which committee members worked with Bryan Tysinger and Duncan Leaf, Leonard D. Schaeffer Center for Health Policy and Economics, University of Southern California, whose sustained efforts were indispensable. We also thank Jeffrey Sullivan, Precision Health Economics, for his valuable input during early stages of the project, and Gretchen S. Donehower, Center on the Economics and Demography of Aging, University of California, Berkeley, for producing analyses used in Chapter 3.

This report has been reviewed in draft form by individuals chosen for their diverse perspectives and technical expertise, in accordance with procedures approved by the National Academies of Sciences, Engineering, and Medicine's Report Review Committee. The purpose of this independent review is to provide candid and critical comments that will assist the institution in making its published report as sound as possible and to ensure that the report meets institutional standards for objectivity, evidence, and responsiveness to the study charge. The review comments and draft manuscript remain confidential to protect the integrity of the deliberative process. We thank the following individuals for their review of this report: Sandro Galea, Department of Epidemiology, Mailman School of Public Health, Columbia University; James S. House, Institute for Social Research, University of Michigan; Laurence J. Kotlikoff, Department of Economics, Boston University; Alicia H. Munnell, Carroll School of Management and Center for Retirement Research, Boston College; Samuel H. Preston, Population Studies Center, University of Pennsylvania; Jonathan S. Skinner, Department of Economics, Dartmouth University; Bruce D. Spencer, Department of Statistics, Northwestern University; Wilbert van der Klaauw, Center for Microeconomic Data, Research and Statistics, Federal Reserve Bank of New York; and James W. Vaupel, Max Planck Institute for Demographic Research, Rostock, Germany.

Although the reviewers listed above have provided many constructive comments and suggestions, they were not asked to endorse the conclusions or recommendations nor did they see the final draft of the report before its release. The review of this report was overseen by V. Joseph Hotz, Department of Economics, Duke University, and Charles F. Manski, Department of Economics, Northwestern University. Appointed by the Academies, they were responsible for ensuring that an independent examination of this report was carried out in accordance with institutional procedures and that all review comments were carefully considered. Responsibility for the final content rests entirely with the authoring committee and the institution.

Lastly, we acknowledge the efforts of several individuals within the Academies. We are indebted to Danielle Johnson, senior program assistant, for providing the essential infrastructure for this project. Danielle handled many administrative matters during the committee's tenure, with assistance from Barbara Boyd and Tina Latimer. Mary Ghitelman was instrumental in preparing the final graphs throughout the report. We also thank Kirsten Sampson Snyder for her coordination of the review process and Robert J. Katt, who edited the volume and made numerous suggestions for its improvement. Kevin Kinsella, the Academies study director, managed the overall work of the committee, along with Thomas Plewes, director of the Committee on Population, and Scott Weidman, director of the Board on Mathematical Sciences and Their Applications.

Ronald D. Lee and Peter R. Orszag, *Cochairs*
Committee on the Long-Run Macroeconomic Effects of
the Aging U.S. Population—Phase II

Contents

[1]Appendix B and the accompanying Excel workbook are not printed in this volume. Both are available to download at nap.edu/GrowingGap under the **Resources** tab.

Summary

According to many studies, life expectancy has been rising fastest for people with higher education or income, so the gap in longevity by socioeconomic status has been increasing. This trend is important in itself, but it also means that higher-income people will increasingly collect government benefits such as Social Security over more years than will lower-income people. It also means that some proposed policy changes to make programs fiscally sustainable, such as raising the normal retirement age for Social Security or raising the eligibility age for Medicare, might disproportionately affect those with lower incomes.

These topics are discussed in this report. The study first reviews the literature on differences in longevity by education and by income and on trends in these differences; the committee then constructs some new estimates of our own. Next the report discusses the conceptual background for these issues and why they are important. We go on to evaluate the way that the widening income differences in mortality affect the value of net lifetime benefits for different income groups from Social Security retirement and spousal benefits, Disability Insurance, Survivors Insurance, Medicare, Medicaid, and Supplemental Security Income. Finally, we consider how the differential changes in mortality would affect analyses of some possible reforms to government programs for the elderly in the face of population aging. We consider the consequences of policies such as raising the earliest eligibility age and the normal retirement age under Social Security, raising the age of eligibility for Medicare, basing the cost-of-living adjustment on a different kind of consumer price index, and changing the formula for how benefits are calculated for higher-income beneficiaries.

Life expectancy has risen markedly in the United States over the past century. It has long been the case, furthermore, that better-educated, higher-income people live longer, on average, than less-educated, lower-income people. In recent decades, however, the *gap* in life expectancy between higher-income individuals and those lower on the socioeconomic distribution has been expanding.

How have larger historical and projected gaps in life expectancy by income and education affected lifetime benefits under programs such as Medicare and Social Security? The analysis presented here examines the impact of a steeper mortality gradient by income on the major federal entitlement programs: Medicare, Medicaid, Social Security retirement, Disability Insurance, and Supplemental Security Income. The results show a considerable change in the overall distribution of these government benefits, driven by the growing gap in life expectancy by income and education.

Taking into account the widening gaps in longevity by lifetime earnings classes that have been found by a variety of other studies and that are confirmed by the analyses made for this report, the committee provides estimates of projected benefits under the major entitlement programs by lifetime earnings categories and also analyzes potential policy interventions from that perspective. As the report documents, changes in the distribution of life expectancy alter the distribution of lifetime net benefits from some of this nation's most important public programs. In essence, actual and projected changes in life expectancy mean that major federal entitlement programs will unexpectedly come to deliver disproportionately larger lifetime benefits to higher-income people who, on average, will increasingly collect those benefits over more years than those with lower incomes.

TRENDS IN LIFE EXPECTANCY: THE GROWING GAP BY LIFETIME EARNINGS

The starting point for the committee's analysis is trends in mortality. Using Social Security earnings history data linked to the Health and Retirement Study, we estimate mortality patterns based on life expectancies at age 50 for males and females in different generations by quintile of lifetime earnings. Our "lifetime earnings" measure is average nonzero earnings, as reported to Social Security, between ages 41 and 50. In our analysis of public programs, we compare the consequences of the mortality regime at ages above 50 for the generation born in 1930 to the mortality regime we project for the generation born in 1960.

Our results confirm numerous other studies showing that the gradient in life expectancy by income has been rising over time. Even among those born in 1930, people who wound up in the top quintile of lifetime earnings (i.e., they were in the top fifth of earners, based on how much they earned

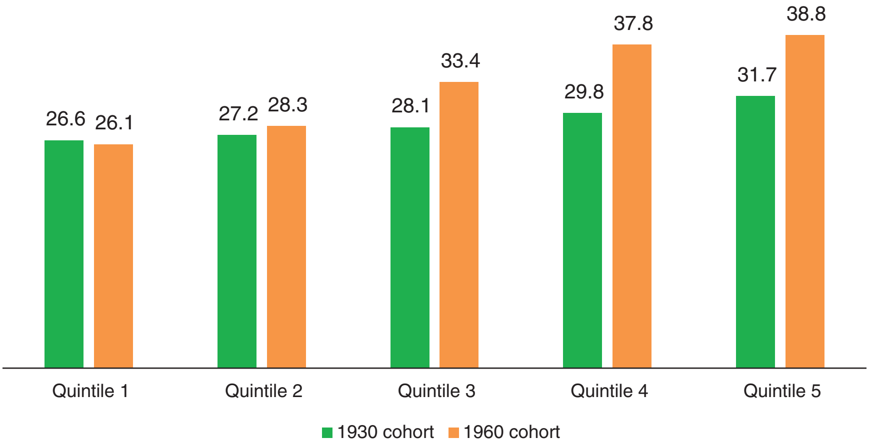

FIGURE S-1 Estimated and projected life expectancy at age 50 for males born in 1930 and 1960, by income quintile.
SOURCE: Committee generated from Health and Retirement Study data.

at ages 41 to 50) have longer life expectancy at age 50 on average than those in the bottom quintile. The gap, though, is estimated to have risen substantially since then because life expectancy of generations at the bottom of the earnings distribution is relatively flat or even declining, whereas life expectancy is rising rapidly at the top.

For example, consider male workers in the bottom fifth of lifetime earnings. Under the study's mortality regime of those born in 1930 and surviving to age 50, they would have an additional life expectancy of 26.6 years, so they could expect to live to age 77, on average (see Figure S-1). Under the study's mortality regime of those born in 1960, on the assumption that trends in mean and in dispersion continue, life expectancy at age 50 is slightly lower, at 26.1 years.[1] In other words, for a period of more than 30 years, there will have been *no* net gains in life expectancy at age 50 for males at the bottom of the earnings distribution, if these projections hold.

The story is different at the top of the earnings distribution. For males in the top earnings quintile, life expectancy at age 50 for the 1930 birth cohort is 31.7 years. For those born in 1960, life expectancy at age 50 is projected to rise to 38.8 years. In other words, between the 1930 cohort

[1]Mortality above age 50 for the 1960 generation is not observed in our dataset; mortality and life expectancy are projected using a model that is fit to the experience of generations born up to 1953, as explained in Chapter 3. Mortality for those born in 1930 is observed from ages 62 to 78 and is projected to older ages using our fitted model.

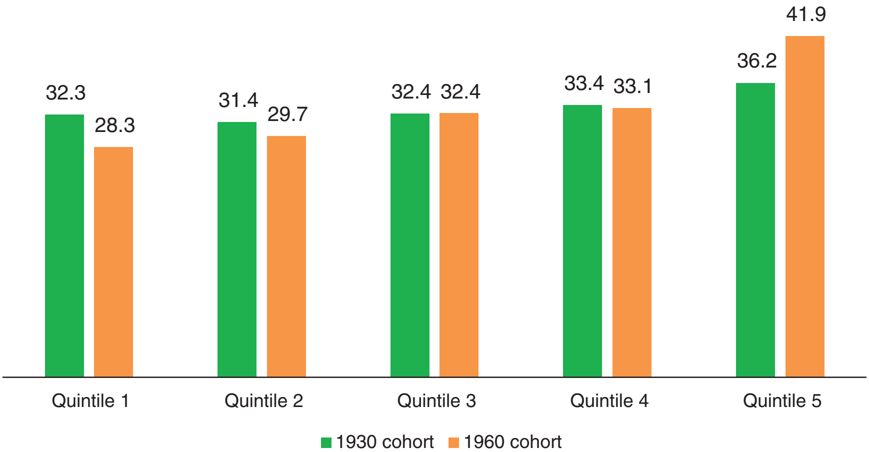

FIGURE S-2 Estimated and projected life expectancy at age 50 for females born in 1930 and 1960, by income quintile.
SOURCE: Committee generated from Health and Retirement Study data.

and the 1960 cohort, according to these estimates and projections, life expectancy is roughly unchanged for males at the bottom of the earnings distribution but increases by more than 7 years for those at the top.

The implication of these differential trends is that the gap in life expectancies is expanding rapidly. For males born in the 1930 cohort, the highest quintile's life expectancy at age 50 is 5.1 years longer than the lowest quintile's. For males born in the 1960 cohort, the projected gap widens to 12.7 years.

For females, the results appear even more pronounced (see Figure S-2), although the estimates are less reliable. The committee estimates suggest that life expectancy at age 50 for females at the bottom of the earnings distribution declines markedly between those born in 1930 and the projections for those born in 1960, from 32.3 years to 28.3 years. At the top of the female earnings distribution, however, life expectancy is projected to rise by more than 5 years. The result is that the gap in life expectancy between high-earning females and low-earning females is projected to expand from 4 years to 13.6 years.

IMPACT OF GROWING GAP IN LIFE EXPECTANCY ON BENEFITS FROM MAJOR ENTITLEMENT PROGRAMS

Given these substantial increases in projected life expectancy differentials, it is not surprising that the committee's estimates also suggest a

TABLE S-1 Present Value of Entitlement Program Benefits at Age 50, by Sex, for People Under the Mortality Regimes of the 1930 and 1960 Birth Cohorts

	Present value of benefits at age 50 based on the mortality profile for those	
Earnings Quintile	Born in 1930	Born in 1960
Males		
Lowest	$402,000	$391,000
2	347,000	366,000
3	344,000	432,000
4	364,000	499,000
Highest	402,000	522,000
Gap, High-Low	*$0*	*$132,000*
Ratio, High/Low	*1.00*	*1.34*
Females		
Lowest	$539,000	$452,000
2	405,000	373,000
3	394,000	386,000
4	373,000	357,000
Highest	410,000	480,000
Gap, High-Low	*–$129,000*	*$28,000*
Ratio, High/Low	*0.76*	*1.06*

growing gap in projected lifetime benefits under programs such as Social Security and Medicare because higher earners are increasingly more likely to receive such benefits over longer periods of time relative to lower earners. Table S-1 reports the present value of Medicare, Medicaid, Social Security (including retirement and disability), and Supplemental Security Income benefits by income quintile, derived from simulations using the Future Elderly Model (described in Chapter 2). The simulations perform a hypothetical experiment examining the impact of changing mortality on lifetime benefits, assuming that the policy parameters for those programs are fixed at their current levels (2010 for program structures).[2] This allows the analysis to focus on the effects of mortality differences by quintile. The

[2]Health changes affect economic outcomes between the two cohorts; in particular, health status affects earnings, workforce participation, and benefit claiming behavior. Both these effects and the pure mortality rate differences will affect results when comparing the 1930 and 1960 cohorts.

columns in Table S-1 provide insight into the marginal effect of the *changes* in actual and projected life expectancy by lifetime earnings.

As Table S-1 shows, these major entitlement programs generated benefits that, in present value at age 50, are either evenly distributed across lifetime earnings categories (for males) or somewhat tilted toward lower earners (for females). In particular, for males under the 1930 regime, total lifetime benefits accruing to those in both the lowest and the highest earnings category average roughly $400,000 in present value at age 50. The overall picture is one of relative neutrality across the earnings distribution. As discussed in Chapter 4, this pattern arises from a balance between Social Security retirement benefits (which were larger in absolute dollar amounts for higher earners than lower earners), Medicare benefits (which were about the same on average across the earnings distribution), and Medicaid, Disability Insurance, and Supplemental Security Income benefits (which were larger in absolute dollar amounts for lower earners than higher ones).

For females, the distribution of benefits by lifetime earnings for those under the 1930 regime is such that the top quintile had lower average benefit levels (in present value dollars) than the bottom quintile. The biggest source of the difference in the patterns between males and females is that Medicaid benefits (which were larger at the bottom than at the top for both males and females) are on average much larger for females than males, tilting total benefits toward those at the bottom of the earnings distribution.

As life expectancy gaps increase, however, this pattern changes markedly. For males under the 1960 mortality regime, lifetime benefits in present value at age 50 are projected to be significantly larger in the top earnings category than at the bottom, in contrast to the roughly neutral 1930 distributional pattern. For females, the distribution of lifetime benefits is projected to evolve to being roughly neutral across the earnings distribution, in contrast to the tilt toward lower earnings in the 1930 cohort. So, for example, the gap in present value of benefits between the highest quintile and the lowest quintile under the 1930 regime is zero for males and –$129,000 for females. Under the 1960 regime, the gap is projected to become $132,000 for males and $28,000 for females.

The results in Table S-1 are for benefits alone, but one should also be interested in benefits minus taxes paid. Because of modeling limitations (the model used by the committee lacks data on taxes paid before age 50), the analyses for this study were only able to include taxes paid after age 50. The committee's simulation experiment calculates the net present value of expected taxes paid and government benefits received by a generation over the rest of its life starting at age 50. The program rules are assumed to remain as defined in 2010 and to persist through subsequent years until all members of the generation have died. The taxes and benefits by age are projected forward, conditional on these rules and on additional assumptions including income growth and health care cost grow (the net benefit measure is discussed in Chapter 2, and the committee's simulation experiment is explained in greater depth in Chapter 5). Table S-2 presents the net present value results.

The results in Table S-2 illustrate that although the *level* of net benefits is clearly different from the *level* of gross benefits, the *changes* across the cohorts as mortality changes, which are the primary focus of this study, are similar. The gap between the top quintile and the bottom quintile, for example, widens by approximately $125,000 for males and $150,000 for femails, regardless of whether gross or net benefits are used, as life expectancy shifts from that of those born in 1930 to the projections for those born in 1960. The reason is that taxes paid after age 50 are not substantially affected in our model by the changes in mortality, so the changes across the total regimes are not significantly affected by whether or not taxes are subtracted from benefits.

TABLE S-2 Present Value of Net Benefits (benefits received minus taxes paid after age 50) at Age 50, by Sex, for People Under the Mortality Regimes of the 1930 and 1960 Birth Cohorts

	Present value of net benefits at age 50 based on the mortality profile for those	
Earnings Quintile	Born in 1930	Born in 1960
Males		
Lowest	$319,000	$310,000
2	246,000	266,000
3	217,000	301,000
4	202,000	331,000
Highest	189,000	306,000
Gap, High-Low	*–$130,000*	*–$4,000*
Ratio, High/Low	*0.59*	*0.99*
Females		
Lowest	$487,000	$402,000
2	341,000	310,000
3	296,000	290,000
4	251,000	236,000
Highest	240,000	310,000
Gap, High-Low	*–$247,000*	*–$92,000*
Ratio, High/Low	*0.49*	*0.77*

Another perspective on the change in mortality is to examine how lifetime benefits compare to baseline wealth. As seen in Table S-3, the difference in mortality regime has a notable effect on the distribution of lifetime net benefits relative to an inclusive measure of wealth (which includes wealth at age 50, after-tax earnings after age 50, in present value at age 50, and total benefits in present value received after age 50). The share of wealth accruing from these net benefits rises by 7 percentage points for the top quintile of male earners but falls slightly for the lowest quintile. For females, the share rises by 5.4 percentage points for the top earners and falls by 3.6 percentage points for the bottom earners. As a result—whatever the baseline pattern of progressivity—the overall progressivity of lifetime benefits as defined by this measure declines markedly for both males and females. To put the point another way, the switch to the 1960 mortality regime increases the fraction of wealth represented by entitlement benefits by 5 to 7 percent for top earners, and reduces those resources by 0 to 4 percent for the lowest earners.

Two observations about these findings are noteworthy. First, the preceding discussion focused mostly on the top versus the bottom quintile.

TABLE S-3 Present Value of Net Benefits as a Share of Present Value of Inclusive Wealth

	Present value of net benefits at age 50, relative to inclusive wealth, based on the mortality profile for those		
Earnings Quintile	Born in 1930 (%)	Born in 1960 (%)	Percentage Point Change
Males			
Lowest	45.7	45.6	–0.1
2	34.9	36.8	1.9
3	26.9	33.3	6.4
4	20.0	28.9	8.8
Highest	14.4	21.4	6.9
Females			
Lowest	69.0	65.4	–3.6
2	56.6	54.8	–1.8
3	45.3	44.9	–0.4
4	34.7	33.5	–1.3
Highest	25.4	30.8	5.4

But the comparison for males applies also to roughly the top half of the earnings distribution relative to the bottom half. Life expectancy for males in even the third and fourth quintiles of lifetime earnings is projected to rise substantially; for those in the bottom and second quintile, it is largely flat. That pattern is also reflected in the present value of net benefits also. Second, the increased gaps in the present value of net benefits are driven primarily by Social Security (where the absolute level of present value dollars for top earners is projected to rise significantly relative to bottom earners) and Medicare (where the program is projected to move from being roughly neutral with regard to lifetime earnings to one in which the present value of benefits for higher-earning males is much larger than for lower earners).

Actual and projected population aging raise the costs of government programs for the elderly, leading to fiscal pressures and a likely policy response. The report analyzes the way that changing mortality differentials would interact with some possible policy responses. Most policy analysis, to the extent it includes any distributional analysis, either focuses solely on Social Security (where the analysis often includes a lifetime perspective) or on the progressivity of annual benefit flows (without taking into account differences in life expectancy and therefore lifetime benefits). By contrast, this report evaluates a number of policy changes from the perspective of the impact of differential trends in mortality on lifetime benefits by earnings quintile, a perspective that has rarely been applied in previous policy analyses.

The committee considers six potential policy reforms to the Social Security program and one to Medicare. The reforms were analyzed to determine how they would interact with projected changes in life expectancy by income quintile. These potential reforms were selected from a long list of possible changes that have emerged from policy discussions during past years. The committee's selection for analysis of these particular policy reforms is not indicative of committee preferences or recommendations of them.

The Social Security simulations include raising the early eligibility age (EEA) by 2 years (to age 64); raising the Social Security normal retirement age (NRA) by 3 years (to age 70): raising both the EEA and NRA; reducing the cost-of-living adjustment applied to benefits by 0.2 percent per year (starting at age 62); reducing the top primary insurance amount (PIA) factor by one-third; and reducing the top PIA factor to zero. We also simulate raising the Medicare eligibility age by 2 years (to age 67).

The committee examines the effect on the present value of benefits relative to wealth for the top and bottom income quintiles and finds that most of these policy changes would make overall net benefits more progressive. The exceptions are those for raising the EEA for Social Security from age 62 to 64 or raising the Medicare eligibility age to 67. In terms of the impact of these changes on program solvency, the most significant effects are seen with regard to raising the NRA by itself or raising the EEA and NRA jointly. The simulations for both these changes suggest a reduction in present-value benefits on the order of 22-23 percent for males and 14-15 percent for females.

In summary, the report finds that the United States is experiencing a substantial widening of differences in life expectancy at age 50 by lifetime earnings. According to the model and projections used for the analyses, these gaps will, in turn, exert a substantial influence on the pattern of lifetime benefits under programs such as Medicare, Medicaid, and Social Security. The report also provides analyses of several recent policy proposals from the perspective of their impact on the distribution of lifetime benefits, given the findings on life expectancy.

The analysis in this report is forward looking and necessarily requires projections of mortality by income quintile and birth cohort. Thus, there is unavoidable uncertainty in the numerical results presented; this uncertainty is discussed at length in Chapter 3 and revisited in the concluding Chapter 6. To summarize that discussion, the committee cannot be certain that the trends in mortality inequality that have been widely observed in the literature and that we have confirmed in the analyses presented here will in fact continue over the coming decades and not reverse. Nonetheless, the widening of mortality differences by education and lifetime income in past decades has been well established by many studies. Our analyses find that smaller increases in mortality inequality would simply imply proportionately smaller effects on lifetime net benefits. And while we cannot provide probability distributions reflecting a numerical measure of the uncertainty in our estimates of the size of effects, the committee does have a relatively high degree of confidence that effects of the sort we describe are taking place. Given the impact that such effects can exert on the nation's most important social insurance programs, the increasing inequality in life expectancy at different points of the earnings distribution is an issue worthy of attention from policy makers and researchers alike.

1

Introduction

The U.S. population is aging, in part because of increasing life expectancy and in part because of low fertility rates. Social Security projections suggest that between 2013 and 2050, the population aged 65 and over will almost double, from 45 million to 86 million (Board of Trustees, Federal Old-Age and Survivors Insurance and Federal Disability Insurance Trust Funds, 2014). The fraction of the population aged 65 and over will rise from 14 to 21 percent. Population aging will have important fiscal effects as well as effects on the broader economy.

One key driver of population aging is ongoing increases in life expectancy. Five decades ago, average U.S. life expectancy was 67 years for males and 73 years for females; the averages are now 76 and 81, respectively. Longer life is an important component of improved human well-being, but longer lives potentially strain the U.S. economic system because older people are less likely than younger adults to work and, as a group, older people consume much more than they earn through their labor. A substantial amount of policy discussion has focused on this increase in average life expectancy and the fiscal burden it imposes on programs such as Social Security. Policy makers, however, have focused much less on the *distribution*, rather than the average, of changes in life expectancy.

It has long been the case that better-educated, higher-income people enjoy longer life expectancies than less-educated, lower-income people. The causes include early life conditions, behavioral factors (such as nutrition, exercise, and smoking behaviors), stress, and access to health care services, all of which can vary across education and income. Over the past several decades, however, a number of studies have found that the gradient in life expectancy by education and income has become steeper: the gap in life expectancy between the top and the bottom has become larger.

A core question the committee examines in this report is what impact the growing gap in life expectancy has on the present value of lifetime benefits (net of taxes paid in later life) that people with higher or lower earnings will receive from major entitlement programs. As this report documents, rising inequality in life expectancy has important effects on the distribution of net benefits from some of this nation's core public programs.

The report also examines how society might respond to disproportionate gains in life expectancy by certain segments of the population. For most government programs, the issue does not seem particularly relevant. For example, policy makers presumably need not worry about people with a lower life expectancy receiving lower lifetime benefits from defense or environmental programs. For programs such as Medicare and Social Security, however, it is more natural to consider the concept of lifetime benefits. The committee discusses the distinction between *ex ante* inequity (i.e., expected differences across identifiable groups) and *ex post* inequity (i.e., differences in realized outcomes across individuals, even within the identifiable groups). We also explore, from a lifetime net benefit perspective, how the growing gap in longevity affects traditional policy analyses of reforms to the nation's leading entitlement programs.

BACKGROUND TO THIS REPORT

Division C Title I of the Consolidated Appropriations Act, 2010 (Public Law 111-117) mandated that the Department of the Treasury engage the National Academy of Sciences in a contract to study the long-term economic effects of an aging U.S. population. Because of funding uncertainties, this contract was split into two sequential phases. In Phase I of the project, the purpose was twofold: (1) to investigate the prospects for older Americans to maintain adequate living standards, given recent trends in public and private pension provision, personal savings, longevity, and health; and (2) to consider the expected effects of an aging population on wages, productivity, returns to savings, wealth, and other macroeconomic variables.

Phase I began in September 2010 and culminated in the 2012 report *Aging and the Macroeconomy: Long-Term Implications of an Older Population* (National Research Council, 2012). That report summarized existing knowledge in seven main topic areas,[1] discussed various policy implications, and offered a set of research recommendations. The goal of the study

[1]The seven areas were demography, health and disability, labor force participation and retirement, productivity and innovation, saving and retirement security, capital markets and rates of return, and fiscal policy.

was to provide a factual foundation for the social and political debates that will intensify in the future. These debates, centered on deficit reduction, focus heavily on policies regarding public entitlements such as Medicare and Social Security. The report did not address the details of entitlement programs, because this has been done at great length elsewhere, nor did it offer specific policy recommendations. Rather, the intent was to understand the broader and more fundamental factors related to population aging, to clarify policy-relevant issues, and to suggest policy levers that could be useful in designing responses to population aging.

In the course of the Phase I committee's work, it became clear that a necessary next step would be to focus not only on the impact of discrete factors but also on the interactions among factors. The Phase I Committee concluded that it would not be feasible for that committee to quantify these broad macroeconomic effects of population aging through use of a macrosimulation model incorporating the key economic feedbacks and intergenerational linkages. Instead, it left to the Phase II study the task of investigating and quantifying, with an appropriate model, the key interactions of the steepening mortality gradient with government programs and of assessing possible policy responses for these programs that would help to meet the fiscal challenges posed by an aging population.

CHARGE TO THE COMMITTEE

There is a broad consensus in the United States that population aging will place fiscal pressure on the major government programs that help support older persons in this country. Official projections show that Social Security, Medicare, and Medicaid are on unsustainable paths, and failure to remedy this situation raises a number of economic risks. Rising health care costs per person mean that the fiscal burden of the Medicare and Medicaid programs will be particularly acute as time elapses and the population ages.

This committee was charged with building on the previous (Phase I) study by considering the policy implications of certain macrolevel changes in the U.S. population. The primary focus in this Phase II report is on the implications of increases in the widening distributions of longevity by long-term earnings for age-related public programs and for their reform to meet the challenges of an aging population. Among the tasks assigned to the committee was "examination of how the growing gaps in income and life expectancy affect national public programs such as Social Security, Medicare and Medicaid, and how these gaps interact with proposed policy adjustments to achieve sustainability in the context of population aging." For the complete statement of task, see Box 1-1.

BOX 1-1
Project Statement of Task

An ad hoc committee shall conduct a study that will help clarify the long-term macroeconomic effects of population aging in the United States. Phase I of the study and the resulting 2012 report summarized what is known about how factors such as savings rates, stock market exposure, productivity, consumption patterns, and global capital flows react to demographic shifts. Phase II of the study shall incorporate quantitative modeling and projections in order to develop new insights about the long-run macroeconomic effects of the aging U.S. population. The primary focus of the study will be on the implications of increases in the spread of population distributions of income and longevity for age-related public programs and for the reform of these programs to meet the challenges presented by an aging population.

Phase II of the study shall include, but will not be limited to, the following elements:

- Evaluation of long-term trends in the share of national output devoted to support of the elderly population.
- Documentation and exploration of the underlying causes of the growing gaps in income and life expectancy in the United States.
- Examination of how the growing gaps in income and life expectancy affect national public programs such as Social Security, Medicare, and Medicaid, and how these gaps interact with proposed policy adjustments to achieve sustainability in the context of population aging.
- Construction of generational accounts by lifetime income or education for different population cohorts under different policy regimes.

ORGANIZATION OF THE REPORT

Chapter 2 of this report provides a brief overview of population aging in the United States as elaborated in the Phase I study (National Research Council, 2012). The chapter discusses why population aging is an economic problem and examines measures and descriptors of individual heterogeneity in an aging population. It also briefly considers the need for entitlement reforms and the importance of evaluating potential reforms from the perspective of their likely impacts on different population groups. The chapter concludes with a summary description of the Future Elderly Model, the committee's primary tool for modeling economic outcomes across individuals and estimating net benefits by lifetime earnings for key government programs.

The widening gap in U.S. life expectancy by income group is the focus of Chapter 3. The chapter examines other published analyses showing a steepening of the mortality gradient by income and education and examines some of the possible causes. It presents new projections of the changing gradient by a measure of lifetime earnings. It also provides some insight into the possibility that trends seen over the past several decades will continue in the future, and it explores the implications if they do.

Chapter 4 considers how a society should react to disproportionate mortality gains among different segments of the population and discusses the effects of differential mortality on retirement incentives. It then looks at the policy implications of differential mortality and assesses the impacts of the historical and projected changes in mortality gradients on Medicare, Social Security, and other entitlement programs using the Future Elderly Model. The committee's estimates show a noticeable projected change in the distribution of net benefits across lifetime earnings categories, driven by the differential trends in mortality.

In Chapter 5, the committee turns to policy interventions and assesses some commonly proposed policy changes from the perspective of the differential trends in mortality. For example, many proposals to increase the normal retirement age under Social Security are motivated by the rise in average life expectancy. As this report documents, however, the average masks substantial historical and projected differences across various earnings categories; we show the impact of that proposal and others on lifetime benefits across the earnings categories and in a manner that reflects their different life expectancy trajectories. We also explore a potential reform to Medicare.

Chapter 6 provides a brief set of conclusions.

Appendix A provides biographical sketches of committee members.

Appendix B, a comprehensive and technical appendix with model details, is not printed in this volume. The appendix and accompanying Excel workbook are available to download at nap.edu/GrowingGap under the **Resources** tab.

2

Population Aging in a Heterogeneous Society

POPULATION AGING IN THE UNITED STATES

Populations around the world are aging as the effects of low fertility and increasing longevity reduce population growth rates at younger ages, while growth accelerates at older ages. This process is also occurring in the United States: U.S. life expectancy rose by 32 years from 1900 to 2012, and fertility has remained near or below the replacement level of 2.1 births per woman since the mid-1970s. For decades, the large baby boom generations kept the population relatively young, but now they are moving into older ages and will usher in rapid population aging over the coming decades. The growth rate of the labor force has slowed from 2.7 percent per year in the 1970s to 0.7 percent for 2000 to 2009, despite rising rates of immigration, and is expected to be close to 0.5 percent in coming decades.

Looking to the future, it seems likely that fertility will rebound from the lows that have been associated with the recent recession, but if instead it remains near 1.9, then future aging would deepen. As for life expectancy, the Phase I report (National Research Council, 2012, henceforth "the 2012 report") foresees it rising steadily to 84.5 years in 2050, over 1.6 years more than assumed in the 2014 Social Security Trustees Report (Board of Trustees, Federal Old-Age and Survivors Insurance and Federal Disability Insurance Trust Funds, 2014).[1]

[1]Although immigration also affects population aging, this effect is weaker than is sometimes suggested. For example, the old-age dependency ratio (defined as the population aged 65 and older, relative to the population aged 20 to 64) is projected in the 2012 report to rise from about 0.20 in 2010 to 0.39 in 2050. To reduce that by 10 percent (from 0.39 to 0.35) would

Because of its history of higher fertility, the U.S. population will age less than populations of other rich industrial nations in Europe and East Asia. While U.S. fertility has been near replacement in recent decades, fertility in Europe and Japan has been a half child lower, on average (around 1.6), with some countries temporarily in the 1.0-1.2 range. The 2012 report projected global population aging with the population of each country weighted by its projected level of per capita income. The U.S. old-age dependency ratio is projected to be close to the global average in 2010 and 2050 but higher in the intervening years. The 2012 report noted that the more rapid aging in the rich countries should lead to international flows of capital from them to younger, lower-income countries.

The macroeconomic and fiscal effects may be very different depending on whether the years of life gained as mortality falls are healthy, vigorous years or frail years with chronic illness and need for personal care. The prevalence of disability at older ages declined between 1980 and 2000, but it appears that since 2000 the decline ended for those aged 65 to 85, and there was actually an increase in disability at ages 40 to 64 (Freedman et al., 2004; Schoeni et al., 2008; Seeman et al., 2010). This clouds the outlook for the coming decades. Nonetheless, the earlier declines mean that older people generally are in better health than before. For example, the 2012 report (p. 90) notes that the self-reported health of a 69-year-old in the 2000s is similar to that of a 60-year-old in the 1970s.

WHY POPULATION AGING HAS IMPORTANT ECONOMIC CONSEQUENCES

The macroeconomic consequences of aging depend in part on consumption and saving responses and in part on labor supply. One simple metric with which to evaluate the impact of population aging on consumption comes through the weighted support ratio of hypothetical earners to hypothetical consumers; roughly speaking, this ratio provides a proxy for the earnings capability of workers relative to society's consumption needs.[2] The weighted support ratio for the United States is projected to decline by 12 percent between 2010 and 2050. Other things being equal, this would mean that total consumption would need to be 12 percent lower in 2050

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require 1 million additional net immigrants each year between now and then. To achieve this change through higher fertility would require an additional half child per woman. Probabilistic projections in the 2012 report (pp. 56-59) indicate that it is virtually certain that there will be substantial population aging by 2050, and there is only a 1 in 40 chance that the old-age dependency ratio will rise less than 60 percent by 2050.

[2]Hypothetical earners are the weighted sum of labor income by age in some base period multiplied by the population age distribution in a given year, and hypothetical consumers are similarly defined (see Cutler et al., 1990).

than otherwise, or equivalently that consumption would grow about 0.3 percent per year less rapidly than otherwise. Changes in labor supply could offset part of this effect by changing the support ratio itself.

With no changes in labor supply, population aging tends to raise the share of national output devoted to support of the elderly so long as their per capita consumption does not decline relative to the rest of the population. Estimates of consumption by the elderly reported in the 2012 report (p. 48, Figure 3-10) show that relative per capita consumption by the elderly did not decline relative to the non-elderly during the period 1960 to 2007. Indeed, instead of declining, elderly per capita consumption relative to the non-elderly increased dramatically during that time period. For example, consumption by an 80-year-old relative to a 20-year-old doubled from 1960 to 2007. The biggest relative increase was in public expenditures on health care, but increased private expenditures on health care and increased other private consumption at older ages also contributed. The estimates in the 2012 report include both private household expenditures (allocated to individual household members) and public in-kind transfers. They do not include government cash transfers, because these are not necessarily consumed, and if consumed they would then be double counted, showing up also in private consumption expenditures.

The age profiles of U.S. consumption shown in Figure 3-10 of the 2012 report and others for intermediate years can be multiplied by the population age distribution of each year and summed to find total aggregate consumption by the elderly aged 65 and above. This aggregate elder consumption can then be expressed as a share of total consumption, which is shown here in Figure 2-1. In 1960, elder consumption was 9.4 percent of total consumption; this share grew roughly linearly, pausing in the 1990s, to a level of 18.9 percent in 2011, double the 1960 share. Over this same period, the percentage share of the elderly in the population rose from 9 percent in 1960 to 13 percent in 2010, an increase of 45 percent, and is projected to rise to 21 percent by 2050 (Board of Trustees, Federal Old-Age and Survivors Insurance and Federal Disability Insurance Trust Funds, 2014). Evidently both population aging and the tilt in the age profile of consumption contributed to this increased share of aggregate consumption, and these two demographic pressures will intensify in the coming decades. If the age profile of consumption has the same shape in 2050 as it does today, then with the projected population age distribution of 2050, the elder share of consumption will increase further to 29.8 percent. Similar committee calculations for the aggregate share of elder consumption in gross domestic product (GDP) found that it more than doubled between 1960 and 2011 from 6.8 percent to 16.0 percent.

One potential response that would mitigate these effects is longer work lives, which would attenuate the change in the support ratio as the popula-

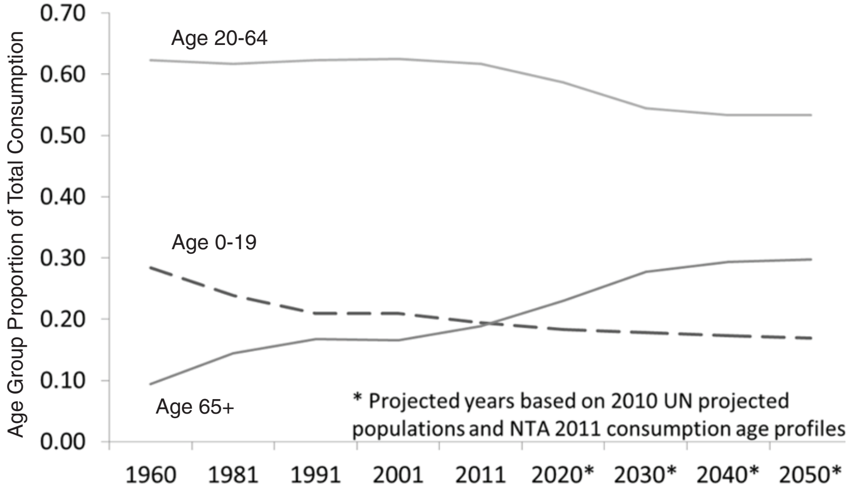

FIGURE 2-1 Share of total U.S. consumption for three age groups, 1960-2050.
SOURCE: Ronald Lee and Gretchen Donehower, personal communication to the committee, August 2014, using United Nations (UN) data and data from the National Transfer Accounts (NTA) project; see Lee and Mason (2011, Chapter 9) for details and methods.

tion ages. There is significant potential for such increases in working lives. In particular, although disability rates rise strongly with age, health is not the main limitation on work at older ages for most workers. More than half of males aged 65 to 69 who are not working have no health impairment, as do half of those aged 70 to 74. Based on data from 2000 to 2003, labor force participation could have been about 50 percent higher than it was for males who completed high school or less, and also for those with any college (2012 report, p. 91). The 2012 report (pp. 90-93) also included projections of the potential labor force aged 20 to 74, incorporating trends in age, education, occupation, ethnicity, obesity, diabetes, and other major and minor impairments. These projections indicate that if disability rates for each characteristic stay the same, then the proportion able to work will also stay approximately the same through 2050, despite population aging. The implication is that there is considerable room for older people to postpone retirement, should they so choose.

NEED FOR ENTITLEMENT REFORM

Another dimension of the effects of population aging is its impact on the federal budget through the major U.S. entitlement programs. Policy makers have long recognized the need for entitlement reform in the face of an aging population and rising health care costs per beneficiary. The Congressional Budget Office (CBO), in its 2014 Long-Term Budget Outlook, estimates that without policy changes, federal debt will rise from 74 percent of GDP at the end of 2014 to 106 percent at the end of 2039. During that period, Social Security spending is projected to rise from 4.9 percent of GDP to 6.3 percent, while Medicare, Medicaid, and other health expenditures by the federal government are projected to rise from 4.9 percent of GDP to 8.0 percent (Congressional Budget Office, 2014a).

As the CBO (2014a, p. 5) notes:

> [T]he unsustainable nature of the federal tax and spending policies specified in current law presents lawmakers and the public with difficult choices.... To put the federal budget on a sustainable path for the long term, lawmakers would have to make significant changes to tax and spending policies: reducing spending for large benefit programs below the projected levels, letting revenues rise more than they would under current law, or adopting some combination of those approaches.

This report delves neither into detail on the underlying causes of the nation's long-term fiscal gap nor into the wide array of policy options available for addressing it (see Box 2-1 for a consideration of potential Medicare reforms). These topics have been amply covered elsewhere. Instead, the committee's focus is on the causes of the growing historical and projected gap in life expectancy among people with different long-term earnings histories, the effects of that growing gap on the distribution of benefits under the major entitlement programs, and the implications of the growing gap for some possible policies to address the fiscal sustainability problem. These issues would be important topics even if the nation's long-term fiscal imbalance did not exist.

INDIVIDUAL HETEROGENEITY IN AN AGING POPULATION

In the context of a population that is aging and the need for entitlement reform, a core focus of this report is on the growing heterogeneity in life expectancy by socioeconomic status. This heterogeneity is important because the demography and behavior of various groups within the population can potentially affect the aggregate numbers. Similarly, those groups can be affected by a change in policy in vastly different ways. Different groups within the U.S. population have systematically greater chances of living longer than others, with important implications for policies whose impacts depend on the number of years lived. This aspect of heterogeneity, the relation of mortality to socioeconomic status, is known as the "mortality gradient."

BOX 2-1
Medicare Reform

Despite recent slowdowns in spending growth, Medicare spending is still of great concern for policy. The Congressional Budget Office (CBO) projects that—without policy intervention—Medicare will account for 5.7 percent of GDP by 2035 (Congressional Budget Office, 2014a). The increase in Medicare spending, which currently accounts for 14 percent of federal outlays, is a major factor in projected growth of the national debt. The Patient Protection and Affordable Care Act of 2010 (Affordable Care Act) introduced a number of policy changes to constrain Medicare cost growth. The CBO's analysis suggested the largest savings would come from reductions in payments to Medicare Advantage plans (private plans that have historically received more funding per enrollee than traditional fee-for-service Medicare) and reductions in annual payment increases for certain types of providers, including hospitals. A problem with such reimbursement rate reductions is that some studies suggest that lower provider fees may increase the volume of services provided and also cause private payers to raise their prices, reducing the efficacy of these policies as a cost containment option over the long term (see, e.g., Nguyen and Derrick, 1997). The CBO (2007) has estimated that a decline in physician payment rates that generate a $1,000 decline in physician revenues per year would cause physicians to boost volumes or intensity sufficiently to offset $280 of that decline. Other research, however, does not support these estimates (e.g., White, 2013).

Perhaps more importantly, the Affordable Care Act also included many changes (such as Accountable Care Organizations and bundled payments) intended to shift Medicare's payment structure over time away from fee-for-service reimbursement. Some observers have argued that, without policies that fundamentally change Medicare's payment structure, Medicare expenditure growth will be difficult to contain over time (Holtz-Eakin and Ramlet, 2010; Orszag and Emanuel, 2010).

Although actual and projected life expectancy has continued to rise in recent decades, the gains have been different for different population subgroups, as this report explores in Chapter 3. Women have higher life expectancy than men, but their rate of increase in life expectancy has fallen well below that of men, probably because of delayed effects of their later uptake of smoking (National Research Council, 2011). Hummer and Hernandez (2013, p. 6) note that a number of studies have been carried out using data since the 1980s, and they summarize the results as follows:

> Even with a variety of data sets and methodological approaches, all arrived at the same general and important conclusion: Educational differences in mortality and life expectancy have widened over the past 20 to 25 years.

> In fact, age-specific mortality rates among black and white women who did not complete high school actually *increased* over the past two decades. Moreover, the pace of mortality decline has been steepest among highly educated individuals in most age, sex, and racial/ethnic groups.

Waldron (2007) and Bosworth and Burke (2014) analyzed gains in life expectancy by decile of lifetime earnings and found, as summarized in the latter, "life expectancy is rising for those at the top of the distribution of individuals ranked by alternative measures of socio-economic status, but it is stagnant or falling for those at the bottom" (Bosworth and Burke, 2014, p. 16).

THE FUTURE ELDERLY MODEL

The social science literature features several well-known and complementary approaches for measuring population health and projecting future disease burden and mortality (see, for example, Manton et al., 1993; Lee, 2000; Hayward and Warner, 2005). Perhaps not surprisingly, the models display an underlying trade-off between data complexity and the applicability of the model. For example, early life-table approaches such as those of Sullivan (1971) require only age-specific population data and disability rates at those ages; these elements are all present in cross-sectional data. The straightforward data requirements, however, come at a cost, because the Sullivan method appears too insensitive to large changes in disability and mortality and may thus underestimate future trends in population health (Bonneux et al., 1994). Multistate life-table models and microsimulation models that exploit longitudinal data can accommodate richer dynamics than Sullivan's method and thus provide more flexibility in modeling the dynamic interplay between morbidity, disability, and mortality. Such dynamic models obtain population health trends as aggregates from individual stochastic processes underlying these outcomes.

To explore the fiscal and distributional consequences of changes in mortality and longevity, the committee needed a model that links health and mortality to economic outcomes across socioeconomic strata and that could track economic outcomes across individuals. After exploring several possible options (see Box 2-2), the committee decided that the Future Elderly Model (FEM) was well suited to its purpose. The primary benefit of the FEM was that it was capable of examining mortality heterogeneity and estimating the impact on major entitlement programs such as Medicare, Medicaid, and Social Security. The FEM, a microsimulation model developed and maintained by the Roybal Center for Health Policy and Economics at the University of Southern California, tracks representative cohorts of Americans over age 50 to project their health status and economic

BOX 2-2
Choice of the FEM Model

The committee considered a number of approaches to implementing the experimental simulations, as summarized below.

1. Congressional Budget Office Long Term (CBOLT) is a microsimulation program developed and used by the Congressional Budget Office (CBO). The Phase I committee had looked into using this program for its work but received a discouraging response from CBO staff to the effect that they would not have the time needed to tailor the model for the committee's purposes. The Phase II committee also made inquiries and concluded that it would not have access to the CBOLT model. Therefore, although CBOLT appeared to be a suitable platform for the experimental simulations needed for this report, it was not available for that purpose.
2. Modeling Income in the Near Term (MINT) is a microsimulation program developed and used by the Social Security Administration. It has many but not all of the capabilities that were needed for the experimental simulations. For instance, it supports simulation of taxes and of Old-Age, Survivors, and Disability Insurance benefits, Supplemental Security Income benefits, Medicare and Medicaid eligibility, and out-of-pocket expenses, but unfortunately MINT does not include simulation of actual Medicare and Medicaid benefits received.
3. The Tax Policy Center model (committee member William Gale codirects the Tax Policy Center) was considered, but it did not solve the need to estimate individual earnings trajectories before age 50.
4. Because it was not feasible to use either CBOLT or MINT, the committee considered use of a macrosimulation approach derived from National Transfer Accounts methods (a project codirected by Ronald Lee, cochair of the committee), in which tax and benefit age profiles would be estimated for long-term earnings quintiles in a recent base year and then these profiles would be projected forward. The committee viewed macrosimulation as a second-best approach to the approach using the Future Elderly Model (FEM).
5. The committee learned of the capabilities and workings of the FEM from committee member Dana Goldman, director of the Future Elderly Model project. A FEM capability of particular appeal to the committee was that, in addition to detailed modeling of health state transitions and use of Medicare, Medicaid, and Disability Insurance programs, it also included non–health-related benefits such as Social Security retirement benefits. After confirming that the model could carry out the required simulations and calculations, the committee decided to use the FEM for the experimental simulations.

outcomes. Developed with funding from the Centers for Medicare & Medicaid Services, the National Institute on Aging, the Department of Labor, and the MacArthur Foundation, the FEM is a well-established simulation model,[3] and has a wide variety of policy uses. It has been used to investigate the economic consequences of delaying disease and disability (Goldman et al., 2013), the costs of obesity in older Americans (Lakdawalla et al., 2005), future disability trends (Chernew et al., 2005), fiscal consequences of worsening population health (Goldman et al., 2010), the costs of cancer (Bhattacharya et al., 2005), the health and economic value of preventing disease after age 65 (Goldman et al., 2006), the value of cardiovascular risk reduction (Goldman et al., 2006, 2009), long-term health outcomes from medical innovation (Lakdawalla et al., 2009; Goldman et al., 2005), the health consequences of price controls (Lakdawalla et al., 2009), and the financial risk in Medicare spending from new medical technologies (Goldman et al., 2005).

The committee worked with the FEM staff to refine or extend certain aspects of the model to carry out the specific analytic tasks required for the committee's work. For a detailed description of the FEM methodology and assumptions, see Appendix B and the accompanying Excel workbook, which are available to download at nap.edu/GrowingGap under the **Resources** tab.

Overview

At its core, the FEM is well equipped to analyze the effect of longevity gaps on public support, because it allows for complex interactions between multidimensional measures of health and economic outcomes; this was a key reason the committee chose to use the FEM. The model was used to estimate and project a set of average outcomes *given the policy environment that persisted over the period for which data were observed*; within that policy environment, we then focus on how *a change in the mortality gradient affects outcomes under Medicare, Medicaid, Social Security, and other entitlement programs*.[4] It is important to note that the FEM takes a "reduced-form" approach. That is, it does not directly model the behavioral

[3]Further information on the FEM may be found at https://roybalhealthpolicy.usc.edu/fem/ [August 2015].

[4]The period of observation varies somewhat with the outcome and the data source, but it is most usefully thought of as the last decade prior to the introduction of the Affordable Care Act.

response to policy changes; a reduced-form approach makes full welfare calculations infeasible.[5]

The FEM takes a cohort of Americans at age 50—each of whom has a measure of lifetime income and an initial health status—and simulates their lifetime net benefits in a baseline scenario. The model starts in 2010 with the policy environment observed in that year and assumed to persist throughout the simulation.[6] The model is run biennially until everyone in the cohort has died, and lifetime benefits and other outcomes are tracked. The model also generates taxes paid at age 50 and thereafter; the present value of these taxes are subtracted from the present value of benefits to generate a "net benefit." As discussed further below, this "net benefit" is not a full measure of the net benefits from the relevant programs because the measure, out of necessity given the structure of the FEM, does not include taxes before age 50. The committee had for this reason originally focused on benefits alone. Because we focus mostly on how net benefits change when the mortality gradient changes, rather than the level of such net benefits, including taxes paid at age 50 and beyond does not fundamentally alter any of the key findings of this report relative to studying benefits by themselves.[7] For that same reason, including taxes paid before age 50, even if that were feasible within the FEM, would have almost no effect; if the focus is how mortality changes after age 50 affect net benefits, then including taxes paid before age 50 would have no effect. (In other words, including taxes paid before age 50 would affect the level of lifetime net benefits but would not have any appreciable effect on the *change* in those lifetime net benefits as mortality after age 50 changed.) Appendix B is a comprehensive and technical appendix with model details and is available online as noted above; within the body of the report, the committee provides only the most salient details.

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[5]To do such calculations, economists would typically rely on so-called "structural" approaches that explicitly model utility and economic behavior in response to policy changes. These models often make many simplifying assumptions to maintain tractability and necessarily lose some of the diversity about individual health and outcomes available in the FEM. A useful example of a structural approach can be found in Rust and Phelan (1997). An annex to Chapter 5 provides further discussion of the reduced form and structural approaches.

[6]It is not feasible to try to predict policy outcomes throughout the simulation, which can run for more than 50 years into the future.

[7]Also, taxes paid at and after age 50 finance all government activities, not just the programs considered here. These computations establish a baseline scenario against which other scenarios can be compared, such as: (1) what would happen if mortality differences changed by income group, or (2) what would happen if program eligibility or benefits changed.

Assigning an Earnings Quintile

The FEM classifies respondents in the Health and Retirement Study (HRS) based on their Social Security earnings histories. The analyses in this report used an earnings measure similar to that of Waldron (2007, 2013) and Bosworth and Burke (2014): the average of a respondent's nonzero earnings between the ages of 41 and 50.[8] For households with two individuals, following Bosworth and Burke (2014), we divided the total household earnings by the square root of 2 to reflect economies of scale in consumption and assigned this value to both individuals in the household. The Social Security earnings records file we used begins in 1951. Thus we could only construct the earnings measure for individuals born in 1910 or later. For those unobserved, we imputed the household earnings measure. Respondents are then classified into earnings quintiles by birth decade and gender.

Measuring Initial Health of the Age 50 Cohorts

There are important differences in the underlying health status of various cohorts of the same age. As noted earlier, although some research has shown improved health and disability among Americans aged 65 and over, the same improvements have not been found among the population aged 40 to 64 (Reynolds et al., 1998; Lakdawalla et al., 2004; Martin et al., 2010a, 2010b). This report relies on predicted outcomes for various cohorts of 50-year-olds; thus, the committee sought to account for these observed differences. The FEM contains an initial-cohorts module to calibrate data from the HRS to population trends observed in the National Health Interview Study (NHIS). Use of this module allowed the committee to generate lifetime outcomes for a cohort of 50-year-olds starting in 2010, but assuming they had the health status of the cohorts born in 1930, 1960, or, in some scenarios, 1990. Table 2-1 describes the differences in cohorts with these different health status assumptions.

Estimating Mortality

Analysis of the effect of the mortality gradient on lifetime benefits requires the full association of mortality and lifetime income class without taking into account the health conditions that may lead to the mortality differentials. The committee conducted an exhaustive comparison of mortality predictions by earnings quintile using the literature summarized

[8]Waldron (2007, 2013) used ages 45-55 rather than 41-50. She explains at length why measures of this sort are preferable to using average indexed monthly earnings (AIME) as defined by the Social Security Administration (see http://www.ssa.gov/oact/cola/Benefits.html and the discussion in Chapter 3).

TABLE 2-1 Future Elderly Model Assignment of Health Status and Risk Factors at Age 50 for Three Birth Cohorts

	Health Status at 50	Risk Factors at 50
1930 Birth Cohort	Heart disease, diabetes, and hypertension prevalences are assigned to match historic NHANES II (1976-1980) rates for 45- to 55-year-olds.	Smoking status and BMI are assigned to match historic NHANES II rates.
1960 Birth Cohort	Standard FEM method based on trends in NHIS, NHANES, and the literature (see Appendix B)	Standard FEM method based on trends in NHIS, NHANES, and the literature (see Appendix B)
1990 Birth Cohort	Standard FEM method based on trends in NHIS, NHANES, and the literature (see Appendix B)	Standard FEM method based on trends in NHIS, NHANES, and the literature (see Appendix B)

NOTE: BMI = body mass index, FEM = Future Elderly Model, NHANES = National Health and Nutrition Examination Survey, NHIS = National Health Interview Survey.

in Chapter 3. We chose to employ a specification that captures this full association between earnings quintile and mortality. Thus, a 2-year mortality probit is specified as a function of age, a linear time trend, earnings quintile, and quintile-specific linear time trends. The model is fully interacted with gender.[9] With age as the time scale, we adjusted the baseline hazard rate by birth year, earnings quintile, and the interaction of birth year and earnings quintile. Men and women were modeled separately. Overall, our model produced life expectancy values that are consistent with other forecasts. This estimation, which is independent of the FEM, was nonetheless tailored to provide the necessary mortality input for the FEM simulations.

Estimating Health Status

The FEM contains a transition module to calculate the probabilities of entering and exiting various health states and the likelihood of various financial outcomes. The module takes as inputs risk factors such as smoking, weight, age, and education, along with lagged health and financial states. This allows for a great deal of heterogeneity and fairly general feedback

[9]In addition to modeling 2-year mortality incidence, we also explored modeling mortality parametrically using a Weibull survival model. Simulation results were similar between the two methods (2-year mortality incidence and Weibull survival model).

effects. The transition probabilities are estimated from the longitudinal data in the HRS. These probabilities are then used to simulate the path of individuals in the simulation. Appendix B contains details on the estimation of these probabilities and a goodness-of-fit exercise.

Estimating Health Care Spending

The committee estimated health expenditure using data from the Medical Expenditure Panel Survey and the Medicare Current Beneficiary Survey. We imputed earnings quintile for respondents in these two surveys using a model estimated on the HRS. This model includes the following variables: 5-year age category dummy, non-Hispanic black, education (less than a high school degree, completed high school degree, and at least some college), single, and widowed. The model is fully interacted by gender. As with mortality, we used reduced-form models for this report. Costs are estimated as functions of age, mortality, and earnings quintile. The models are fully interacted by gender (see the technical documentation in Appendix B for model estimates).

Estimating Benefits and Other Economic Outcomes

A policy-outcomes module aggregates projections about individual-level outcomes into policy outcomes such as taxes, medical care costs, pension benefits paid, and disability benefits. This component takes account of public and private program rules to the extent allowed by the available outcomes. Because the committee had access to HRS-linked restricted data from Social Security records and employer pension plans, we were able to model retirement benefit receipt. We calibrated our 2004 projections on administrative aggregates to ensure that totals matched those figures. Labor force participation, Social Security claiming for old-age and survivor benefits, and disability insurance receipt are specified in ways similar to mortality. Briefly, we replaced demographic variables with earnings quintile, interacted with gender. The lagged state-of-health-related variables are included in the transition models. Instead of age, we included yearly dummy variables for age relative to Social Security's normal retirement age to allow policy changes to influence labor force and program participation.

The committee would have liked to calculate the net present value of net government benefits by lifetime earnings, but we lacked information on tax payments before the age of 50. For individuals with earlier earnings records, perhaps taxes could be imputed, but for many the earnings histories did not reach back far enough. Out of necessity, the committee therefore opted to compute a "net benefit" calculation that only includes taxes paid at age 50 and older. The results, in terms of the effect of differential mortality, are not substantially affected if the analysis is instead focused solely on the present value of lifetime benefits received, excluding all taxes paid. Furthermore, even if it were feasible to include taxes paid before age 50, it is unlikely that doing so would have much if any effect on the principal focus, which is how differential mortality trends have changed the present value of net benefits by earnings categories. Such differential trends should have only minimal effects across earnings categories on taxes paid before age 50, so whether such taxes are excluded (as they are here, out of modeling necessity) or included should have little if any effect on the results.

In summary, we are not able to calculate the full generational accounts for each generation under the different mortality regimes and policy scenarios, as was done by Auerbach and colleagues (1991), because we lack taxes paid before age 50. We were, however, able to calculate the generational account for benefits, which is the present value of survival-weighted benefits, or lifetime benefits for short. Because most mortality occurs at older ages, the mortality differences by lifetime income are unlikely to have much effect on survival-weighted lifetime earnings in any case.

Another perspective on the same point is that the generational account by income quintile is the present value of survival-weighted benefits over the adult years, say after age 18, minus the present value of survival-weighted tax payments. The committee was not able to calculate these generational accounts because we lacked data for taxes before age 50 (along with information about benefits before that age, for that matter). However, our interest is in the way *changes* in mortality by income quintile lead to *changes* in the generational accounts. Because mortality is low in the young adult years and rises very rapidly thereafter, the vast majority of the changes in mortality from cohort to cohort will affect survival after age 50. For this reason, although we are not able to estimate the actual generational accounts, we can estimate a close approximation to the changes in these accounts that are due to changes in mortality by looking at the effect on benefits of changes in mortality after age 50 minus the effect on taxes of changes in mortality after 50.

Estimating Taxes and Net Benefits

The FEM accounts for the most important sources of income for both individuals and the federal government. In particular, the income tax and the payroll tax account for 80 percent of federal revenue (Center on Budget and Policy Priorities, 2015), and these are accounted for in the simulation. Missing from the tax calculations of federal revenue are the corporate income tax (11%) and another 9 percent in miscellaneous taxes—mainly estate taxes and excise taxes paid when purchases are made on specific goods, such as alcohol or gasoline. For individuals, taking into account all the sources we model including Medicare and Medicaid, the FEM accounts for approximately 82 percent of before-tax income.[10] Missing from the income calculations are capital gains (9%) and some sources of business and other income.

The FEM calculates income—both work and in-kind—from three general sources:

1. **Work income** is computed as income from any of the following sources: wages, salaries, bonuses, overtime pay, commissions, tips, second job or military reserve earnings, professional practice or trade income, or self-employment income. It is first modeled as a probit regression for whether a person is working for pay (estimates are in Table 32 of the Excel workbook). If the person is working, then his or her earnings are modeled using the inverse hyperbolic sine—with suitable retransformation—to account for the skewed distribution (the transformation is discussed in Section 4.1 of Appendix B, and estimates are presented in Table 14 of the Excel workbook). Because pension income is an important source of income for older individuals, it is modeled separately. A probit regression models whether or not a person is receiving any pension income from all sources. If the person is claiming a pension, then this income is added to earnings for the purposes of computing taxes.
2. **Government income transfers** include income from the three largest income transfer programs: Social Security, Disability Insurance, and Supplemental Security Income. The model first estimates claiming behavior for each; that is, whether the person has any income from any of these programs. The levels of benefits are then computed in different ways for each program. Social Security and Disability Insurance benefits are computed using algorithms based on the estimated AIME and quarters worked, both of which are derived from simulated and actual work histories. For Supplemental Security Income, benefits for those who claim it are $350/month for those aged 65 and older and $450/month for those under age 65.

[10]This estimate is based on 2011 data from a CBO (2014b) report on the distribution of household income and federal taxes. Note there is some uncertainty about this estimate for several reasons. First, CBO looks at in-kind transfers, especially Medicare and Medicaid. Second, 7 percent of before-tax income is classified as "other income" by CBO and 6 percent is classified as "business income." Some "business income" is captured by HRS questions on self-employment income. Some "other income" is also captured by HRS categories such as annuities. Thus, the HRS measures we use cover between 76 percent and 89 percent of income; we use the midpoint. Another way to put this is that capital income is only 8 percent of before-tax income, and that is the big category we omit.

3. **Government in-kind transfers** include Medicare and Medicaid. Transfers are computed using the data sources noted previously. Medicare spending includes government spending for Parts A, B, and D. For Parts B and D, the model estimates enrollment using a probit as a function of demographics, health status, earnings, and program participation. For those who enroll, a linear model is used to estimate covered health spending. For Medicaid, eligibility is computed as a function of age, gender, and earnings; the level of spending is computed in a similar manner for Parts B and D.

We then compute the two major sources of federal revenue:

1. **Income taxes** are computed using policies summarized by OECD (2005). Couples are assumed to file jointly, and deductions are based on marital status and age. Social Security benefits are partially taxed, with the taxable amount increasing with other income from 50 percent to 85 percent. Low-income elderly have access to a special tax credit, and the earned income tax credit is applied for individuals younger than 65.
2. **Payroll taxes** are computed based on the nonpension portion of labor income, following the tax rules currently in place. For Old-Age, Survivors, and Disability Insurance, both the employer and employee contribution are computed as 6.2 percent of earnings up to the earnings cap. For Medicare, both the employer and employee tax (1.45%) are applied to all earnings, with an additional 0.9 percent paid by the employee for nonpension income above a certain threshold as authorized by the Affordable Care Act.

Net Benefits in a given year are computed as benefits less taxes paid. Benefits include government income transfers (Social Security, Disability Income, and Supplemental Security Income) and government in-kind transfers (Medicare and Medicaid). Taxes paid include income and payroll taxes. For lifetime computations, all benefits and taxes are discounted by 2.9 percent annually.

Estimating Progressivity

The committee was charged, among other tasks, with analyzing how the "growing gaps in income and life expectancy affect national public programs such as Social Security, Medicare, and Medicaid." To do so requires some measure of how gaps in income and life expectancy affect benefits under those programs. The committee was also charged with construction of estimates "by lifetime income or education for different population cohorts under different policy regimes."[11]

These assignments require some measure of lifetime net benefits from programs such as Social Security, Medicare, and Medicaid. The literature on Social Security commonly includes such estimates; estimates of Medicare have been more infrequent; those involving Medicaid are rarer still. Within the Social Security literature, Smith et al. (2003) examine the lifetime present value of Old-Age and Survivors Insurance benefits, while dividing individuals into groups based on various measures of lifetime earnings. Liebman (2002) constructs expected lifetime benefits under Social Security between ages 60 and 100 and then divides beneficiaries into groups based on lifetime earnings. Hurd and Shoven (1983) similarly compute the expected present value of benefits minus the present value of payroll taxes over a lifetime. The committee concluded that assessing the impact of changes in life expectancy on programs such as Social Security similarly required an estimate of lifetime net benefits.

The question then became how changes in lifetime net benefits should be assessed across income or education categories. Multiple methodologies exist for evaluating such a concept of "progressivity." The committee came to the conclusion that the most insightful such measure reflects the ratio of program net benefits to a broad measure of wealth, because that broad measure represents the resources available for consumption or other purposes (including bequests). The proportion of net benefits to such wealth provides a proxy for how important the net benefits are to those available resources. Thus, if program net benefits as a share of wealth rise more for lower earners than higher earners, we say the change is "progressive" and if the reverse is true, the change is "regressive." Our broad measure of wealth combines assets at age 50 in the HRS, the present value of projected earnings (net of taxes) after age 50, and the present value of projected total benefits received after age 50. Total benefits include Medicare, Medicaid, Social Security Retirement, Supplemental Security Income, and Disability Insurance.

Conducting Simulations

Several thought experiments undergird many of the estimates presented in this report. The FEM takes a cohort of Americans at age 50—each of

[11]The charge was to construct generational accounts differentiated by lifetime income or education for this purpose. Because the committee concluded that the FEM was the most appropriate model for purposes of the study task but that model lacks taxes paid before age 50, the committee was not able to construct full generational accounts. The report's measure of lifetime net benefits was the best we could do under the modeling constraints the committee faced.

TABLE 2-2 Summary Characteristics of Policy Simulations in Chapter 5

	Social Security (SS)				Medicare
Scenario	Early Entitlement Age (EEA)	Normal Retirement Age (NRA)	Primary Insurance Amount (PIA)	Other	Eligibility Age
Baseline scenario	62	67	Current SS Policy[a]		65
Exp. 1: Increase EEA to 64, keep NRA at 67	64	67	Current SS Policy		65
Exp. 2: Keep EEA at 62, increase NRA to 70	62	70	Current SS Policy		65
Exp. 3: Increase EEA to 64, increase NRA to 70	64	70	Current SS Policy		65
Exp. 4: Superlative	62	67	Current SS Policy	After age 62, annual SS benefits are reduced by 0.2% in real terms	65

Exp. 5: Reduce the highest PIA factor by 1/3	62	67	PIA = 0.90*MIN(AIME, BP1) + 0.32*MAX(0, MIN(AIME, BP2) - BP1) + 0.1*MAX(0, AIME-BP2)	65
Exp. 6: Lower the second bend point in the PIA calculation and remove benefits above it	62	67	PIA = 0.90*MIN(AIME, BP1) + 0.32*MAX(0, MIN(AIME, BP2) - BP1) where BP2 is the median AIME	65
Exp. 7: Raise the Medicare eligibility age to 67	62	67	Current SS Policy	67

[a]Under current SS policy, PIA = 0.90*MIN(AIME, BP1) + 0.32*MAX(0, MIN(AIME, BP2) - BP1) + 0.15*MAX(0, AIME-BP2), where BP1 and BP2 are the bend points from SS policy.

whom has a measure of lifetime income and an initial health status—and simulates their projected lifetime net benefits[12] in the baseline scenario. The model starts in 2010 with the policy environment observed in that year, which is assumed to persist throughout the simulation. The model was run biennially until everyone in the cohort had died. The committee then examined three types of scenarios:

1. **Change mortality risks.** Here the committee asked how lifetime net benefits change if the same cohort faced the mortality profile of an earlier or later generation.[13] For example, for the cohort of Americans born in 1960—who reached age 50 in 2010—we asked, "How would lifetime net benefits change if these 50-year-olds faced the mortality risks of those born 30 years earlier?" These scenarios isolate the impact of mortality trends on this cohort, which are then reported and compared across earnings groups.
2. **Change federal policy rules.** The committee then asked how salient changes in policies surrounding Social Security—and to a lesser extent Medicare—would impact lifetime outcomes. For example, we asked, "How would changing the normal retirement age for Social Security affect lifetime net benefits?" The results are then reported and compared by earnings group. The policy experiments are summarized in Table 2-2.
3. **Interactions between policy scenarios and mortality changes.** One interest of the committee was whether plausible policy changes could offset the impact of the changes in mortality differentials on the pattern of lifetime benefits, if policy makers chose to do so. For this purpose, we assessed to what extent a policy change would reduce or augment the lifetime generosity of net benefits by earnings group.

[12]The committee modeled the major benefits programs: Social Security (each of disability and old-age and survivor), Medicare, Medicaid, and Supplemental Security Income.

[13]We also allowed the initial health of the 50-year-olds to change because observed health conditions and behaviors are driving these differences. Additional analysis made it clear that the results are not driven by the observed changes in morbidity, and so we focus on mortality in this report.

3

Growing Heterogeneity of the U.S. Population in Income and Life Expectancy

Income inequality has risen noticeably in the United States over the past three decades. According to the Congressional Budget Office (CBO), the share of pretax aggregate household income accruing to households in the bottom quintile of the income distribution fell from 6.2 percent in 1979 to 5.1 percent in 2010 (Congressional Budget Office, 2013b). Over that same period, the share accruing to households in the top quintile rose from 44.9 percent to 51.9 percent—and the share accruing to households in the top 1 percent of the distribution rose from 8.9 percent to 14.9 percent.

The leading view among economists is that skills-biased technical change and the evolution of educational levels have combined to play the leading role in income and earnings inequality. Although the demand for skilled labor has continued to expand over time, the rise in educational attainment has slowed (Goldin and Katz, 2010). The result has been a higher return to education, which has caused an increase in earnings inequality.

Underlying the changes in demand for skills are technology and globalization. In recent decades, transportation and communication costs have fallen and capital has become more mobile. Although consumers have benefited from lower prices, workers in advanced economies are facing greater competition from low-wage countries, which may affect wages (Autor et al., 2013). Indeed, by exploring cross-industry data, a recent Brookings analysis found that out of the 3.9 percentage point decline in labor's share of income over the past 25 years, import competition may account for 3.3 percentage points (Elsby et al., 2013).

Technology and globalization caused "job polarization" (particularly in the 1990s) where employment growth was concentrated in "high-skill, high-wage" and "low-skill, low-wage" jobs. "Middle-skill" jobs, such as bookkeeping and clerical work, suffered (Autor, 2010). More recently, however, within-occupation inequality has grown more than between-occupation inequality, which is not what would be expected if technical change were the main cause (Mishel et al., 2013). Some economists have therefore started to examine other institutional factors, including the decline in labor unions (Western and Rosenfeld, 2011) and the tax system (Piketty, 2013).

The causes and consequences of this evolution in the distribution of household income have been widely debated and studied, and policy makers appear to be well aware of the tradeoffs involved in different approaches to offsetting the rise in income inequality through tax and benefit programs. For this reason, the committee chose to focus on a dimension of inequality that has received less attention: that is, how life expectancies have changed for people with different education and income levels.

For policy purposes, the widening longevity dispersion by income category[1] is highly relevant because benefits in some programs such as Social Security are linked to long-term income. The full value of those benefits, measured as a present value of expected future benefits received, depends on how long the beneficiaries are expected to live. The growing mortality differences across income can make the benefit structures less progressive (or more regressive) on a lifetime basis.

This chapter discusses the literature on differences in mortality by education and income and then presents the committee's own estimates that will be used for the policy simulations in later chapters. What matters for the effect of mortality on the distribution of benefits is the association of mortality with long-term earnings. It is important that this association be relatively unaffected by cases in which temporary ill health causes a concurrent loss of earnings and also an increase in mortality.[2] Cases of this

[1]While the dispersion of earnings and incomes has widened in the United States, the dispersion in age at death for adults (deaths after age 10) has actually narrowed (Edwards, 2011). Despite this narrowing, many studies have found that mortality differences by educational attainment have widened, and likewise by position in the earnings distribution. These findings may seem inconsistent with the narrowing of the dispersion of age at death, but in fact need not be if the increase in differences among education and income groups is offset by a reduction in differences within these groups. Lest this appear unlikely, the committee notes that it is exactly what happened with total world inequality in age at death: within-country differences fell, while between-country differences rose, leaving the total inequality almost unchanged from 1970 to 2000 (Edwards, 2013). This is also what Bound and colleagues (2014) found for the United States with respect to mortality inequality within quantile education groups and overall. Sasson (2014) reports complicated patterns of change in the dispersion of age at death within education groups.

[2]In this case, the resulting association would arise from a short-term reduction in earnings due to illness and would not reflect an association of mortality with the long-term earnings level that would in turn determine benefit levels.

sort will be largely, though not entirely, avoided by analyzing mortality in relation to long-term earnings. The committee measures long-term earnings as the average of nonzero earnings at ages 41 to 50 years.

SHIFT IN THE MORTALITY GRADIENT AND UNDERLYING CAUSES

There is a long tradition of studying differences in mortality by various measures of socioeconomic status (SES) in the United States. A longevity advantage for higher SES groups has been well established in the literature, and sizable differentials in mortality have been documented for more than 40 years (see, for example, Kitagawa and Hauser, 1973). More recent research has found that the differences in mortality not only persist today but also have widened substantially. This research has taken three different approaches. One looks at differences in the mortality of populations of U.S. counties in relation to county-level economic measures. Another looks at mortality by educational attainment. A third approach looks at mortality by career earnings. All three approaches find that the mortality differences are widening.

By whichever indicator is used to capture SES, the evidence shows clearly that since 1960, there has been a large increase in the United States in differential mortality (see, for example, Pappas et al., 1993, using data for 1960-1986). Disparities in mortality have risen whether income or educational achievement is used as the indicator of SES (Preston and Elo, 1995; Manchester and Topoleski, 2008).

The prevailing view among scholars is that mortality differentials originate in part in early childhood or in utero and in part in the health-related behaviors and outcomes of individuals spread over their later life course (Almond and Currie, 2011; Montez and Hayward, 2011). Health-related behaviors (in particular smoking and the nutrition and physical activity lifestyles related to obesity), as well as access to health care, cognitive functioning, and the development of social and psychological resources to seek and preserve health, are the major sources of the mortality differentials. Health behaviors are estimated to account for about 30 percent of the mortality difference for individuals with high versus low levels of education (see summary of the causes for the relation between educational achievement and mortality in Hummer and Hernandez, 2013).

Of particular relevance for the work of this committee is the significant role attributed to smoking and obesity; these two health behaviors/conditions account for a large share of the adult-age mortality disparities across SES groups. Fenelon and Preston (2012) document that overall, about one-fifth of deaths among men and women were attributable to smoking in 2004, and smoking-related mortality explains a large fraction (60 percent) of the U.S. mortality differences across states, specifically the southern states compared to other regions (Fenelon and Preston, 2012). Despite a recent decline in the prevalence of smoking in the United States, the contribution of smoking to mortality patterns has not declined. Evidence indicates a continued increase from 1987 to 2006 in the risk of death among ever smokers compared to those who never smoked (Mehta and Preston, 2012). This peculiar pattern is attributed to other health behaviors adopted by smokers, such as lack of exercise or binge drinking. The implications for mortality in old age of smoking and obesity over the life course appear to be significant and are likely to shape the future mortality of the U.S. population. The penultimate section of this chapter further considers differential trends in smoking by SES.

Approaches to the Analysis of Mortality by Socioeconomic Status

As noted above, one group of studies uses data at the county level to differentiate by SES and finds a consistent pattern of widening disparities in mortality. Singh and Siahpush (2006) constructed a deprivation index based on 11 SES measures available in the U.S. census and examined age-specific mortality by sex in relation to deprivation for 1980-1982, 1989-1991, and 1998-2000 at the county level. They reported that from 1980 to 2000, life expectancy overall increased by 3.3 years. However, for the lowest decile counties, life expectancy increased by only 1.7 years, while for the highest decile it increased by 3.4 years. The gap between the two rose from 2.8 to 4.5 years. It is important, however, to keep in mind that these are differences in life expectancy for whole counties and do not refer to differences across individuals.

Mortality by Education

Many studies have used education as the main marker of SES, in part because it is largely determined by the time an individual's age reaches the mid-twenties. After that, educational status is not affected by health status, so reverse causality in later life is not a concern. The main difficulty with using education, however, is that over time as the educational level attained by successive generations has risen, those with lower levels of education, such as eighth grade or less, become a smaller and more highly adversely selected portion of their generations (Dowd and Hamoudi, 2014). Therefore, if mortality of the less-educated declines more slowly from generation to generation or actually rises, then it is difficult to separate out the part that is due to the greater selectivity of this group from the part due to other causes.

Many analysts have found that mortality differentials by educational attainment have been widening in recent decades. One prominent study reported that life expectancy of white females with fewer than 12 years of education actually declined from 1990 to 2008, by 4 or 5 years (Olshansky et al., 2012). This study also found that the difference in life expectancy between males with less than 12 years of education and those with more than 16 rose from 13.4 years in 1990 to 14.2 years in 2008, while for females the comparable increase was from 7.7 to 10.3 years. Montez and Zajacova (2013) provide a useful review of the literature for the U.S. female population.

Rostron et al. (2010) estimated that in 2005 educational differences in period life expectancy at age 45 for men were between 9 and 13 years, comparing those with less than a high school degree to those with a graduate degree. "Adjusted estimates for the U.S. population show a large disparity in life expectancy by education level, on the order of 10-12 years for females and 11-16 years for males" (Rostron et al., 2010, p. 1). At age 65, the difference for males was 6 to 8 years.

An analysis by Bound and colleagues (2014) seeks to deal with the selection problem by constructing a quantile measure for educational attainment based on position in the ranking of educational attainment rather than on the level of attainment itself. When analyzing this measure in relation to mortality, the researchers find no decrease in life expectancy at low educational levels, but they do still find an increase in the mortality gradient over time:

> However, consistent with other findings (e.g., Waldron 2007) we do see clear evidence for increasing dispersion of survival probabilities between those in the bottom and top of the educational distribution. (Bound et al., 2014, p. 7)

Conditional on survival to 25, they find a difference of 6.3 years in period median age at death in 2010 between the bottom educational quartile of non-Hispanic white males and the top three quartiles, and a difference of 3.1 years in 1990, for an increase of 3.2 years in the differential.[3] This result shows that there has been an increase in mortality dispersion in relation to education even after controlling for adverse selection of those at lower levels of attainment.

A recent study by Goldring and colleagues (2015) takes a different approach to controlling for the effect of selection on the steepening of the mortality-education gradient. They conclude: "Our results indicate that the gradient increased for females during this time period, but we cannot rule out that the gradient among males has not changed" (Goldring et al., 2015, p. 1). They were not able to reject the hypothesis that mortality declines

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[3]These numbers were interpolated from Appendix Table 2 in Bound et al. (2014) by the authors in response to a request from the committee.

were equal across the education distribution. However, because mortality is much lower when education is high, equal declines would represent much larger proportionate declines at higher education levels, which is the relevant concept of a steepening gradient in this report. Therefore the committee interprets their results to be consistent with the others we discuss.

The trends themselves vary along other dimensions. For example, a 1995 review of a variety of studies found that the mortality differential across education groups had widened for men since 1960 but seemed to have flattened for women (Preston and Elo, 1995). More recently, studies including analyses for non-Hispanic whites and blacks with data from 1981 to 2000 found that the general increase in life expectancy occurred among those in the high end of the education distribution, in particular males. Across gender and racial/ethnic groups, however, mortality differentials have declined: "Although SES differences in mortality were rising, mortality differences across sexes and races were falling" (Meara et al., 2008, p. 354).

Meara and colleagues also found that in 2000, the difference in life expectancy at age 25 between high- and low-education black males (for 12 or fewer years of education versus at least 13 years of education) was 8.4 years, and between high and low education white males the difference was 7.8 years. For black and white females, the corresponding difference was 5.4 years. Each of these differences had increased substantially since 1990, by 1.3 to 1.9 years.[4]

Income and Mortality

For purposes of this study, it is more relevant to examine mortality differences in relation to income, because qualification for need-based government programs is based on income, not education. However, when SES is measured through income, new problems arise. Ill health is an important cause of low income, in part because it prevents some from working and in part because sickness leads to out-of-pocket costs that reduce asset holdings and asset income (Smith, 1999, 2005, 2007). Recent research has sought to avoid these problems by constructing long-term earnings measures using Social Security earnings histories.

The Social Security Administration (SSA) calculates the average indexed monthly earnings (AIME) as the basis for determining benefits. The AIME is based on the highest 35 years of an individual's earnings history, adjusted for the economy-wide level of wages in each earnings year. One complication is that because Social Security coverage of the population was gradually expanding over the decades, many eventual beneficiaries only joined

[4]The numbers were calculated by Meara and colleagues (2008) using the Multiple Cause of Death files and the Public Use Micro Sample of the decennial census.

the system some years after they started working, and for them the AIME is not a good measure of their lifetime earnings. For this reason, Hilary Waldron (2007), an SSA analyst, adopted a refined approach. Because the committee uses a similar approach in this report, we discuss Waldron's methodology briefly below.

Waldron calculated the average reported earnings between ages 45 and 55 for years in which positive earnings were reported, for each birth cohort. Years of zero earnings were dropped because it is not known whether these years represent spells of unemployment or years of noncoverage by Social Security. She reports that her procedure results in loss of 16 percent of the sample. These average earnings were then used to construct an "average relative earnings" measure for each cohort, variously classified for purposes of particular analyses as above or below the median, by quintile, or by decile.

The average relative earnings measure is well suited for a cohort analysis of mortality. Waldron analyzed the mortality at age 60 and above for birth cohorts from 1912 through 1941. It is in the nature of the data that actual (as opposed to projected) mortality for these birth cohorts is observed at different ages for different birth cohorts, because Waldron used Social Security data from 1972 to 2001. For example, for the 1912 birth cohort, death rates at ages 60 to 89 were observed. For the 1920 birth cohort, death rates from 60 to 81 were observed. For the 1941 birth cohort, death rates were observed only in a single year, 2001 (Waldron 2007, Table 2). Similarly, the earnings data for ages 45 to 55 were observed for different periods, with the earliest usable data with adequate coverage beginning in 1957, so that the earliest birth cohort with the necessary earnings data was 1912. Waldron's mortality data come from Numident, the official death file of Social Security.

Waldron found that the life expectancy difference at age 60 for males between the top and bottom half of the earnings distribution was 1.2 years for the 1912 cohort, rising to 5.8 years for the 1941 cohort. The bottom half of the earnings distribution was estimated to gain 1.9 years of life expectancy between the 1912 and 1941 birth cohorts, while the top half was estimated to gain 6.5 years of life.

Because the Social Security data have limited SES information, Bosworth and Burke (2014) used Social Security earnings histories linked to the Health and Retirement Study (HRS) for the years 1992 to 2010. The HRS has rich data on health, disability, SES, and economic behavior. However, the number of individuals in the HRS is much smaller than in the Social Security database used by Waldron, and mortality is observed during fewer calendar years. Bosworth and Burke used a measure of "midcareer earnings" similar to Waldron's measure but based on ages 41 to 50 rather than 45 to 55, enabling them to include more recent birth cohorts in their analysis.

In addition to using individual earnings histories in relation to individual mortality, as did Waldron, Bosworth and Burke also constructed an earnings measure for households, equal to the sum of the male and female lifetime earnings divided by the square root of 2 to adjust for scale economies. The estimated mortality equations in Bosworth and Burke contain education and race measures in addition to earnings decile, so they are not fully informative for purposes of using earnings as the SES measure. However, they did find trends in the relationship between career earnings quantiles and mortality quite similar to those found by Waldron.[5]

Bosworth and colleagues (2014) also examined mortality in relation to career earnings, using an approach similar to Bosworth and Burke (2014) but analyzing mortality differentials by cause of death from HRS data. They also studied mortality in relation to education. Regardless of the measure of SES used, they found a widening of mortality differentials by SES over generations currently old or approaching old age.

Pijoan-Mas and Rios-Rull (2014) conducted another careful statistical analysis of socioeconomic differences in mortality and their changes over time in the United States, based on the same HRS dataset that Bosworth and Burke (2014) used, which this committee uses as well. Their abstract concludes: "Finally, we document an increasing time trend of the socioeconomic gradient of longevity in the period 1992-2008, and we predict an increase in the socioeconomic gradient of mortality rates for the coming years." Thus this paper confirms the qualitative conclusions of the other studies of income and mortality we have discussed, although it finds much smaller differentials by income quintile than those estimated by Bosworth and Burke (2014) or by Waldron (2007). For reasons discussed below, however, the paper's findings are not directly comparable to the others and therefore are not consistent with them.

First, we note that the Pijoan-Mas and Rios-Rull income measure, which they call "nonfinancial income," is quite different from the midcareer or lifetime earnings measures used by Bosworth and Burke (2014) or by Waldron (2007). The Pijoan-Mas and Rios-Rull measure includes not only

[5]Bosworth and Burke (2014) report in footnote 18: "The magnitude of increase in life expectancy for the 10th compared to the 1st decile seems quite comparable to the results reported in Waldron (2007). She estimated the increase in life expectancy at age 65 between the top and bottom half of the career earnings distribution of men for the 1912 and 1940 birth cohorts as 5 and 1.3 years respectively." If the data in the middle panel of Table 5 in Bosworth and Burke are used to calculate life expectancy for the top and bottom five deciles for birth years 1920 and 1940, in order to compare to Waldron's estimates, for males the increases were 4.84 and 2.96 years, respectively. This estimated difference is considerably smaller than Waldron's, but her comparison is for the 1912 to 1940 cohorts, whereas Bosworth and Burke's is for 1920 to 1940. Some of the difference may also be due to inclusion of education and race in the Bosworth and Burke estimates.

labor income but also Social Security retirement income, unemployment and disability insurance benefits, and employer pensions and annuities, all measured and summed for the same year that mortality is observed for an individual. The midcareer earnings measure is constructed for a fixed age range (41 to 50 for Bosworth and Burke and 45 to 55 for Waldron) for each individual and does not vary across the individual's age, removing one of the two rationales given for the procedures introduced by the authors. The midcareer earnings measure is also much narrower, including only labor income, and a 10-year average, so less subject to annual variation. Equally important, Pijoan-Mas and Rios-Rull estimate a period mortality model using HRS data for 1992 to 2010, whereas the other studies estimate cohort models using these data. To see how much difference this can make, consider that Waldron (2007) estimates a period model for 1999 to 2001 as well as a cohort model for differences between the top and bottom half of midcareer earnings in life expectancy at age 60. For the period life expectancy at age 60, the estimated difference is only 2.6 years, whereas for cohort life expectancy at age 60, it ranges from 4.3 years for the 1932 birth cohort to 5.1 and then 5.8 for the birth cohorts of 1937 and 1941, respectively.

The literature discussed in the above paragraphs, and the committee analysis described below, focus on the individual as the unit of analysis. It is worth noting, however, that given the tendency for people of similar status to marry one another, and given the fact that within a marriage the partners share their economic status, the gradient for individual survival by socioeconomic status implies a longer joint survival of higher-status married couples. This tendency will then be reinforced by the tendency of marriage to lead to higher survival, at least for men.

In summary, an abundance of research over the past two decades finds that SES differentials in mortality are widening, whether SES is measured by educational attainment or income quantile, by composite indices of SES at the county level, or by any of several long-term earnings measures based on Social Security earnings histories. For the purposes of this report, the estimates using career earnings are the most relevant for analyzing the progressivity of government programs and the differential impacts by income class of a menu of possible policy changes.

Estimating the Changing Relationship of Mortality to Income Quintile

The work of the committee follows the approach in Waldron (2007) as developed and modified in Bosworth and Burke (2014) to use data from the HRS for individuals age 50 and above. The main differences in the committee's approach are that we did not include education or race variables in our estimation equations because we were interested only in the income differentials in mortality, because these will affect government benefits of various kinds and eligibility for benefits does not depend on education or race.[6] Also, while Bosworth and Burke used HRS data for 1992 to 2010, for reasons related to our later use of the Future Elderly Model, we have used HRS data for 1992 to 2008. The nature of the HRS constrains our analysis to ages 50 and older, although some data for younger spouses or respondents were also available.

Our estimates and extrapolations are based on an analysis of deaths in the 2-year period between waves of the HRS (using a probit model). The model is fully interacted with gender and includes as covariates the individual's year of birth, age, career income quintile (based on average Social Security earnings for positive-earnings years between ages 41 and 50), and the interaction of age and quintile.[7] We also follow Hurd and Zissimopolous (2003) in estimating the earnings of individuals who are above the cap based on the reported quarter of the year in which they reached the cap.

Quintiles are defined separately for males and females, because of the concern that women who never worked would unduly affect the estimated association of income quintile and mortality. This potential problem is reduced but not eliminated by using the household-based income measure described above.

The committee experimented with other specifications, including estimating a different mortality factor for each income quintile for each 10-year birth cohort. We settled on the specification just described, which is closer to the Bosworth and Burke specification, because it is less demanding of the limited size of the dataset.

[6]Our rationale for using a stripped-down model that employs a measure of long-term earnings but excludes education, race, risk factors for health, actual health, or other covariates is as follows. Benefits under Social Security in particular depend on long-term earnings, not on earnings in any single year. However, if a person has had a heart defect since childhood that both reduces long-term earnings and raises mortality, then for our purposes that should be reflected in our estimates. If a person has low education and therefore has both low earnings and high mortality, then that should be reflected in our estimates. Similarly, if racial discrimination leads both to low earnings and higher mortality, then that should be reflected in our estimates. For this reason, our mortality estimates contain no covariates other than age, gender, year of birth, and some interactions. This approach has two interrelated consequences worth noting: (1) the existing literature is of limited use for our purposes, and (2) our estimates of the association of long-term earnings quintile with mortality may differ from results in the literature.

[7]Individuals with zero earnings for all years within the age range were dropped by Waldron (2007, p. 5) because the administrative records do not permit distinguishing between those who were not employed and those who were employed but whose earnings were not covered by Social Security. In our analysis, those with zeros for all years in the age range will sometimes live in a household with an earner with positive earnings, and if not, earnings were imputed. Earnings were also imputed for those too old to have earnings records and for those who did not give the HRS interviewers permission to access their earnings records.

As a further robustness check, rather than modeling 2-year mortality incidence we explored modeling mortality parametrically using a Weibull survival model. With age as the time scale, we adjusted the baseline hazard rate by birth year, earnings quintile, and the interaction of birth year and earnings quintile. Males and females were modeled separately. Simulation results were similar for this method and the one we adopted, although the Weibull led to longer life expectancies for the highest quintile and shorter life expectancies for the lowest quintile.

One potential difficulty should be discussed. Elo and Preston (1996, p. 47) reported that "differentials are larger for men and for working ages than for women and persons age 65 and above." If this narrowing of differentials with age were true only for the educational differentials that Elo and Preston analyzed, then it might be explained by the smaller selection effect for older cohorts; when older people were in school, it was more common to achieve less than 8 or 12 years of schooling. However, if this is also true when lifetime income is used as the measure of socioeconomic status, then our estimates of the steepening gradient could be biased upwards. The reason is that for cohorts born more recently, the mortality experience observed in the HRS is for age ranges starting closer to age 50, when gradients are by assumption steeper, whereas the mortality for older cohorts in the HRS are at older ages when the gradient is less steep.

Fortunately, Waldron (2007, Table 1), using the much more extensive Social Security database, was able to estimate odds ratios for the top half of the income distribution relative to the bottom half separately and independently by year of birth and by age group. In these estimates, for a given age group the odds ratios increase with cohort birth year. For example, for men aged 60 to 64, the odds ratio rises almost monotonically from 1.27 for those born 1912 to 1915 to 1.84 for those born 1936 to 1938. Similar patterns are found for each age group up to 75 to 79, while the 80 to 84 age group shows a slight reversal.

Mortality Estimates for the 1930 and 1960 Birth Cohorts

The results of the committee's preferred estimates are presented for two birth cohorts: 1930 and 1960. It is important to keep in mind that the mortality of these cohorts is observed in the HRS only through 2008. Therefore the estimated mortality for the 1930 cohort is based on observations beginning in 1992 at age 62 and ending in 2008 at age 78. For the 1960 birth cohort, mortality is not observed at all, because this cohort turns 50 in 2010, 2 years after the 2008 HRS. The age range and number of deaths observed for each of the HRS birth cohorts are illustrated in Figure 3-1.

For the policy simulations in the report, the committee used the observed and simulated survivorship and mortality at each age, but for pre-

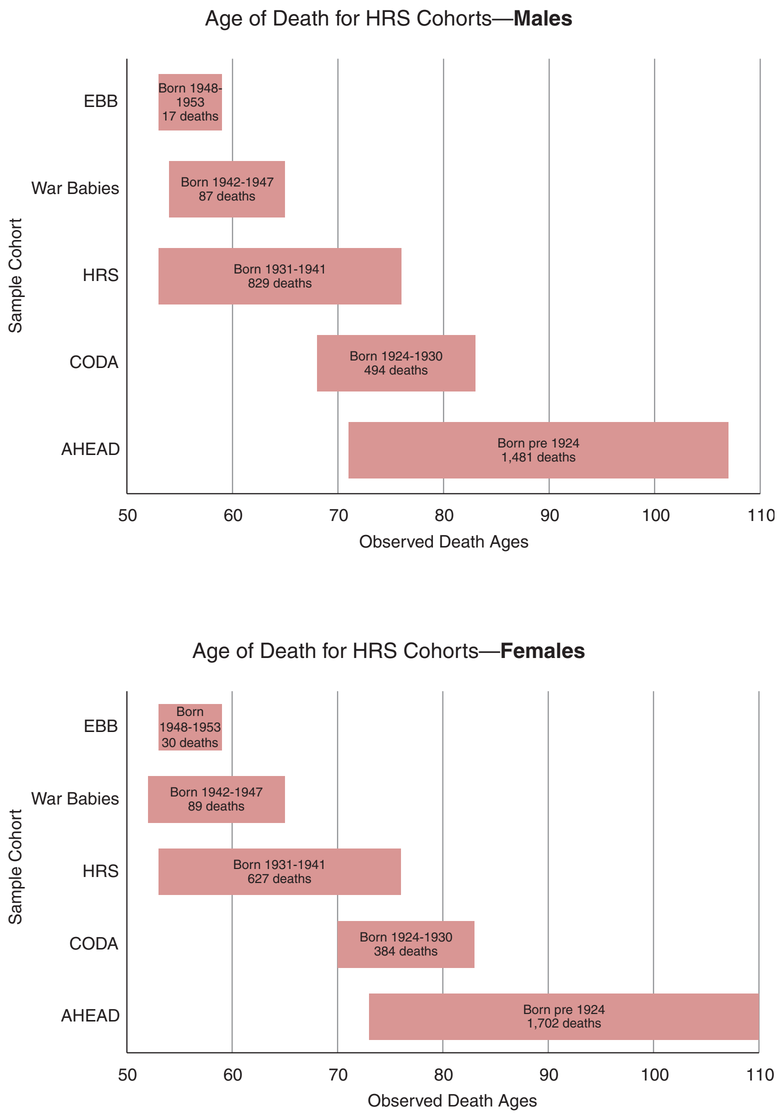

FIGURE 3-1 Observation ages and death counts for the HRS birth cohorts used in the committee's estimates of the mortality-career earnings gradient. EBB = early baby boom, CODA = children of depression era, AHEAD = birth cohorts included in the original AHEAD survey, which was eventually absorbed into the HRS. Some individuals were dropped from the analysis because of missing values, nonresponse, and similar reasons.
SOURCE: Committee generated from Health and Retirement Study data.

sentation purposes we use the life expectancy at age 50 as a convenient and widely understood summary measure. This requires that future mortality be extrapolated to high ages in future years until each birth cohort has died out. This extrapolation has been carried out on the assumption that all estimated trends continue in the future. These extrapolated trends are quite similar to both Social Security projections and Waldron's (who uses the Social Security projections), when averaged across gender and income quintile, as will be discussed below. However, because Social Security actuaries assume a future slowing of the historical trend of mortality decline while we assume the historical trend will continue, the committee projections are slightly higher. Projections by gender, however, differ in important ways as will be discussed.

In order to investigate the consequences of mortality inequality for the 1960 birth cohort, we construct a plausible scenario for mortality at ages 50 and above based on our fitted model, on the assumption that the base period trends we observe continue, both in average mortality and, more importantly, in the widening of the differentials by midcareer earnings. This scenario will be referred to as the mortality regime of the 1960 birth cohort, but it is important to keep in mind that it is entirely extrapolated or projected rather than observed.

To be sure, we cannot be sure that the trend in mean mortality will continue, but most forecasters assume that it will. This is approximately true of the projections reported in the Social Security Trustees Reports and in the projections by the U.S. Bureau of the Census. We also cannot be sure that disparities in old-age mortality by midcareer earnings will continue to widen. There is evidence from the cross-sectional studies reviewed above that mortality differences by educational attainment percentile continued to widen between 1990 and 2010 (Meara et al., 2008; Bosworth et al., 2014; Bound et al., 2014), and we are not aware of any evidence that the steepening trend for differences by income has slowed. Nonetheless, there is uncertainty about whether these trends will continue.

UNCERTAINTY OF THE MORTALITY PROJECTIONS

These projections of mortality and its dispersion in relation to midcareer income and by gender are subject to uncertainty from a number of sources. These were discussed above but are summarized here.

- The HRS that we use as our data source for deaths by age and midcareer income covers deaths from 1992 to 2008 for a survey population that started with about 21,000 individuals, a number gradually depleted by death and loss to follow-up and augmented by new recruits above age 50.

- This limits the number of years that each cohort is observed and raises the random component in the number of deaths occurring at a given age, income category, and year. We do observe the mortality experience of 32 birth cohorts, but some are observed for very few years or 1 year. The mortality of each cohort is observed across a different range of ages, with the older cohorts observed at older ages and the younger ones at younger ages.
- There is uncertainty about the appropriate model, including the way to express the trend in mortality.
- Our projections assume that our fitted trend will continue in the future, but the Social Security projections assume that the trend gradually slows.
- All the parameters of the model on which the projections are based are estimated with uncertainty.
- The estimated model itself contains an error term that reflects the inability of the model to fit the data perfectly, which is an additional source of uncertainty in the projected values.

Although the literature contains a number of probabilistic methods for forecasting mortality, they were developed for simpler situations; it would not be appropriate to apply them in this setting. Developing appropriately modified versions of these methods to use here is beyond the scope of the present study. Therefore, although a formal treatment of the uncertainty in our mortality projections is not possible, to address this uncertainty we have constructed a second scenario in which the trend in mean mortality continues but the increase in mortality disparities by income is only half as great for the 1960 cohort as in our baseline scenario. Chapter 4 presents the key results using both the baseline scenario and this scenario with reduced dispersion. While it is also possible that future dispersion will increase more rapidly than our projection, increased dispersion would reinforce the results reported in later chapters, so we focus on the reduced-dispersion scenario, which reflects the opposite possibility, to explore the uncertainty in the results on which the committee's conclusions depend.

To see how this reduced-dispersion scenario is constructed, consider the top to bottom differential in life expectancy at age 50 for males (difference between the top quintile, Q5, and the bottom quintile, Q1). In the baseline analysis, this differential grows from 5.1 years to 12.7 years between the birth cohorts of 1930 and 1960, or by 7.6 years. In our alternative scenario, it instead grows by 7.6/2 = 3.8 years so that in 1960 the life expectancy at age 50 differential for males is 5.1 + 3.8 = 8.9 years instead of 12.7 years. We cannot give the probability that the actual differential will be greater than or equal to the alternative scenario. It will be possible to see, however, how much difference it would make to our results if the actual widening of the dispersion in longevity turns out to be only half as large as in our baseline projection.

Much more speculatively, we also calculate for some purposes the projected life expectancy at age 50 for the 1990 birth cohort by income quintile, on the assumptions that the underlying trend in mortality decline remains unchanged from the base period and that the underlying trend in differentials about that trend likewise continues unchanged. This second assumption, about the trend in differentials, is particularly problematic because the differentials are strongly influenced by trends in smoking behavior, including both uptake and quitting—trends that are not expected to continue for long. Thus, these calculations for the 1990 cohort should be taken as illustrative. Nevertheless, the extrapolations for the 1990 birth cohort are useful to provide a sort of upper bound on mortality differentials and policy consequences after midcentury. The committee was particularly interested in the later-born cohorts such as 1960 and 1990 because cohorts such as these will be fully affected by any policy reforms that affect age of eligibility for benefits, such as Social Security retirement, or that interact with age and survivorship in other ways, such as changes in the cost-of-living adjustment.

The results of this estimation and extrapolation are shown in Figure 3-2. In the upper panel for males, for birth years 1930 and 1960, life expectancy at 50 always rises as one moves from lower to higher income quintiles. The difference between life expectancy for the highest and lowest quintiles is 5.1 years for the 1930 cohort and 12.7 for the 1960 cohort (projected).

For females, a similar pattern is observed: higher income quintiles have higher life expectancy at 50, except for the second quintile in 1930. The difference between life expectancy for the highest and lowest quintiles is 3.9 years for the 1930 cohort, slightly smaller than for males, and 13.6 for the 1960 cohort (projected). These quantitative differences are also quite similar to the male differences. We also note that our estimates show a decline of a few years for life expectancy at age 50 for the bottom income quintile and a slight decline for the second lowest income quintile.

As a plausibility check, one can average across gender and quintile to get a cohort life expectancy at age 65, which can be compared to SSA estimates or projections of that same quantity (Bell and Miller, 2005). The agreement is quite good for each birth cohort. Giving the SSA figure first, the comparisons are as follows: for 1930, 17.9 versus 17.5 years; for 1960, 19.6 versus 21.1 years; and for the distantly projected 1990 birth cohort (not shown in the graphs), 21.2 versus 21.8 years. Not surprisingly, the SSA projects that life expectancy will rise more slowly than the projections reported here, which assume that base period trends continue in the future.

If the same calculation is carried out by gender, then anomalies arise. In the committee's estimates/projections, life expectancy is slightly lower for

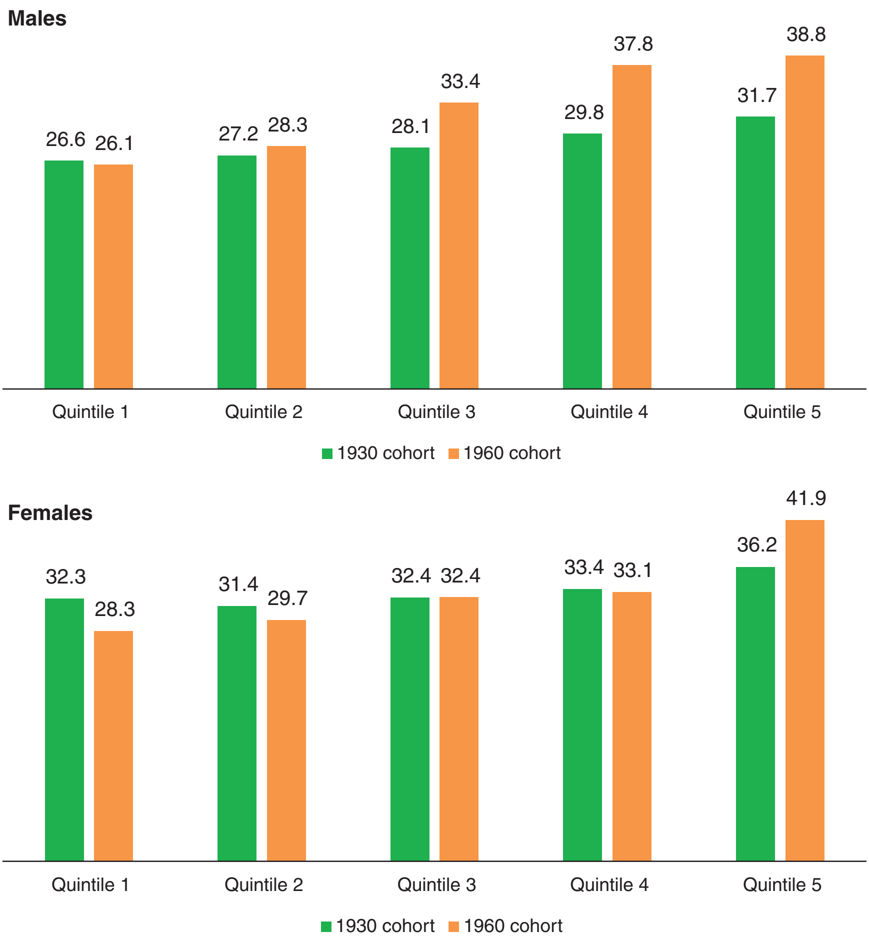

FIGURE 3-2 Estimated and projected life expectancy at age 50 for males and females born in 1930 and 1960, by income quintile.
SOURCE: Committee generated from Health and Retirement Study data.

females than males in the 1960 cohort and considerably lower in the 1990 cohort. Although a narrowing of the male-female life expectancy difference in the future is plausible, it is not plausible that male life expectancy will be higher than female, and this outcome is not consistent with the SSA projections. Thus, one must interpret the gender-specific results with caution. This is frequently the case in the literature. Estimates of mortality differences by income for females are often unstable or present other problems (Waldron, 2007; Bosworth and Burke, 2014). Analysts typically focus on results for males.

Although these summary life expectancy figures are useful and (mostly) intuitive, the probability of survival to specific advanced ages is also revealing. These estimated probabilities, based on the same estimated and projected mortality schedules, are presented in Figure 3-3. One can see, for example, that a top quintile male born in 1930 and surviving to age 50 has a 45 percent chance of living to age 85, whereas a bottom quintile male has only a 27 percent chance. The implications for receipt of retirement and health care benefits are clear. But for the 1960 birth cohort, the corresponding probabilities are 66 percent and 26 percent, rising substantially for the top quintile but holding steady or declining slightly for the bottom quintile male.[8]

The corresponding percentage probabilities of survival from age 50 to 85 for females are 60 versus 46 percent for the 1930 birth cohort, and 77 versus 32 percent for the 1960 birth cohort. These top quintile females would have more than two times the chance of survival to age 85 as those in the bottom quintile. The projected probabilities for female survival from 50 to 100, shown in the last panel of Figure 3-3, show an implausibly great advantage to the top quintile for the 1960 birth cohort.

INTERPRETATION OF RESULTS

This chapter began by noting the increasing dispersion of the income distribution in the United States in recent decades. The committee went on to note the widening of distribution of survival by education group and by income. Although it would be natural to think that the two trends are related, it is important to realize that none of the evidence discussed in this chapter bears on whether or not they are related. The analysis developed first by Waldron (2007), then by Bosworth and Burke (2014) and by this committee in this report, finds a relationship between the income quantile (ranked position) and survival. We find, for example, that survival chances rose more quickly for males in the top 20 percent of the income distribution than for males in the bottom 20 percent. Recent CBO projections also embody an expansion in the mortality gradient by lifetime earnings (see Box 3-1). However, this says nothing about any causal relation between changes in survival and the level of income or its dispersion.

It is true that one possible explanation of the finding about income

[8]More speculatively, the corresponding probabilities for surviving from age 50 to 100 for the cohort born in 1990 would be 82 versus 24 percent, giving the top quintile male more than triple the chance of a bottom quintile male in the cohort. The contrasts for survival to age 100 are far greater.

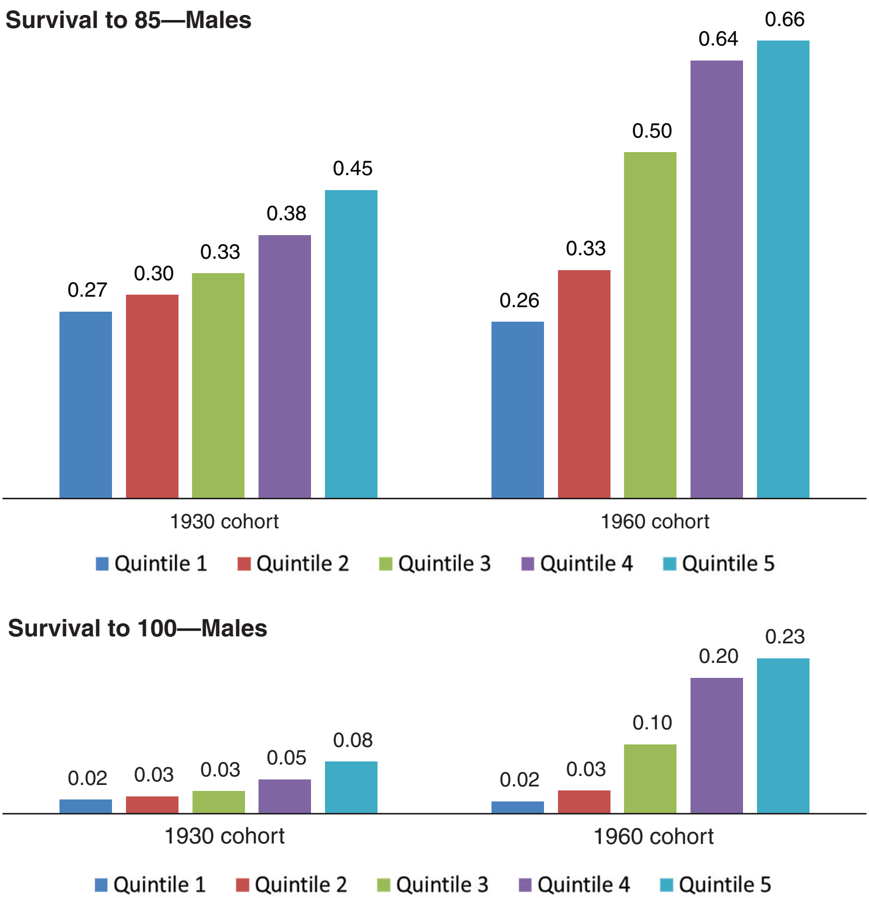

FIGURE 3-3 Proportions of males and females reaching age 50 who survive to ages 85 and 100, by birth cohort and income quintile.
SOURCE: Committee generated from Health and Retirement Study data.

quintiles and survival might be that trends in income distribution mean that those in the bottom quintile are now poorer relative to those at the top than was the case in the past, and therefore their survival has grown relatively worse. None of the studies just mentioned has addressed this important question, which would require different methods and models. Another possible explanation is that inequality itself is bad for health and leads to higher mortality for those at the lower ranks, as has been found in

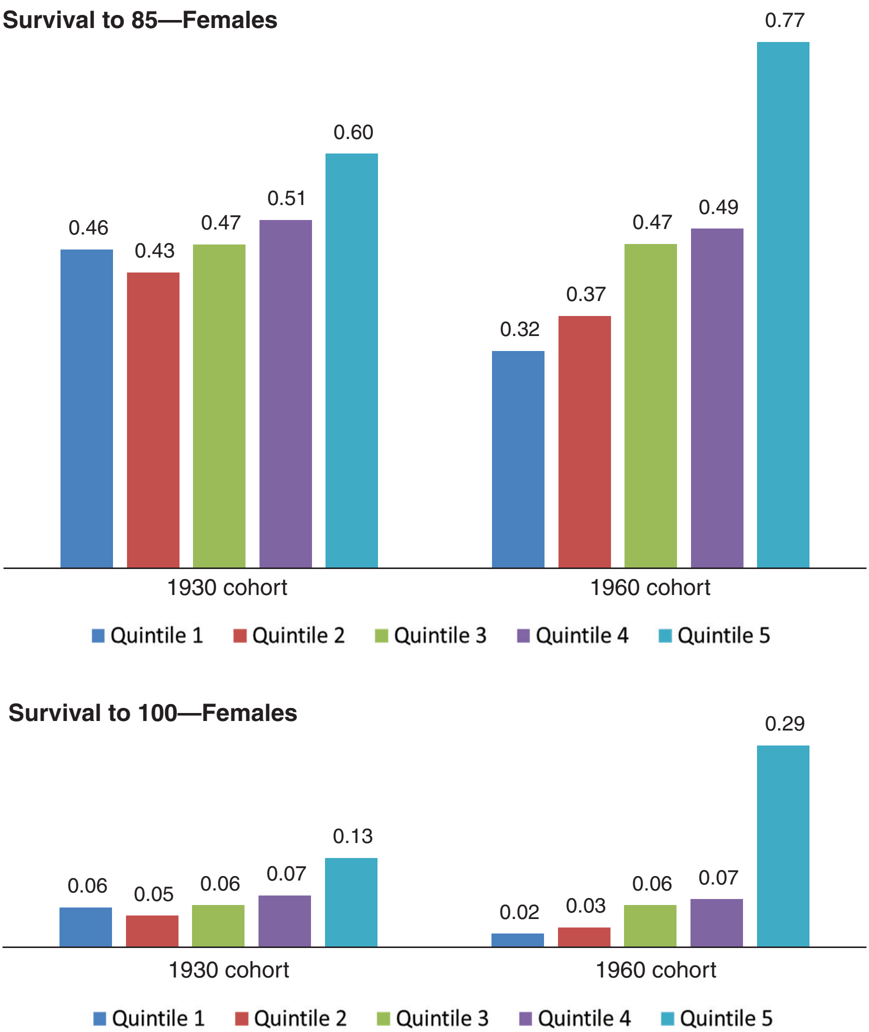

FIGURE 3-3 Continued

the famous Whitehall Studies (see, for example, Marmot et al., 1978, 1991; see Box 3-2). A third possibility is that education drives both differences in income and differences in health, and that its relationship to both has grown more steep, leading to a noncausal association of health and income. Doubtless there are other possibilities as well. For our immediate purposes in this report, all that is needed is the association.

BOX 3-1
Congressional Budget Office (CBO) Projections

Official projections from the CBO embody some degree of expansion in the mortality gradient by lifetime earnings quintiles, although both the magnitude and trend (change in slope) of that mortality gradient appear somewhat smaller than the central estimates in this report. The table on the facing page, based on data published by the CBO, shows additional years of life expectancy at age 65 for people who have never received disability benefits. The gap in life expectancy at age 65 between the highest and lowest lifetime earnings quintiles is projected to increase by 2.8 years for males born in 1974 (who turn age 65 in 2039) compared to males born in 1949 (who turn age 65 in 2014). For females, the gap is projected to rise by 2.0 years over the same period.

Direct comparisons of the CBO projections to the estimates in this report are challenging for several reasons, including the differences in birth cohorts (this report focuses on those born in 1930 and 1960, whereas CBO projections show those born in 1949 and 1974); the treatment of those who have qualified for disability insurance (this report includes them, whereas CBO projections exclude them); and the age at which the additional years of life expectancy are measured (this report focuses on age 50 because of the structure of the Future Elderly Model, whereas the CBO examines life expectancy at age 65).

Despite these differences, two features of the CBO projections are worth highlighting. The first is that the CBO, in its official long-term budget projections, assumes that the mortality gradient will continue to widen. However, the second feature is that the CBO appears to assume a more modest degree of steepening over time than does the simple projection of current trends presented here. For example, the committee's central estimates suggest that the mortality gradient

FUTURE TRENDS IN THE MORTALITY GRADIENT

What will happen in the future to differentials in life expectancy across groups of the U.S. population? The gaps between those at the top of the socioeconomic ladder compared to those at the bottom are likely to persist, but less clear is whether the gaps will widen further or narrow.

The task of predicting the course of mortality is complex, and even more complex is the task of predicting the patterns of differentials. For projecting future trends, patterns of tobacco smoking and obesity and their likely impact on mortality into the future are important. Because both obesity and smoking are distributed unequally across socioeconomic groups in the population, the health and mortality differentials related to them are expected to continue in the future. In this regard, two counteracting influences prevail among young adults who will be of retirement age in the future: smoking has declined but obesity has increased over time (see Figbetween the lowest and highest quintiles expanded by 3 to 4 months per year, on average, between the 1930 and 1960 birth cohorts. The CBO projections, by contrast, assume that the gradient steepens by 1 to 1.3 months per year, on average, between the 1949 and 1974 birth cohorts. The CBO projections also suggest that the gap increases less for females than males; our projections show the opposite.

Life Expectancy for Nondisabled People at Age 65 by Lifetime Earnings Quintile: 1949 and 1974 Birth Years

Lifetime Earnings Quintile	1949	1974	Change in Life Expectancy
Males			
Lowest	22.9	24.5	1.6
Highest	26.3	30.7	4.4
Difference	3.4	6.2	2.8
Females			
Lowest	26.3	28.3	2.0
Highest	27.5	31.5	4.0
Difference	1.2	3.2	2.0

SOURCE: Based on supplemental data in Congressional Budget Office (2014), see http://cbo.gov/publication/4547 [July 2015].

ures 3-4 and 3-5). Looking at these risk factors in young age is important, because scholars have documented the influence of their presence in young age for age-related risk of dying later in life. There is, for example, evidence indicating that obesity in early adulthood appears to increase mortality at age 50 (Preston et al., 2013).

Because tobacco smoking has continued to decline overall, much attention has centered on the rising obesity trends and whether obesity and its related disease consequences will counteract the possible gains in life expectancy due to declining smoking. A common practice is to classify subjects as underweight, normal, overweight, and obese according to levels of body mass index (BMI). There is repeated evidence, through individual research projects, meta-analyses of a series of studies, and systematic literature reviews, of a nonlinear relationship (J-shape) between BMI and subsequent mortality, wherein researchers find that being overweight in old age may be protective to avoid mortality in case of hospitalizations or injuries (Al Snih

BOX 3-2
Shifts in Income Inequality and the Mortality Gradient in Other Countries

There has been considerable study of changes in income inequality since the mid-1980s in many countries but relatively little research into the interplay of changing income distributions and changing mortality patterns. Furthermore, changes in mortality gradients by income quantiles (the focus of this report) or other such groupings do not appear to have been investigated and published elsewhere.

With regard to income, the OECD has documented that while real disposable household income grew by an average of 1.7 percent during the two decades prior to the recent global economic crises, the income of the richest 10 percent of households rose faster than that among the poorest 10 percent of households in the great majority of OECD countries (OECD, 2011). At present, the average income of the top 10 percent of the population in OECD countries is approximately 9 times that of the poorest 10 percent. There is large variation among OECD countries, with the top-to-bottom ratio being significantly lower in Nordic and some continental European nations while the ratio reaches or exceeds 14 in the United States, Israel, Mexico, Chile, and Turkey. The OECD calculates that the overall Gini coefficient* increased by about 10 percent between the mid-1980s and the late 2000s, with increases noted in 17 of the 22 OECD nations that have sufficient time series data. A separate analysis of 129 regions in 13 European countries found that the combined absolute gap in average household income between the highest- and lowest-income deciles expanded by 14 percent between 1999 and 2008 (Richardson et al., 2014).

The question whether the dispersion of health and mortality by SES has been widening has not received a great deal of attention in most countries, perhaps because of as-yet insufficient data for establishing a solid connection. In an initial attempt at cross-national comparison, Mackenbach and colleagues (2003) examined national-level longitudinal data on mortality by occupational class and educational attainment from Denmark, Finland, Sweden, Norway, Britain (England

et al., 2007). Overall, however, underweight and especially obesity in old age confer heightened risks of dying (Flegal et al., 2013; Masters et al., 2013; Winter et al., 2014). Obesity-related conditions include heart disease, Type 2 diabetes, and certain cancers, which are some of the leading causes of "preventable" deaths.

As mentioned before, the influence of smoking and obesity on differentials in mortality depends on how unequally they are distributed in the population. Although tobacco smoking has declined overall, the difference in prevalence of smoking by income level (measured relative to the poverty line) has remained roughly the same over the past 20 years (see Figure 3-6). In 1990, 40 percent of males aged 18 and older in the low end of the and Wales), and from Turin in Italy. Looking at the time periods 1981-1985 and 1991-1995, they concluded that relative inequalities in overall mortality increased in all countries, often because mortality from cardiovascular disease declined relatively faster among higher socioeconomic groups. More recent and expanded comparative work has documented persistent differences in health status among socioeconomic groups in 18 European countries (University Medical Centre Rotterdam, 2007).

Researchers in the United Kingdom have had a longstanding interest in the relationship between SES and health. The well-known Whitehall Studies I and II (begun in 1967 and 1985, respectively) have been linchpins in the development of research in this area and have shown a clear and powerful association between health and social class. Subsequent studies and reports have demonstrated a widening mortality gap between social classes from the 1950s through the mid-1990s and persistent gaps in life expectancy through the mid-2000s (United Kingdom House of Commons, 2009; Marmot et al., 2010; Dorling, 2013).

Unlike the situation in Britain, there does not appear to be a clear relationship between increasing income inequality and changing health in Canada. Recent analyses (Anderson and McIvor, 2013; Conference Board of Canada, 2014) have documented rising income inequality during 1990-2010; by 2010 the top income quintile received 39 percent of total national income compared with 7 percent for the lowest quintile. The Conference Board of Canada analysis concluded that health was seemingly unaffected by the rise in income inequality. And a report from the Public Health Agency of Canada (2011) asserts that differences in health between the highest- and lowest-income groups generally have been lessening over time, albeit with exceptions (e.g., the low-high income-group difference in diabetes mortality increased 40 percent during the first decade of the 21st century).

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*The Gini coefficient is a measure of statistical dispersion that represents the degree of inequality in the income distribution of a population. The coefficient varies between 0 (complete equality) and 1 (complete inequality).

income distribution (below 100% of the poverty line) were smokers, compared to 22 percent of their counterparts in the high end of the distribution (above 400% of the poverty line). By 2010, the comparable figures were 33 percent and 13 percent, respectively. The gap in smoking between poor and rich hovered around 15 to 20 percentage points over the 30-year period. Figure 3-6 shows a similar trend for females, except that the poor-rich gap widened slightly over time.

For obesity, although the pattern has been of rising prevalence for individuals at all levels of income over time, the difference in prevalence between the low- and high-end income groups over the years 1990 to 2010 has actually narrowed (see Figure 3-7). By 2010, among the U.S. population

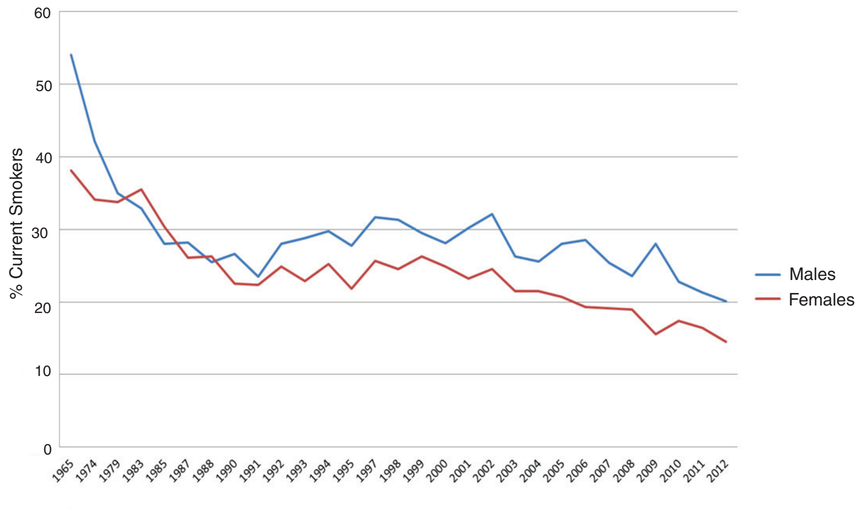

FIGURE 3-4 Smoking among U.S. adults aged 18-24, by gender, 1965-2012. Estimates are for current cigarette smoking.
SOURCE: Based on data from the National Health Interview Survey, see http://www.cdc.gov/nchs/hus/healthrisk.htm [July 2015].

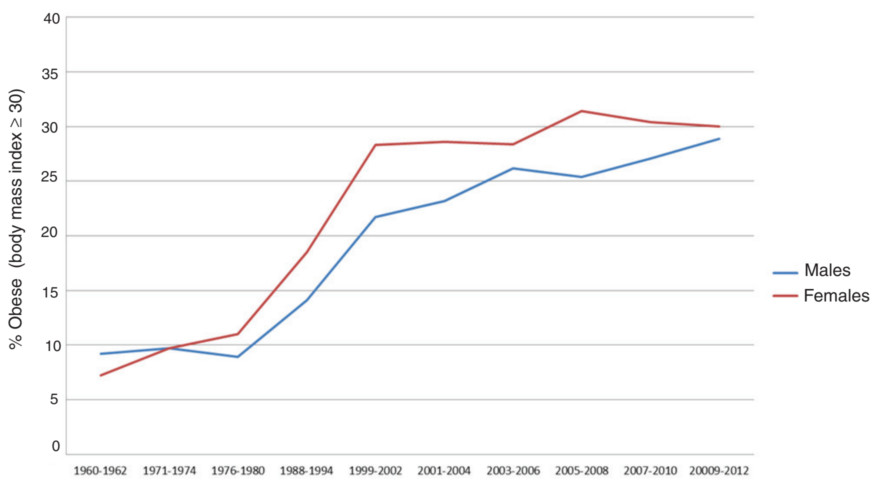

FIGURE 3-5 Obesity among U.S. adults aged 20-34, by gender, 1960-2012. Body mass index (BMI) equals weight in kilograms divided by height in meters squared. Obesity equals BMI greater than or equal to 30.
SOURCE: Based on data from the National Health Interview Survey, see http://www.cdc.gov/nchs/hus/healthrisk.htm [July 2015].

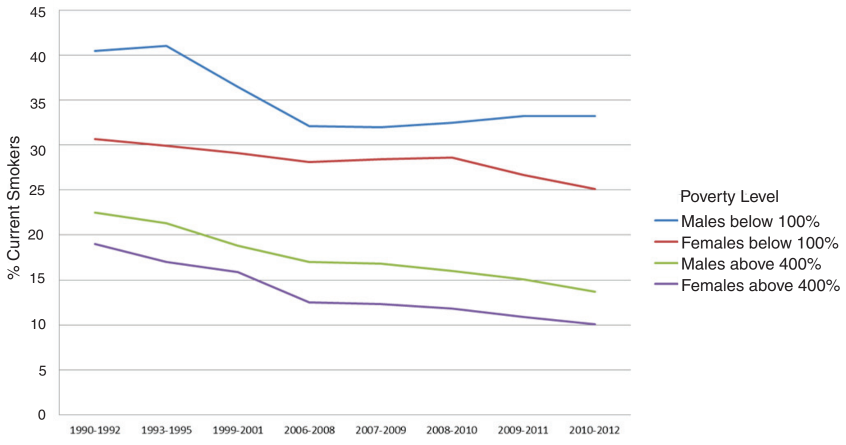

FIGURE 3-6 Smoking among adults aged 18 years and older, by gender and poverty level, in the United States, 1990-2012. Estimates are for current cigarette smoking, age-adjusted to the year 2000 standard population using five age groups: 18-24 years, 25-34 years, 35-44 years, 45-64 years, and 65 years and older. Poverty-level data are percentages of the estimated poverty thresholds set by the U.S. Census Bureau and based on family income and family size and composition.
SOURCE: Based on data from the National Health Interview Survey, see http://www.cdc.gov/nchs/hus/healthrisk.htm [July 2015].

aged 20 and older who were in the low end of income, 37 percent were obese, compared to 31 percent of their high-income counterparts. Interestingly, the narrowing gap in recent years between the two groups is due to a relatively higher rise in obesity among the rich compared to the poor.

Thus the expectation is that the gains in life expectancy that previous cohorts enjoyed could be somewhat curtailed by prevailing smoking and obesity patterns. One study (Preston et al., 2014) makes projections for 2010 to 2040 using data for the cohorts that were age 25 in 1988 to 2006. As expected, the prediction is that changes in smoking and obesity will have large counteracting effects on the mortality of older U.S. adults. For males, the combined effect will be 0.83 years of gain in life expectancy by 2040, but for females the gain will be much smaller, 0.09 years by 2040.

What is harder to predict is the impact of medical advances and other relevant changes on future health outcomes and life expectancy. It is certainly possible that with advances in oncology and other fields, life expectancy at older ages may rise substantially in the future.

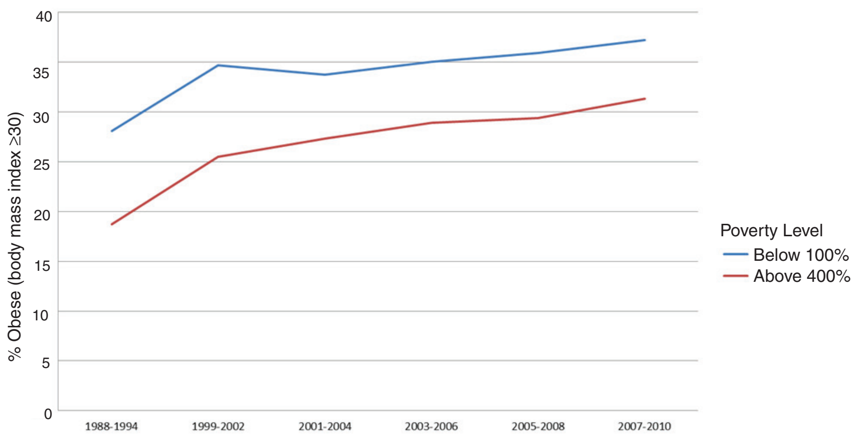

FIGURE 3-7 Obesity among adults aged 20 years and older, by poverty level, in the United States, 1988-2010. Body mass index (BMI) equals weight in kilograms divided by height in meters squared. Obesity equals BMI greater than or equal to 30. Percentage of poverty level is calculated by dividing family income by the U.S. Department of Health and Human Services' poverty guideline specific to family size, appropriate year, and state. Percentages are of the estimated poverty threshold. SOURCE: Based on data from the National Health Interview Survey, see http://www.cdc.gov/nchs/hus/healthrisk.htm [July 2015].

Even if innovation increases life expectancy in the future, it may widen inequality in life expectancy. Access to innovative health technology (e.g., new treatment for a major chronic disease) has been historically unequal because of the nature of new discoveries, which tend to be relatively costly to implement at first. Thus the groups in the high end of the income distribution are likely to benefit from new medical technology first, producing and exacerbating health disparities. A similar conclusion is reached by researchers who document a wider gap in disparities by education groups when new medical technologies that require sophistication are introduced (Goldman and Lakdawalla, 2005). Because new technologies are expected to continue to propagate and be adopted differently by groups within the population, significant health disparities from this source are expected to prevail in the foreseeable future (Rogers et al., 2013).

Unequal ability to manage diseases by ill persons in the high end of the income distribution compared to those at the lower end has been proposed as a persisting source of the health gradient. There is evidence that the health gradient across educational groups of the U.S. population is in part due to disparities in adherence to treatment. Goldman and Smith (2002) use diabetes and HIV as cases to illustrate this contribution to the health gradient.

Another important influence on future patterns of mortality differentials will be the impact of ongoing health care reforms in the United States. By providing increased access to health care to groups that lacked access previously, will these reforms produce narrowing gaps in risks of dying across socioeconomic groups? Research conducted to assess the consequences of not having health insurance concludes that the benefits of insurance are significant for the population in good health. In addition, a report from the Institute of Medicine (2009) found evidence of a secondary effect operating through the supply of health care services in the community. If communities are heavily uninsured, then the supply of services tends to be relatively low or of lower quality, thus affecting negatively even the health care of the insured groups living in the same community. If these arguments are applied to an increase in health insurance coverage due to health care reforms, then the past evidence would suggest that increased access to health care could result in higher use of preventive services, reducing premature death. Similarly, earlier detection of cancers and diminished risk of cardiovascular diseases, stroke, and injuries would be expected. However, evidence on the effects of recent reforms is not yet available.

Thus, uncertainty remains about whether mortality disparities will widen or narrow in the future. The committee's analysis does not assess the various causes of mortality and its disparities; it is instead a reduced-form extrapolation of previous trends. In the absence of clear evidence from a cause-based analysis, however, we view the trend extrapolation as an acceptable approach to a central estimate for the future.

ADDITIONAL CAVEATS TO THE MORTALITY ANALYSIS IN THIS REPORT

The discussion in this chapter has highlighted several caveats that apply to the chapter analysis and by extension to other parts of the report. By way of summary, the committee notes that although there is broad agreement among researchers that the dispersion of mortality by SES has widened in the United States in recent decades, there is uncertainty about the speed, extent, and differences by gender. We have used the HRS as our primary dataset for analysis of mortality as well as for other purposes, and both its sample size and the range of years it covers are smaller than one would like.

To be relevant for current policy choices, the committee has simulated outcomes for the generation born in 1960, but the HRS does not contain mortality data for this generation because it does not reach the age of 50 (at which primary eligibility for the HRS begins) until 2010, and the latest

HRS administration used for this report was in 2008. Therefore, we had to simulate or project the mortality of this generation. The committee did have data for at least a few years for generations born up to 1953, but we had to extrapolate for at least 7 years on the assumption that earlier observed trends continue. Furthermore, as discussed earlier, the analysis observes the mortality of more recent generations only when they are in their 50s, whereas it observes the mortality of earlier born generations at older ages such as in their 70s. Fortunately, Waldron (2007, 2013), using the larger Social Security dataset, confirms that differentials are widening even when all generations are observed at the same younger ages.

We have avoided any causal interpretation of the widening trends we observe because our calculations do not require one. The simple association is sufficient to calculate the consequences for the progressivity of various public programs. Although it would be useful to know whether the widening distribution in earnings is a cause of the widening distribution of mortality and life expectancy, the committee's analysis does not address this issue. There are many other points that similarly are not addressed—for example, the relative roles, if any, of education, smoking, and obesity. These topics deserve study in their own right.

The measurement of lifetime earnings used by the committee follows other recent literature, but it is a compromise forced on us by the history of Social Security coverage and benefits. We, like others, have used the average of earnings during years when earnings were positive, for a span of 10 years near typically peak earnings. The whole earnings history cannot be used because many workers in earlier cohorts joined Social Security well after they began working, so Social Security earnings histories miss a segment of their earlier earnings.

In light of its deliberations on the data and the literature, the committee believes that policy makers and researchers alike should pay more attention to the distribution of life expectancy—and not just to changes in average life expectancy—because it appears that something of importance is occurring that has received too little attention. We acknowledge, however, that this report has significant limitations with respect to the available data and the necessary analytical assumptions described in this chapter. The committee therefore hopes that the report will spur further research and discussion of trends in life expectancy inequality, much as the literature on income inequality has expanded over the past two decades.

4

Implications of Growing Heterogeneity

How should society react to disproportionate historical and projected mortality gains among different segments of the population? Should groups that have larger gains in their life expectancy receive correspondingly larger gains in the present discounted values of their government benefits?

For most government programs, there is little concern for the question of the present value of benefits. For example, policy makers would not worry about people with a lower life expectancy receiving lower lifetime benefits from national defense or clean air because there is no obvious time dimension: in any given year, people who are alive pay taxes and receive benefits. But for programs with a strong or explicit time and age dimension, where the ages at which taxes are paid and benefits are received differ significantly, the principle of equal treatment requires consideration of such differences.

Since the inception of Social Security, for example, discussions of the philosophy of its benefit structure have revolved around two concepts. The first is the expected rates of return that individuals receive on the money that they and their employers pay in contributions during their working years. An "actuarially fair rate of return" would mean that an individual could expect to receive back from the system a stream of benefits with a present value equal to the present value of the contributions collected in his or her name. As is inherent in the start-up of a pay-as-you-go system, early cohorts of Social Security recipients received average rates of return on their contributions that were in excess of the actuarially fair rate of return. Given demographic trends, however, those retiring today and in future decades will receive average rates of return below the actuarially fair level, reflecting the cost of transfers to earlier cohorts of retirees. Within a cohort (i.e., an age group at a point in time), one can compare expected rates of return for different segments of the population (e.g., income groups) and question the extent to which these are "equitable," in the sense of different groups having similar expected rates of return.

The second central consideration in the philosophy underlying Social Security is the extent to which benefits provide an adequate safety net for individuals in the lower part of the income distribution. This safety net is achieved via a transfer from those with high lifetime income to those with low income.

The justification for considering equitable rates of return comes from several sources. The first is simple fairness: the notion that individuals should receive from the system a benefit commensurate with what they put in. This notion is particularly important if one views Social Security as a system to force people to save for their retirement. A second, related, consideration is based on political economy. If some elements of the population view Social Security as being unfair, then there would be support for dismantling the system. The third justification is efficiency: providing an actuarially fair rate of return minimizes the disincentive to work that would otherwise be associated with mandatory Social Security contributions, both during the working career and at the margin of the date of retirement.[1] Many aspects of the Social Security system are designed to underline the equitable rates of return dimension. These include the designation of flows from workers as "contributions" rather than taxes, the fact that half of the contribution comes visibly from the worker's paycheck, and the tracking of contributions over each individual's working life.

The justification for the redistribution from high- to low-income individuals is a utilitarian concern for the poorest members of society. Unlike the return of one's own contributions in the form of benefits, this redistribution is not as visible an element in the structure of Social Security. Rather, it is embodied in the benefit formula, which is opaque to most recipients. The tradeoff between equity in rates of return and redistribution from high- to low-income individuals is embodied most notably in the structure of the Social Security benefit formula that translates average indexed monthly earnings (AIME)[2] into a primary insurance amount (PIA), as well as in provisions such as survivors' benefits.

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[1]If workers recognize that their payroll taxes are associated with future benefits, then the effects of these taxes on labor supply should be muted relative to income taxes, which carry no marginal benefit. Whether workers actually respond differently to payroll taxes than to income taxes is unclear.

[2]The computation used by the Social Security Administration to define the AIME is described further below, in the section "Background on Social Security."

IMPLICATIONS OF GROWING HETEROGENEITY FOR SOCIAL SECURITY

Because of the progressivity of the Social Security benefit formula, individuals with low lifetime earnings *ceteris paribus* on average receive higher expected rates of return on their contributions than those with higher lifetime earnings. Thus there is an inherent tradeoff between equity in terms of rates of return and the degree to which the system redistributes among income groups. In the current Social Security system, the gap in expected rates of return between low- and high-income individuals is neither as large as it would be under a flat old-age pension (in which all individuals received the same benefits regardless of the amount contributed) nor as small as it would be in a system of individual accounts in which there was no redistribution.

Another salient aspect of Social Security is that it is an annuity. Such a system necessarily entails redistribution from people who die young to those who die at older ages. This redistribution generates *ex post* inequity in terms of rates of return. Unlike the *ex ante* differences in returns that are generated by the benefit formula, this sort of *ex post* inequality is not necessarily perceived as a negative aspect of the system. There is a good reason for this: annuities are simply a form of insurance against living a long time, in which case there will be more years of consumption that have to be paid for. Similarly, people whose houses do not burn down earn a low rate of return on their fire insurance, while those whose houses do burn down earn a high rate of return; but the *ex post* inequality of rates of return does not seem problematic because those who earn the high rates of return need the money more and because, *ex ante*, one does not know which group one will be in.

The fact that Social Security benefits are paid in the form of an annuity may be taken to be a form of paternalism, in the sense that most well-informed and rational consumers would have chosen to sign up for an annuity anyway. Alternatively one may view Social Security as solving the problem of adverse selection in the annuity market.[3]

The distinction between *ex post* and *ex ante* inequity can be used to think about the effect of differences in life expectancy among groups on Social Security payouts. Much of the reason that *ex post* inequity may not offend notions of fairness is that it is not predictable. Among the population of living 60-year-olds, there are some who will receive high *ex post* rates of return because they live a long time, while others will receive low rates of return because they will die young, but mostly we do

[3]Adverse selection in the annuity market refers to the observation that individuals who purchase annuities tend to live longer than people who do not buy such products. Longer-lived people are more costly for insurers, and their participation in the market raises overall prices (see Webb, 2006).

not know which people are which. Thus there is no perception of unfairness, and no distortion of decisions about labor supply.

However, when there are identifiable groups that vary in life expectancy, the inequity is more easily perceived. Furthermore, because the *ex post* inequity penalizes, on average, those with lower lifetime earnings, it undermines the progressivity of Social Security and has the potential to undo much of the redistribution embedded in the benefits formula.

To show the interaction of changing life expectancy with considerations of equitable rates of return and adequacy of benefits for lower-income individuals, the committee uses a very simple, stylized model. To match the analysis of data elsewhere in this report, we switch our focus from rates of return to the present value of net benefits received by different groups. However, these two concepts are closely related: for an individual with a given history of contributions, an increase in the present value of net benefits translates into a rise in the expected rate of return.

Consider a simplified scenario in which there are two equally sized groups: high income and low income. Within each group, all individuals have the same income. As a starting point, imagine a scenario in which the first group has higher lifetime wages (and thus higher contributions to Social Security) but in which the two groups have equal life expectancy. Also assume that the Social Security system is financially balanced, so that the present value of contributions from both income groups combined is equal to the net present value of benefits paid to both groups.

Figure 4-1 shows the relationship between the degree of redistribution incorporated into the benefit formula and the present value of benefits received by members of the two groups. Specifically, the horizontal axis represents the sensitivity of benefits to contributions. The left-most entry on this axis ("none") indicates a system in which high- and low-income groups receive the same annual benefits. The right-most entry ("full") indicates a system in which there is no redistribution embodied in the benefit formula. Each income group is represented by one curve on the graph.

The curve representing the relationship between the sensitivity of benefits to contributions and the present discounted value of benefits is downward sloping for the low income and upward sloping for the high income. Notably, in the case where there is no sensitivity of benefits to contributions (i.e., full redistribution) the two curves intersect, meaning that the two groups have the same present value of benefits despite their differences in earnings and Social Security contributions. At the right side of the graph, the gap in present value between high and low income is proportional to the gap in the present value of their Social Security contributions. Figure 4-1 also shows an initial level of sensitivity of benefits to contributions in the middle of the range, indicating a benefit formula with partial redistribution: the high-income group has higher present value of benefits than the

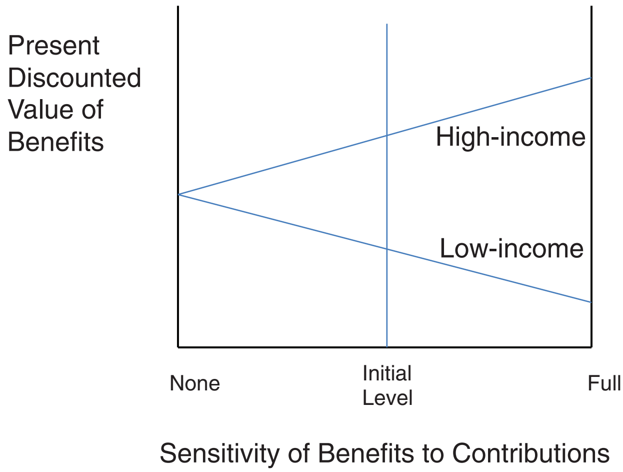

FIGURE 4-1 Present discounted value of benefits with equal mortality.

low-income group, but the gap in these benefits is smaller than the gap in the present value of contributions between the two groups. This "initial level" presumably represents some choice on the part of society regarding the proper balance of equity in rates of return versus adequacy of benefits for people with low lifetime income.

Now consider the effect of differential changes in mortality in this setting. In the simplest case, life expectancy rises for the high income but remains constant for the low income. The initial effect of this change, holding the benefits formula constant, would be to shift upward the curve representing the present value of benefits received by the high income without affecting the present value of benefits received by the low income (see Figure 4-2). For the same "initial level" in the sensitivity range, the gap in present value of benefits between the two groups would thus rise.[4]

[4]Although this example focuses on present value of benefits, the same effect can be illustrated in terms of rates of return, as in the analysis by Goda and colleagues (2011). They look at the effect of differential mortality on the rate of return to Social Security contributions for stylized workers at different points in the earnings distribution. For example, considering the cohort born in 1938, males in the 25th percentile of the earnings distribution would receive an internal rate of return (IRR) of 1.51 percent versus an IRR of 0.75 percent for those at the 75th percentile, if the two groups experienced mortality at the average rate for males of their cohort. However, adjusting for the mortality rates actually experienced by these different parts of the earning distribution, the IRR for males at the 25th percentile decreases to 1.07 percent, while the IRR for males at the 75th percentile increases to 1.28 percent. In this particular case, the effect of differential mortality is sufficient to raise the IRR for high earners above that for low earners, but this is not always so; it is not true for some of the other male birth cohorts

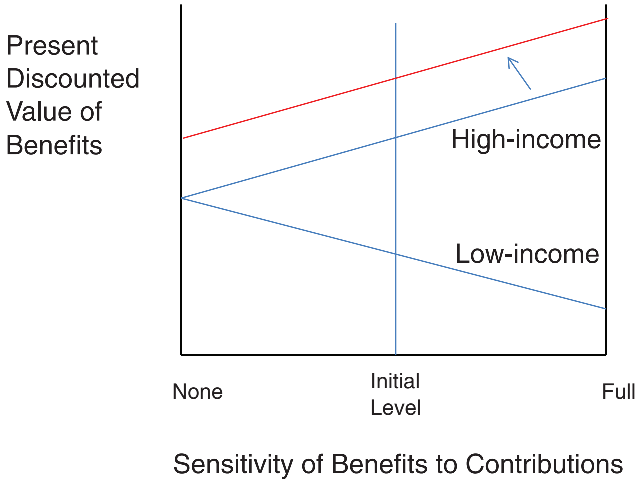

FIGURE 4-2 The effect of decreased mortality among the high-income on relative present discounted value of Social Security benefits.

Results from the Future Elderly Model (FEM) can be used to illustrate the effect just described, anticipating more detailed results to be presented later in this chapter. Specifically, consider the change in the present discounted value of future benefits (taking all entitlement programs together) of 50-year-olds that results from projected changes in mortality between the cohort born in 1930 and the cohort born in 1960 (the latter based on the committee's "best forecast"). For this exercise, the wage profiles of individuals are held constant, as is the policy environment regarding all government entitlement programs. For males in the bottom quintile of lifetime earnings, the present value of net benefits (i.e., benefits after age 50 minus taxes after age 50) would change very little, reflecting the small change in their life expectancy. Specifically, projected net benefits would fall from $319,000 to $310,000. By contrast, for males in the top quintile of lifetime earnings, the present value of projected net benefits would rise from $189,000 to $306,000.

The analysis of how differential mortality affects the present discounted value of net benefits is only a first step in the story. If life expectancy rises for high earners but is relatively constant for low earners, then that will raise the present value of net benefits of the former group and leave unchanged the present value of net benefits of the latter. However, if the Social Security system is to remain actuarially balanced, then something else has

they examined or for any of the female cohorts they examined. Nonetheless, the accounting for differential mortality always made the system less progressive (Goda et al., 2011).

to change in response to this change in life expectancy. The easiest adjustment to think about is an increase in the normal retirement age (NRA), defined as the age at which beneficiaries receive "full" benefits under the Social Security benefit formula (described in more detail later in this report). Whatever its policy benefits and costs, an increase in the NRA has historically been part of the response of Social Security to rising life expectancies. An increase in the NRA will reduce the present value of benefits for both groups. In Figure 4-3, this is represented as a downward shift in the curves representing present discounted values for both high-income and low-income participants.

Given that the current system reflects a balancing of concern with equity in rates of return with adequacy of income for people with low income, one can see that the change in mortality in the absence of a change in the benefit formula moves the system in the direction of more equity and less adequacy—that is, in the direction of making it less redistributive. This can be seen in Figure 4-3, where the net result of changing longevity and the adjustment of Social Security NRA is that the present discounted value of benefits has risen for the high income and fallen for the low income and that the gap between these present values has increased. In the figure, these effects can be undone by shifting the vertical line representing the sensitivity of benefits to contributions to the left; in other words, making the formula that maps the AIME into a PIA have a larger redistributive component. This is shown in Figure 4-4.

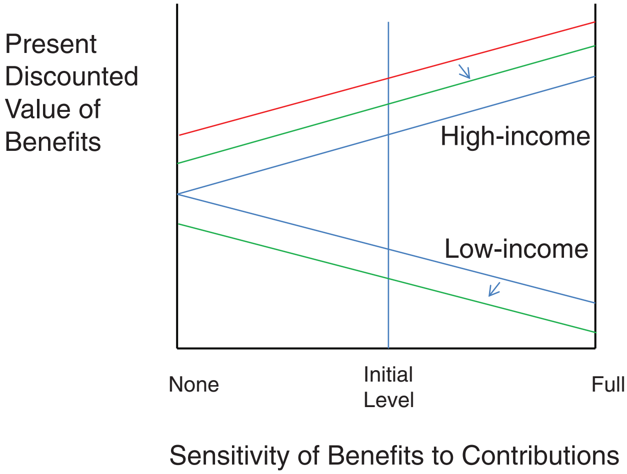

FIGURE 4-3 An increase in normal retirement age (NRA) to offset lower mortality of the high income (red line). Arrows indicate the change in benefits curves, relative to Figure 4-2, due to the increase in NRA.

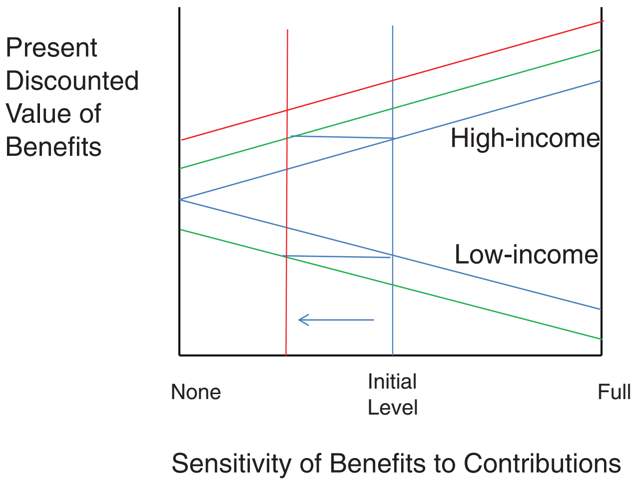

FIGURE 4-4 A change in the benefit formula (shift of vertical line to the left) to counteract the combined effects of increased longevity for the high income and an increase in normal retirement age.

There are several subtleties that are ignored in this simplified presentation. Perhaps most significant, by focusing on the present discounted value of benefits rather than annual benefits themselves, the analysis above ignores the degree to which growth in life expectancy can strain the system. In the face of rising life expectancy, the present value of benefits is held constant by reducing annual benefits. But this constancy of expected return may be of little comfort to an elderly person who now has to get by with smaller annual benefits. In this simple example, it was possible to restore the present value of benefits of both high and low income to the same levels that existed before the change in longevity. Because the longevity of the low income did not change, this would require increasing their benefits to fully undo the increase in the NRA. As a result, the entire reduction in annual benefits would fall on the high income.

EFFECTS OF DIFFERENTIAL MORTALITY ON BENEFIT CLAIMING AND RETIREMENT INCENTIVES

The above discussion focused on the fairness aspects of mortality differentials. A second consideration is the effects of differential mortality on the incentives for Social Security benefit claiming. Social Security beneficiaries can choose to claim benefits earlier or later than the NRA, but the benefits are adjusted in such a way as to provide the same present value of lifetime benefits, on average.[5] Because those who claim early will, on average, receive more years of benefits than those who claim later, the average monthly benefit is adjusted down. Similarly, those who delay claiming benefits will receive fewer years of Social Security benefits, and their benefit is adjusted up.

The adjustment is intended to be actuarially fair so as to provide the same present value of benefits regardless of when someone claims benefits. But the benefits of early claiming depend on life expectancy. Consider those whose life expectancy after age 67 is 10 years; for them, claiming at 62 would increase their years of benefits by about 50 percent (15 years instead of 10 years).[6] If, instead, their life expectancy at age 67 were 20 years, then early claiming would have a proportionally smaller effect on years of benefits (25 years instead of 20 years, or a 25% increase). Thus, in order for the system to be actuarially fair for high earners and low earners, the adjustment would have to depend on income in a way that changed over time in keeping with changes in life expectancy by income category.

Differential mortality in relation to lifetime earnings thus does two things. Relative to a situation in which the low and high income have the same life expectancy, differential mortality lowers lifetime benefits for lower earners. Second, it also raises the incentives for early claiming for the lower earners. A more efficient and arguably fairer system would have both the annual benefits and the early claiming adjustments indexed to life expectancy. This would mean that people with lower than average life expectancy (in this context, those with low lifetime income) would face a larger reduction in monthly benefits for early claiming, and similarly a larger increase in monthly benefits for late claiming, than would people with higher life expectancy. This sort of indexing could raise lifetime Social Security benefits for poor people and lower their incentives for early claiming relative to the current system. To the extent that retirement and claiming go hand in hand, this would also lower the incentive for early retirement.

The question of early retirement incentives is a difficult one, however. On the one hand, encouraging lower-income workers to delay retirement

[5]Social Security benefit claiming and retirement may not occur simultaneously, because one can claim benefits but continue to work or retire but postpone claiming benefits. This discussion focuses on claiming because the benefit adjustment discussed depends on age of claiming, not age of retirement. For simplicity, our discussion assumes that the age of retirement is fixed (e.g., at the early retirement age), while the age of benefit claiming may vary. Of course, an incentive that encourages a worker to claim later may also lead him or her to retire later. If that occurs, then the worker's monthly benefit amount would generally rise because of his or her longer work history (as well as because of the adjustment mechanism discussed here), although the worker would also be making additional payroll tax contributions.

[6]For simplicity, this calculation assumes that all retirees survive until at least age 67.

would increase lifetime earned income as well as annual Social Security benefits. On the other hand, not penalizing the earlier retirement for lower-income workers might be a better social policy: these workers might be in poorer health, making work more difficult; they may have more physically taxing jobs; they may have worked for more years because they are less likely to have taken time out for education; and, because of their shorter life expectancy, they may want to retire early to ensure that they actually get to enjoy retirement for a few years in good health.

THE DISTRIBUTION OF SOCIAL SECURITY BENEFITS

The preceding discussion of conceptual issues surrounding the progressivity of Social Security under differential mortality abstracts from many details of how the program operates. In this section, the committee provides some additional background information on the Social Security program that is necessary for our subsequent discussion and reviews the empirical literature on the distributional effects of Social Security before turning to new estimates based on the FEM.

Background on Social Security

While the basic structure of Social Security is straightforward, there are many complexities that affect its distributional impact. Individuals are eligible to receive retired worker benefits if they have a minimum of 10 years (40 quarters) of covered earnings. To calculate the monthly benefit amount, past earnings are multiplied by a wage index to bring their value up to the present day. An average of the top 35 years of indexed earnings is calculated, which, converted to a monthly value, is the AIME. Next, a piecewise linear formula (straight lines connecting bend points) is applied to the AIME to create the PIA, which forms the basis for the monthly benefit amount. This formula introduces progressivity into the system because the rate at which the AIME is translated into PIA declines as AIME increases. In 2014, each dollar of average monthly earnings up to the first bend point of $816 is converted into 90 cents of PIA; the conversion factor is 32 percent of PIA until the next bend point of $4,917 and 15 percent for earnings beyond this value.

The monthly benefit amount also depends on the age at which benefits are first claimed. Workers may claim as early as age 62, the early entitlement age,[7] and as late as age 70. Workers receive the PIA if they claim at the NRA, which has been rising over time from age 65 (for those born by

[7]The term "early entitlement age" may also be referred to as "early eligibility age" in the research literature.

1937) to 67 (for those born in or after 1960). Workers face an actuarial reduction (increase) for claiming before (after) the NRA, designed to ensure that the expected benefits received over a worker's lifetime are roughly the same regardless of claiming age.[8] A worker whose NRA is 67 receives a benefit equal to 70 percent of PIA by claiming at age 62 or equal to 124 percent of PIA by claiming at age 70.[9]

A few more relevant details pertain to other benefits and Social Security financing. Dependent and surviving spouses and children of insured workers are eligible for benefits, equal to 50 percent of the worker's PIA for a dependent spouse and 100 percent for a surviving spouse. Many individuals are dually entitled as both a worker and a spouse but receive only the larger of the benefits to which they are entitled. The Social Security and Disability Insurance (DI) programs are integrated; the DI benefit calculation is largely similar to that for Social Security except that there is no reduction for early claiming, and DI eligibility requires passing a medical screening process as well as meeting recent work requirements. Finally, Social Security and DI benefits are funded by payroll taxes (or contributions) of 6.2 percent of earnings by both employers and employees (12.4 percent total) on workers' earnings up to a taxable maximum amount: $117,000 in 2014.

Past Research on the Progressivity of Social Security

One way to estimate the progressivity of Social Security is to compare the replacement rate for workers at different points in the income distribution. The replacement rate is usually defined as the monthly benefit amount divided by pre-retirement average monthly career earnings.[10] The Board of Trustees of the Federal Old-Age and Survivors Insurance and Federal Disability Insurance Trust Funds (2013) reported that the replacement rate for a worker who consistently earns the national average wage over his or

[8]Whether the reduction factor is, in fact, actuarially fair for a typical worker is a matter of some dispute. Shoven and Slavov (2013) argue that the gains from delaying Social Security have increased dramatically since the 1990s because of a combination of low interest rates, increasing longevity, and legislated increases in the gain for claiming delays beyond the NRA (the Delayed Retirement Credit).

[9]A further complication in the benefit calculation is the Social Security earnings test. Before the NRA, workers face a reduction in benefits if they earn above an exempt amount ($15,480 in 2014). However, upon reaching the NRA, the worker is credited for any lost months of benefits through a recomputation of the actuarial adjustment. Although there is some evidence the earnings test may affect claiming behavior (Gruber and Orszag, 2003), it does not affect the (*ex ante*) progressivity of Social Security, and so the committee abstracts from it in our discussion.

[10]The replacement rate may also be calculated using final earnings or an average of earnings in the years just before retirement. Goss and colleagues (2014) compared replacement rates using alternative earnings measures.

her career (a "medium-wage" worker) and retires at age 65 would be 41.7 percent. The replacement rate rises to 56.3 percent for a low- wage worker and to 77.4 percent for a very low-wage worker; it falls to 34.6 percent for a high-wage worker.[11] The monthly benefit amount rises with past earnings, even though the replacement rate falls; the hypothetical high-wage earner would receive a benefit of $2,016 a month, versus $1,520, $923, and $705 for the medium-, low-, and very low-wage earners, respectively. Nonetheless, as measured by the replacement rate, the Social Security system is progressive in the sense that the system replaces a larger fraction of earnings for lower-income workers.

One clear drawback of the replacement rate measure is that it includes benefits but not contributions, yielding an incomplete picture of the program's distributional impact.[12] Several related measures of Social Security's "money's worth" address this shortcoming, as detailed by Geanakoplos and colleagues (1999). One such measure is the internal rate of return (IRR), the interest rate that a worker would have to receive on contributions to a (hypothetical) savings account so that the account balance at the time of the worker's retirement would finance a stream of benefits equal to those promised by Social Security. A second measure is the benefit/tax ratio, which is the present value of lifetime benefits received divided by the present value of taxes paid (using an assumed rate of time preference, or discount rate). Another measure is the net transfer, which is the difference of the two present values rather than their ratio. As with the replacement rate, one might compare the money's worth measures for people at different points in the income distribution to assess progressivity.[13] An alternative approach, employed by Coronado and colleagues (2011), is to calculate the Gini coefficient, a measure of income inequality within a population, before and after Social Security benefits and taxes, to see if Social Security reduces (or increases) inequality.

It is well known that the money's worth of Social Security has fallen over time, as the introduction of a pay-as-you-go system benefited early cohorts, whose benefits were quite generous in light of their modest contri-

[11] Goss and colleagues (2014) compared these fictional workers to real workers from a large sample of 2011 claimants and found that the very low-, low-, medium-, and high-wage workers correspond to workers at the 12th, 25th, 56th, and 81st percentiles of the lifetime earnings distribution, respectively.

[12] Economic theory suggests that the incidence of employer contributions to Social Security may fall on workers, in the form of reduced wages; evidence from Gruber (1997) supports this hypothesis, and virtually all analysts adopt this convention in their calculations.

[13] In theory, one might also wish to compare how Social Security affects the utility (happiness) of individuals at different points in the income distribution. However, comparing utility across individuals would require making additional assumptions for which there is relatively little guidance from economic theory. Therefore, discussions of Social Security progressivity generally rely on financial, rather than utility, measures.

butions, at the expense of later cohorts, who necessarily fared less well as the system matured and the worker to beneficiary ratio fell. Leimer (1995) reported that the 1900 birth cohort received an IRR of 11.9 percent, as compared to 4.8 percent for the 1925 cohort, 2.2 percent for the 1950 cohort, and 1.9 percent for the 1975 cohort.

For our purposes, however, it is more relevant to look at money's worth within a birth cohort. Liebman (2002) did so for a sample of individuals born in 1925-1929. Grouping individuals in quintiles according to the AIME (of the higher-earning spouse, for married individuals), he found that the system is progressive. The IRR was 2.70 percent for the lowest AIME quintile in his cohort, 1.32 for the middle quintile, and 0.85 for the top quintile. With a 3 percent discount rate, all quintiles experience a negative net transfer, but the lowest AIME quintile loses $22,103 or 3.3 percent of earnings, versus $196,230 or 7.9 percent of earnings for the top quintile. With a lower discount rate of 1.29 percent, the two lowest AIME quintiles experience positive net transfers, on average.

The results obtained in any analysis of money's worth depend, to some extent, on decisions the researcher must make in order to carry out the calculations. Chief among these is the choice of earnings measure used to determine an individual's place in the income distribution. Gustman and Steinmeier (2001) and Coronado and colleagues (2011) found that the estimated progressivity of Social Security may be reduced or even eliminated when using lifetime rather than annual earnings, household rather than individual earnings, and potential (with full-time work at the current hourly wage) rather than actual earnings. These changes reduce progressivity because there may be people who have low earnings by the initial earnings measure and receive high net transfers who would be reclassified as higher earners under the new definition, such as a part-time worker (higher potential than actual earnings) or nonworking spouse (higher household than individual earnings). The inclusion of earnings above the taxable maximum increases progressivity, because it boosts the earnings of the highest-income workers and thus lowers their replacement rate. Using a higher discount rate is another decision that tends to reduce progressivity, by reducing the value of benefits received at very old ages, which accrue disproportionately to higher-income workers (Fullerton and Mast, 2005).

Another key factor that may affect the progressivity of Social Security and is of particular interest here is differential mortality. As described earlier, there are large and growing differences in mortality by socioeconomic status (SES) that would be expected, by themselves, to reduce progressivity. Liebman (2002) explores this empirically, using education and race/ethnicity as measures of SES. When money's worth is calculated using mortality probabilities that vary only by age and sex, low-SES groups gain more from Social Security than do high-SES groups. The IRR is 0.60 percentage points higher for blacks than for whites and 0.55 points higher for high school dropouts than those with some college or more. When race- and education-specific mortality tables are used, the estimated black-white difference in IRR falls to 0.10 points and the education difference falls to 0.17 points. In essence, the progressive effect of the Social Security benefit formula is largely undone by the fact that low-SES groups have lower life expectancies and so receive fewer years of benefits, on average.

While the discussion to this point has focused on Social Security retired worker benefits, disability insurance benefits are also relevant. DI benefits are likely to be quite progressive for several reasons (Meyerson and Sabelhaus, 2006). First, DI benefits are calculated using the same progressive formula as retired worker benefits. Second, low-income workers are empirically more likely to enter the DI program and receive benefits. Third, workers who end up on DI have shortened careers, which may make them more likely to be classified in a low-income group, depending on the earnings measure used in the analysis. In the Meyerson and Sabelhaus analysis, the overall Old-Age, Survivors, and Disability Insurance system is strongly progressive, with workers in the lowest quintile of household lifetime earnings having a benefit-tax ratio of 1.65 versus 0.65 for workers in the top quintile (for a sample of workers born in the 1960s, using a 3 percent discount rate and incorporating differential mortality). The lion's share of this progressivity is due to DI benefits, which account for approximately 0.60 of the ratio at the 10th percentile of income versus about 0.05 at the 90th percentile.

A final program worthy of mention is the Supplemental Security Income (SSI) program, which is included in the calculations below. The program provides cash benefits to low-income individuals who are aged 65 and older, blind, or disabled. In 2014, the maximum monthly benefit amounts were $721 for single individuals and $1,082 for couples, but these benefits are, with few exceptions, reduced dollar-for-dollar against other income, including Social Security or DI benefits. Therefore, the program is expected to provide benefits primarily to very low-income individuals and to add to the overall progressivity of old-age support programs.

FEM Results on the Distribution of Social Security Benefits

The committee's discussion now turns to the new estimates of the distribution of Social Security benefits generated specifically for this study using the FEM (see Box 4-1). To put these results in context and facilitate comparison with the previous literature, it is worth highlighting several aspects of the committee's approach. First, our estimates represent the projected present value of the stream of benefits that individuals can expect to receive from age 50 until death, using a real rate of 2.9 percent to discount future

BOX 4-1
Cohorts and Scenarios in the Future Elderly Model (FEM)

The committee's analysis of public programs focuses on two hypothetical cohorts that have the health and mortality experience of people born in 1930 and 1960. The FEM takes a cohort of Americans at age 50—each of whom has a measure of lifetime income and an initial health status—and simulates their lifetime benefits in a baseline scenario, which is based on the 1930 cohort. It then modifies the health and mortality experience to mirror that of the 1960 cohort. The model starts in 2010 with the policy environment observed in that year and assumed to persist throughout the simulation. The model is run biennially until everyone in the cohort has died; lifetime benefits and other outcomes are tracked. This establishes a baseline scenario against which other scenarios can be compared, such as what would happen if mortality differences changed by income group or what would happen if program eligibility or benefits changed.

benefits back to age 50. These estimates are not directly comparable to the money's worth measures discussed above because they do not incorporate Social Security taxes and they represent the value of benefits as of age 50. Second, to classify individuals into quintiles, we use the average of nonzero earnings between ages 41 and 50; for married individuals, we sum household earnings and divide by the square root of 2. This approach is likely to generate lower estimates of progressivity because it uses: (1) an average of earnings rather than a single year's earnings; (2) household rather than individual earnings; and (3) by excluding zero-earnings years, something closer to potential rather than actual earnings for a worker with an intermittent work history. Although decisions such as the choice of earnings measure are always important, they are arguably less critical in this case, given that our goal is not to estimate the money's worth of Social Security per se but rather to assess how the distribution of Social Security benefits is changing over time in light of unequal longevity increases.

The experiment that the committee performs is based on the program rules as of 2010 and compares outcomes for two hypothetical mortality and health regimes. The first is based on the experience of the 1930 birth cohort, with its initial health status distribution by income quintile and estimated mortality gradient. The second is based similarly on the experience of the (simulated/projected) 1960 birth cohort health status and gradient. Health status does not enter directly into mortality or medical spending, so those outcomes are driven entirely by the mortality gradient as described

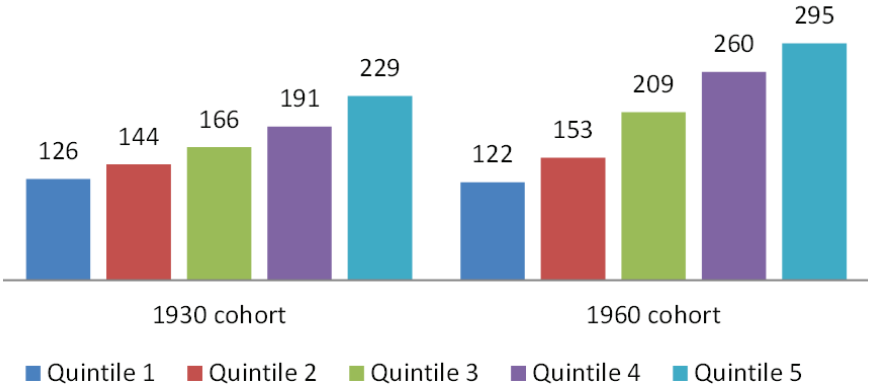

FIGURE 4-5 Average lifetime Social Security benefits for males (in thousands of dollars).
SOURCE: Committee generated using Health and Retirement Study data and cohort assumptions.

in Chapter 3.[14] Health does influence some economic outcomes, so the differences in initial health prevalence and simulated health transitions for the two cohort regimes will lead to some cohort differences in trajectories in earnings, workforce participation, Social Security claiming, SSI claiming, and DI claiming. And again we emphasize that our estimates are dependent on *projections* of mortality after age 50, rather than observed levels, for the 1960 cohort.

Given this setup, we calculate the present value of lifetime benefits received by each lifetime earnings quintile in each generation; for the 1960 cohort, this calculation is entirely based on projected net benefits. Later in this chapter, we also include taxes paid after age 50 to compute overall net benefit profiles from Social Security and other programs combined. (A description of the FEM's estimation of taxes and net benefits is included in Chapter 2.) Because we do not attempt to allocate income taxes to each individual program, however, we use the net benefit concept only when examining the major entitlement programs in combination. We use a benefit-only approach when examining each program in isolation.

The baseline estimates of the present value of survival-weighted Social Security benefits for males by earnings quintile are displayed in Figure 4-5. For the 1930 cohort, benefits rise with earnings quintile. Workers in the

[14]In the committee's use of the FEM, health status does not directly influence mortality outcomes but the lower quintiles have both worse health status (e.g., more diabetes) and higher mortality.

lowest quintile (quintile 1) can expect to receive, on average, $126,000 of benefits over the rest of their lives (discounted back to age 50), while workers in the top quintile (quintile 5) can expect to receive $229,000, a value which is $103,000 or 82 percent more than that for bottom quintile workers. The fact that higher earners receive higher benefits is not surprising, because the monthly benefit amount rises with the AIME, albeit in a nonlinear relation.

The real point of this calculation, however, is to see how the results change when one moves to the mortality and income experience based on the 1960 cohort. The committee's results suggest that between the 1930 and 1960 cohorts, projected life expectancy at age 50 falls slightly for quintile 1 males (from 26.6 to 26.1 years), rises slightly for quintile 2 males (27.2 to 28.3 years), and rises more substantially for quintile 3 (28.1 to 33.4 years), quintile 4 (29.8 to 37.8 years), and quintile 5 males (31.7 to 38.8 years). The additional 6 to 8 years of life expectancy for the top three quintiles leads to large increases in their expected lifetime Social Security benefits, as seen in Figure 4-5, with projected benefits for the top quintile in 1960 reaching $295,000. For this cohort, the difference between the top and bottom quintiles is $173,000, or 142 percent of the bottom quintile's benefit.

These results suggest that Social Security benefits are becoming more unequal over time because of gains in projected life expectancy that accrue disproportionately to those in the upper half of the income distribution. Under the mortality conditions of the 1960 cohort, the lifetime benefits advantage of the top quintile over the bottom quintile has grown by $70,000 ($173,000-$103,000). Although payroll tax contributions are not included in these calculations, it seems unlikely that their inclusion would change the key finding, given the magnitude of the benefit increases enjoyed by the top three quintiles.

The results for females, shown in Figure 4-6, also show benefits rising with earnings quintile in the 1930 cohort, with expected benefits of $112,000 for quintile 1 female and $208,000 for quintile 5 females. Benefits here are any received by the individual, including dependent spouse and survivor benefits derived from the earnings record of the spouse. Because of their lower career earnings and benefit entitlements, females' total expected benefits are about 90 percent as large as those for males, even though they can expect to live 4 to 5 years longer. As for males, the gap between the top and bottom quintiles for female is large and widening over time, with values of 86 percent of bottom quintile benefits for the 1930 cohort versus 158 percent of bottom quintile benefits for the 1960 cohort. These percentage changes are a bit larger than those for males because the model predicts a decline in life expectancy for the four lower quintiles of females over time, so the expected benefits for bottom quintile females decline between the 1930 and 1960 cohorts. At the same time, the dollar gain by the

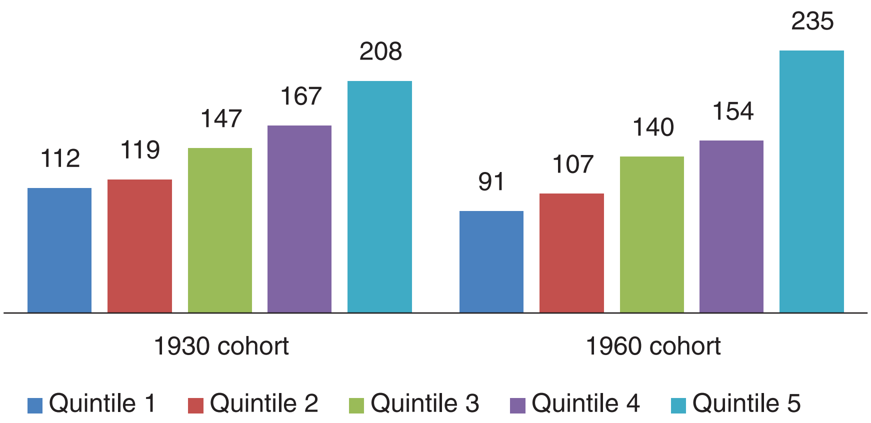

FIGURE 4-6 Average lifetime Social Security benefits for females (in thousands of dollars).
SOURCE: Committee generated using Health and Retirement Study data and cohort assumptions.

top quintile relative to the bottom quintile of $48,000 is smaller than for males. But the overall message is the same for females as for males: diverging life expectancy is making Social Security benefits vary more by earnings quintile over time.

The results for DI benefits are shown in Figures 4-7 and 4-8 for males and females, respectively. Expected DI benefits are much smaller than expected Social Security benefits because the probability of ever receiving DI benefits is far lower. As discussed above, DI benefits are predicted to be distributed more toward lower career earnings, and the results bear this out. While Social Security benefits rise with earnings quintile, DI benefits decline sharply. In the 1930 cohort of males, for example, benefits are $25,000 for the lowest quintile, $14,000 for the second, and $4,000 for highest quintile. While a low-AIME worker on DI receives a smaller benefit than a high-AIME worker on DI, the low-AIME worker is so much more likely to receive DI that his expected DI benefit is larger. The pattern for females is the same, but the values are less than half as large, because of their lower career earnings and somewhat lower probability of ever going on DI, compared to males.

In this experiment, expected benefits for both males and females are quite stable across cohorts. This is perhaps unsurprising, given that the increases in life expectancy are concentrated in the third through fifth quintiles, which have relatively low probabilities of DI claiming. In results not shown here, the FEM predicts that the probability of claiming DI over a

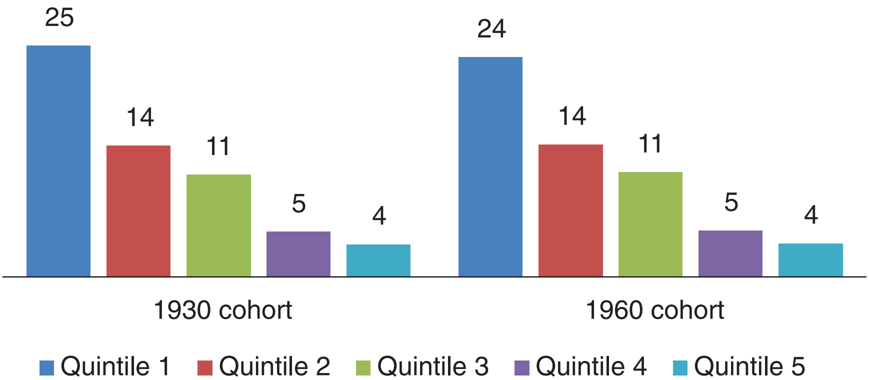

FIGURE 4-7 Average lifetime Disability Insurance benefits for males (in thousands of dollars).
SOURCE: Committee generated using Health and Retirement Study data and cohort assumptions.

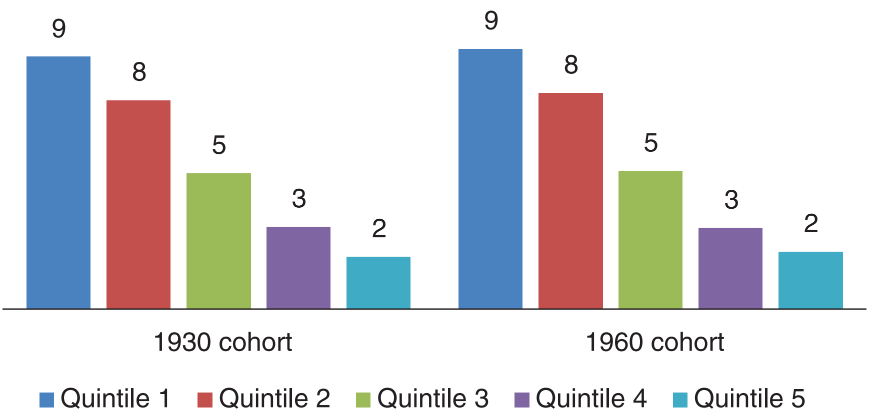

FIGURE 4-8 Average lifetime Disability Insurance benefits for females (in thousands of dollars).
SOURCE: Committee generated using Health and Retirement Study data and cohort assumptions.

2-year period for the 1930 cohort peaks around age 62 at nearly 20 percent for quintile 1 males versus roughly 10 percent for quintile 2 or 3 males and 5 percent or less for males in quintiles 4 or 5. The claiming behavior predicted by the FEM for later cohorts is similar. Thus, even though the 1960 cohort has a projected longer life expectancy than the 1930 cohort, this does not necessarily translate into larger expected DI benefits because the types of people who are living longer are unlikely to claim DI. Furthermore, the increases in life expectancy are largely occurring after the NRA, when beneficiaries are no longer receiving DI benefits.

Finally, the results for SSI benefits are shown in Figures 4-9 and 4-10. As with DI, SSI benefits are larger for the lower quintiles because of their

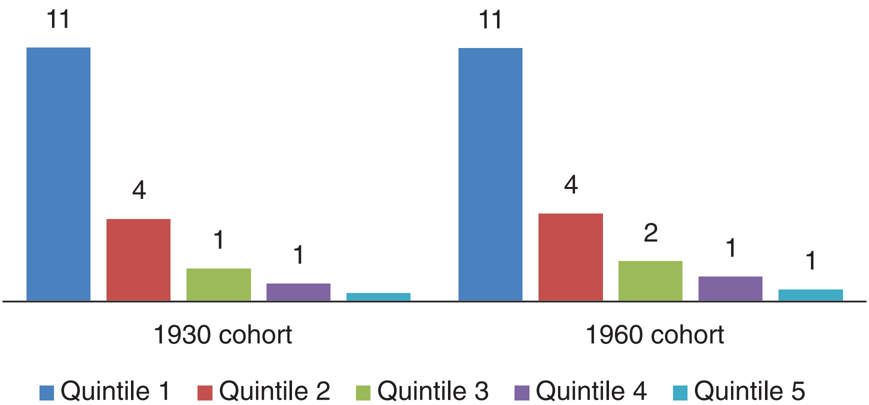

FIGURE 4-9 Average lifetime Supplemental Security Income benefits for males (in thousands of dollars).
SOURCE: Committee generated using Health and Retirement Study data and cohort assumptions.

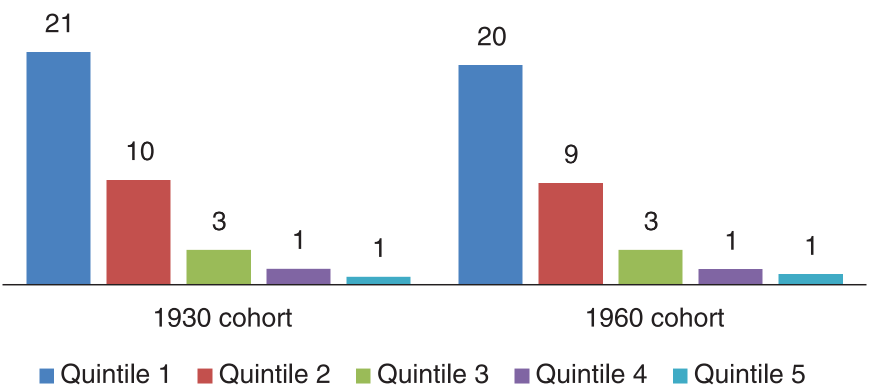

FIGURE 4-10 Average lifetime Supplemental Security Income benefits for females (in thousands of dollars).
SOURCE: Committee generated using Health and Retirement Study data and cohort assumptions.

higher probability of SSI receipt. For males in the 1930 cohort, expected benefits are $11,000 for the lowest quintile, $4,000 in the second, and $1,000 or less in quintiles 3 through 5. Values are about twice as large for females because of their longer life expectancy and higher probability of ending up with the very low income necessary to qualify for SSI. As with DI, changes across cohorts are relatively small.

THE DISTRIBUTION OF MEDICARE BENEFITS

Background on Medicare

The Medicare program is composed of two parts: Medicare hospital insurance, also known as Medicare Part A, helps pay for inpatient care in hospitals and skilled nursing facilities, as well as home health and hospice services. Medicare supplementary medical insurance, which consists of Medicare Parts B, C, and D, helps pay for physician, outpatient, prescription drug, and other services. People who are 65 and older and who have a minimum of 10 years (40 quarters) of Social Security covered earnings (or whose spouse has that minimum) receive Medicare Part A without paying a premium; most enrollees must pay a premium to receive the other parts of Medicare, although the premium covers just a small portion of the costs.[15]

Medicare shares many characteristics with Social Security. Medicare Part A is financed by payroll taxes paid during the working years, and the Medicare benefit is limited (largely) to those aged 65 and older.[16,17] However, the Medicare program has different distributional effects from Social Security for a number of reasons. First, the Medicare hospital insurance payroll tax, which finances Medicare Part A, is levied on *all* wages, rather than on wages up to a cap, as in Social Security. Second, Medicare supplementary medical insurance is financed by general revenues, which consist mostly of income taxes collected through a progressive income tax structure. Finally, whereas the Social Security benefit increases as lifetime earnings increase, Medicare offers essentially the same benefit package to

[15]Other than for high-income enrollees, the premiums for Medicare Part B (which covers physician, outpatient hospital, and some home health services) and Medicare Part D (which covers prescription drugs) are set at about 25 percent of program expenditures (Cubanski et al., 2014). The premium for Medicare Part C, which allows Medicare beneficiaries to enroll in private health insurance plans as an alternative to traditional Part A and Part B coverage, varies based on the chosen plan.

[16]Medicare hospital insurance also receives funding from taxation of the Social Security benefits of high-income taxpayers.

[17]Two other major groups that are eligible for Medicare are those with end-stage renal disease and those who have received DI benefits for 2 years (Rupp and Riley, 2012).

all beneficiaries; the *value* of this benefit is arguably greater for those with lower income.[18]

Valuing the Medicare benefit requires addressing some conceptual issues. First, because Medicare is an in-kind benefit rather than a cash benefit, the value placed on it by its recipients might not be equivalent to the cost to the government of providing it. That is, if beneficiaries were given the cash value of Medicare, some might choose to spend that cash on items other than health care. So, to measure the utility effect of Medicare, one might want to make an adjustment to reflect the fact that not all beneficiaries would value Medicare at its cost. For example, the Census Bureau, when valuing Medicare benefits, chooses to value them at their "fungible" value, which is a measure of what beneficiaries might have spent on health insurance in the absence of Medicare.[19] However, that method ignores the fact that even beneficiaries who couldn't afford to purchase Medicare's health benefits on their own still place some positive value on the benefits received.

Second, one might think that, because all Medicare beneficiaries receive the same medical insurance, one should value it the same for all—perhaps at the average per-beneficiary cost. However, the committee's view is that people who expect to use Medicare benefits more—those in poorer health, for example—would place greater value on it.

For the purposes of this report, we take the simple approach and value Medicare expenditures by lifetime income at their actual cost. Thus, we are measuring the actual government transfers received by people of different lifetime income and not necessarily measuring the welfare effects of such transfers on those individuals.

[18]One exception is that high-income beneficiaries face higher premiums for Medicare Parts B and D, further increasing the progressivity of Medicare. For a full description of the high-income premiums under Medicare, see http://kff.org/medicare/issue-brief/income-relating-medicare-part-b-and-part/.

[19]The Census Bureau explains this concept as follows: "The fungible approach for valuing medical coverage assigns income to the extent that having the insurance would free up resources that would have been spent on medical care. The estimated fungible value depends on family income, the cost of food and housing needs, and the market value of the medical benefits. If family income is not sufficient to cover the family's basic food and housing requirements, the fungible value methodology treats Medicare and Medicaid as having no income value. If family income exceeds the cost of food and housing requirements, the fungible value of Medicare and Medicaid is equal to the amount which exceeds the value assigned for food and housing requirements (up to the amount of the market value of an equivalent insurance policy (total cost divided by the number of participants in each risk class)." See http://www.census.gov/hhes/www/income/data/historical/measures/redefs.html [July 2015].

Past Research

Previous analyses of Medicare progressivity have come to differing conclusions. Bhattacharya and Lakdawalla (2006), using years of education as a measure of SES, found that annual Medicare expenditures are much larger for the less well educated than for the better educated. They calculated the net present value of Medicare Part A, which is funded only by payroll taxes, and conclude that the net actuarial value for Medicare Part A is significantly larger for the less well educated, noting "While Medicare is actuarially unfair for college graduates, high school dropouts almost double their money" (Bhattacharya and Lakdawalla, 2006, p. 278).

In contrast, McClellan and Skinner (2006), using the income of a beneficiary's zip code as an indicator of SES, found the picture less clear cut. For example, they showed that the annual distribution of health spending by zip code income decile changed over time. In the 1980s, beneficiaries living in lower-income neighborhoods had lower Medicare expenditures than those living in higher-income neighborhoods; by the late 1990s, this trend had reversed. They attribute much of this change to the growth in home health spending. Including both the distribution of annual benefits by zip code and differential mortality, they found the distributional consequences of the Medicare program to be roughly neutral in dollar terms. Thus, even though—unlike Social Security—Medicare provides a uniform health insurance benefit to all, McClellan and Skinner found that the higher expenditures of the rich combined with their longer life expectancy are enough to offset their higher tax payments.

Thus, the literature about the progressivity of Medicare is inconclusive. The difference between the Bhattacharya and Lakdawalla study and the research by McClellan and Skinner might be attributable to the differences in Medicare Part A (examined by Bhattacharya and Lakdawalla) versus overall Medicare expenditures (examined by McClellan and Skinner) or to differences between individual education and zip code income as measures of SES.

Results from the FEM

An advantage of the FEM for assessing the value of Medicare is that it is able to link lifetime income to actual medical expenses. Figures 4-11 and 4-12 show the distribution of annual Medicare expenditures at ages 67 and 77 for males and females born in 1930. The findings from the FEM are unambiguous: those with lower lifetime income have *higher* annual Medicare expenditures. For example, for 67-year-old males, the Medicare expenditures in the lowest income quintile are 48 percent higher than in the top quintile; for females at this age, the ratio is 69 percent. The ratio

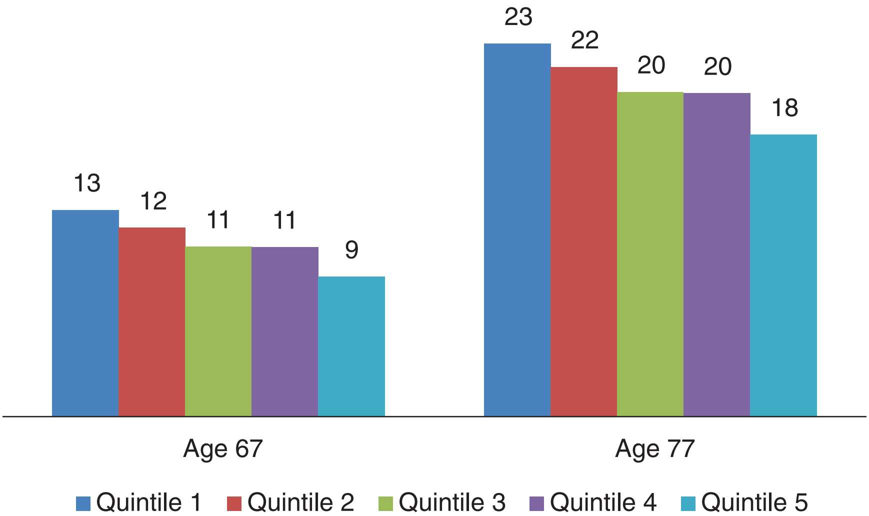

FIGURE 4-11 Average annual Medicare spending for males born in 1930, by income quintile.
SOURCE: Committee generated using Health and Retirement Study data and cohort assumptions.

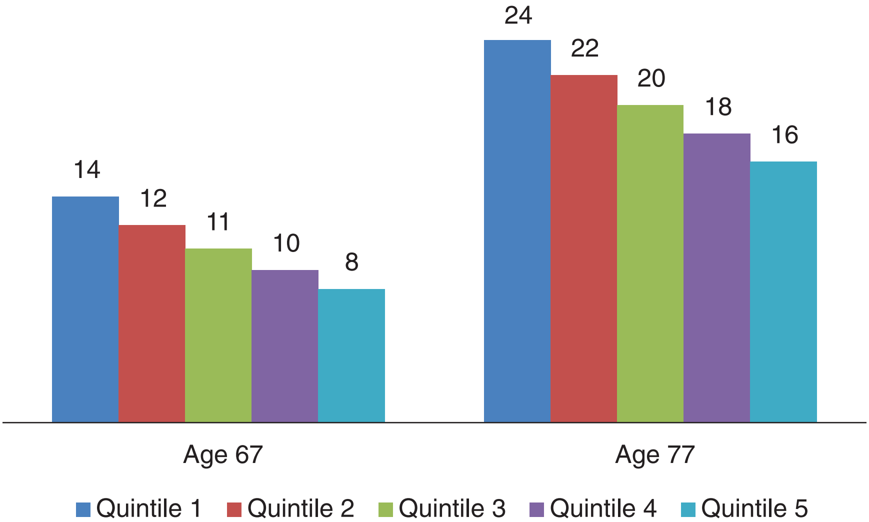

FIGURE 4-12 Average annual Medicare spending for females born in 1930, by income quintile.
SOURCE: Committee generated using Health and Retirement Study data and cohort assumptions.

attenuates somewhat with age, most likely reflecting the fact that the least healthy people in the bottom quintile die earlier (and are out of the sample). At age 77, for example, the Medicare expenditures for males and females in the bottom quintile are 32 percent and 47 percent higher, respectively, than expenditures for those in the top quintile.

The committee's analysis now turns to the estimates of the lifetime distributional effect of the Medicare benefit generated using the FEM. These estimates reflect Medicare expenditures in the period 2002 to 2004—that is, they abstract from rising overall Medicare expenditures over time—adjusted so that they are in 2010 dollars. The result is that differences in benefit receipts across the two hypothetical cohorts arise only from changes in underlying health and life expectancy, not from the ongoing rise in cost per beneficiary across cohorts.

The baseline results showing average lifetime Medicare benefits for males by earnings quintile are displayed in Figure 4-13. For the 1930 cohort, lifetime Medicare benefits are relatively flat by earnings quintile: males in the lowest quintile can expect to receive, on average, $162,000 in lifetime Medicare benefits, only 6 percent more than those in the top quintile. Thus, for the 1930 cohort of males, the higher *annual* Medicare expenditure of those in the lower-income quintiles is roughly offset by their shorter life expectancy.

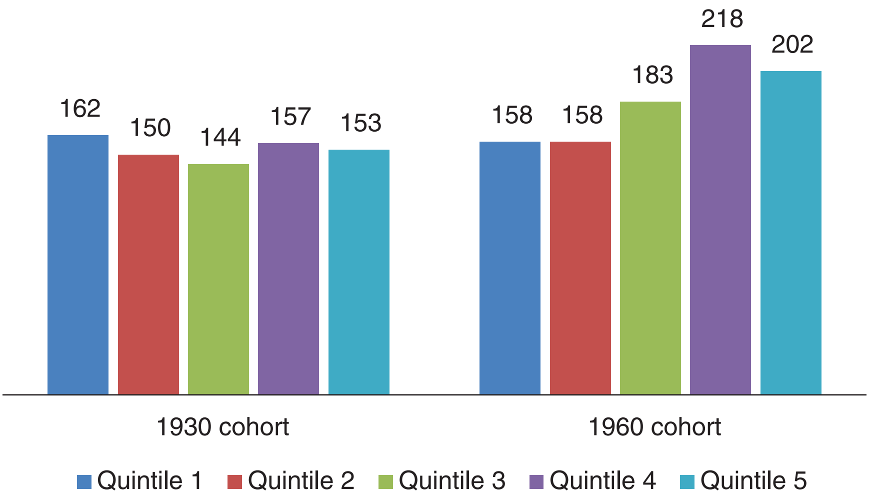

FIGURE 4-13 Average lifetime Medicare benefits for males (in thousands of dollars).
SOURCE: Committee generated using Health and Retirement Study data and cohort assumptions.

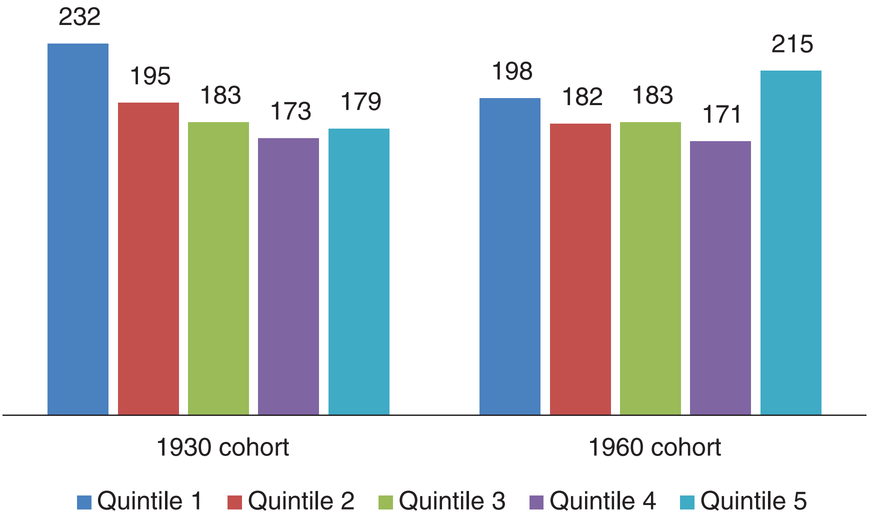

FIGURE 4-14 Average lifetime Medicare benefits for females (in thousands of dollars).
SOURCE: Committee generated using Health and Retirement Study data and cohort assumptions.

Looking forward, however, widening disparities in life expectancy and associated health status change this picture substantially. For the 1960 cohort of males, the projected mortality gradient produces an upward gradient in the distribution of lifetime Medicare benefits with income. For example, those in the bottom income quintile can expect to receive $158,000 in lifetime Medicare benefits, just 78 percent of the lifetime benefits for those in the top quintile.[20]

The results for females, shown in Figure 4-14, are somewhat different, reflecting both the distribution of annual Medicare benefits and the smaller disparities in life expectancy for females in the 1930 cohort. Females in the lowest quintile receive about 30 percent more in lifetime Medicare benefits than those in the top quintile. But, as with the males, the income gradient changes over time. For the 1960 cohort, for example, the lifetime Medicare benefit for females in the lowest income quintile is expected to be only 92 percent of the benefit in the top quintile.

[20]As noted above, these calculations do not account for growth in overall Medicare expenditures; the average Medicare benefit received by those in the 1960 cohort is likely to be many times greater than the average benefit of the 1930 cohort.

THE DISTRIBUTION OF MEDICAID BENEFITS

Background on Medicaid

Medicaid is a program that provides health insurance to those with low income and low assets. It is administered by the states within broad federal guidelines, and the eligibility requirements vary widely across the states. For example, in many states, nondisabled childless adults are ineligible for Medicaid, regardless of income. But all states cover the low-income disabled and low-income elderly, and it is these two groups who account for most of the Medicaid expenditures in the population aged 50 and older that this study addresses.

For elderly and Medicare-eligible disabled Medicaid beneficiaries, most acute health expenditures are financed by Medicare, although Medicaid helps with Medicare premiums and coinsurance. But Medicaid is the primary payer of long-term care services, particularly nursing homes, which are generally not covered by Medicare.[21]

Although Medicaid as a whole is undoubtedly progressive—it is financed by general revenues and provides health care for the poor—there is some question as to the progressivity of the Medicaid nursing home benefit. In most states, Medicaid can be a payer of last resort for nursing homes because people can become Medicaid eligible by spending down their assets.[22] Thus, even people with relatively high lifetime incomes may end up on Medicaid if they require nursing home care for a lengthy period of time. For example, De Nardi and colleagues (2013) found that, for those retirees in the top two quintiles of the income distribution, Medicaid recipiency increases with age, rising from around 4 percent at age 89 to more than 20 percent at age 96. Given the sharp increase in nursing home use with age (Brown and Finkelstein [2008] report that the median age of first entry into a nursing home is about 83 years old) and the longer life expectancy of those with higher lifetime income, the lifetime impact of the Medicaid benefit is worth examining.

[21]Medicare pays for short-term nursing home stays following hospitalizations but not for long-term nursing home use. The Medicare home health benefit has increased greatly over time and has now become an important source of financing for this form of long-term care (Brown and Finkelstein, 2008).

[22]Medicaid eligibility for the disabled and non-elderly requires that assets and income both fall below certain thresholds. But in many states, that income level is fairly high—up to $2,130 per month in 2013; see http://longtermcare.gov/medicare-medicaid-more/medicaid/medicaid-eligibility/share-of-cost/ [July 20115]. In these states, Medicaid-eligible individuals are required to spend most of their income on nursing home care, and Medicaid will cover the remainder of the costs.

Results from the FEM

Figures 4-15 and 4-16 display the present value of Medicaid benefits at age 50 by lifetime earnings quintile. Despite the fact that some Americans with high lifetime income do rely on Medicaid for financing long-term care, the Medicaid benefit is much larger for lower earners than higher ones. For example, for males of the 1930 birth cohort, the present value of Medicaid from age 50 on is $77,000 for those in the lowest earning quintile, $35,000

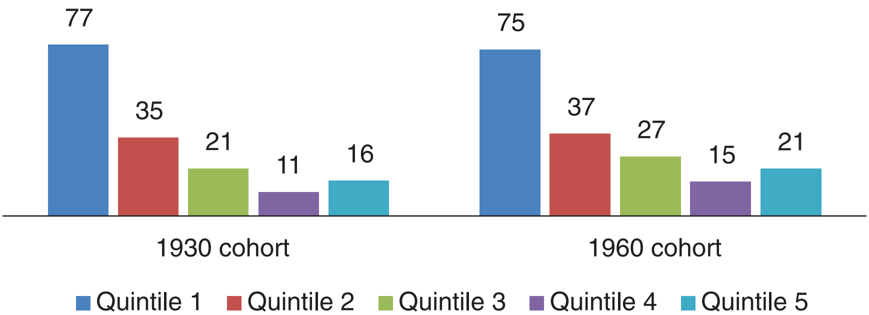

FIGURE 4-15 Average lifetime Medicaid benefits for males (in thousands of dollars).
SOURCE: Committee generated using Health and Retirement Study data and cohort assumptions.

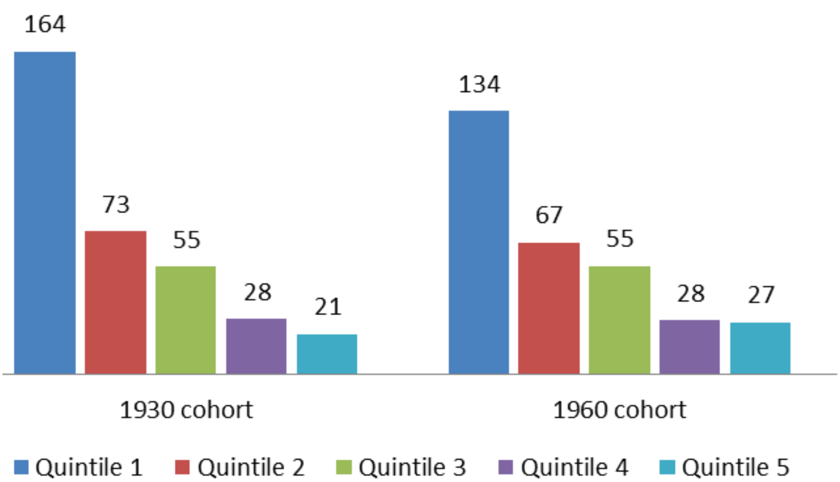

FIGURE 4-16 Average lifetime Medicaid benefits for females (in thousands of dollars).
SOURCE: Committee generated using Health and Retirement Study data and cohort assumptions.

in the second quintile, and just $16,000 for those in the highest quintile. For females—who are much more likely to use nursing homes—the disparities are even larger: the average lifetime Medicaid benefit from age 50 is about $164,000 for females in the lowest earnings quintile but only $21,000 for females in the highest quintile.

Widening disparities in life expectancy over time diminish the extent to which Medicaid benefits decline from lower to higher income quintiles. For example, moving from the 1930 to the 1960 birth cohort reduces the ratio of benefits of those in the bottom quintile to those in the top quintile from about 500 percent to 350 percent for males and from 800 percent to 500 percent for females.

THE DISTRIBUTION OF TOTAL NET BENEFITS FROM MEDICARE, MEDICAID, SOCIAL SECURITY, AND SUPPLEMENTAL SECURITY INCOME

In this section, the committee combines the present value of total benefits, by lifetime earnings quintile, from Medicare, Medicaid, Social Security (including retirement and disability), and Supplemental Security Income and then subtracts taxes paid after age 50 (including personal income taxes, personal payroll taxes on wages, and employer payroll taxes) into a "total net benefit" in present value. As Figures 4-17 and 4-18 illustrate, total net benefits for the 1930 cohort decline as earnings rise across lifetime earnings quintiles. For the 1960 cohort, by contrast, projected total net benefits are roughly flat across the earnings distribution for males (Figure 4-17) and decline less rapidly as earnings rise for females than in the 1930 cohort (Figure 4-18).

For males, the impact of moving from the 1930 cohort to the 1960 cohort is to reduce total net lifetime benefits by 3 percent for those in the bottom quintile and to raise such net benefits by 62 percent for those in the top quintile. For females, that shift reduces net benefits by 17 percent for the bottom quintile and raises them by 28 percent for the top quintile. To examine what is driving these effects, one can analyze the impact on benefits and taxes separately. For males in the 1930 cohort, as shown in Figure 4-19, the present value of total benefits is estimated at about $400,000 in both the bottom and top quintiles. For females, as shown in Figure 4-20, the top quintile has lower average lifetime benefit levels than those at the bottom, largely because Medicaid benefits, which deliver larger benefits to those toward the bottom of the earnings distribution, are a larger factor in the total for females than for males.

The growing gap in life expectancy and associated health conditions, however, is projected to change these patterns significantly, as the figures illustrate for the 1960 cohort compared with the 1930 cohort. Whereas the gap in present value benefits between the highest quintile and the low-

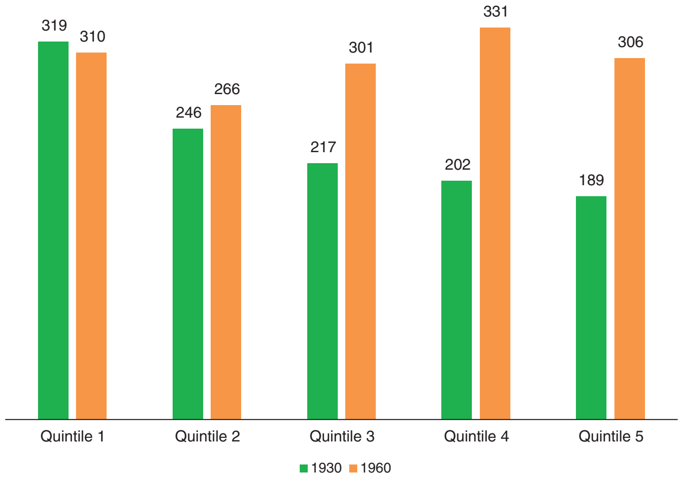

FIGURE 4-17 Average lifetime total net benefits for males (present value in thousands of dollars), by lifetime earnings quintile. Net benefits equal total benefits minus taxes, all from age 50 onward. Total benefits include those from Medicare, Medicaid, Social Security (including retirement and disability), and Supplemental Security Income. Taxes include personal income taxes and payroll taxes (both employer and employee).
SOURCE: Committee generated using Health and Retirement Study data and cohort assumptions.

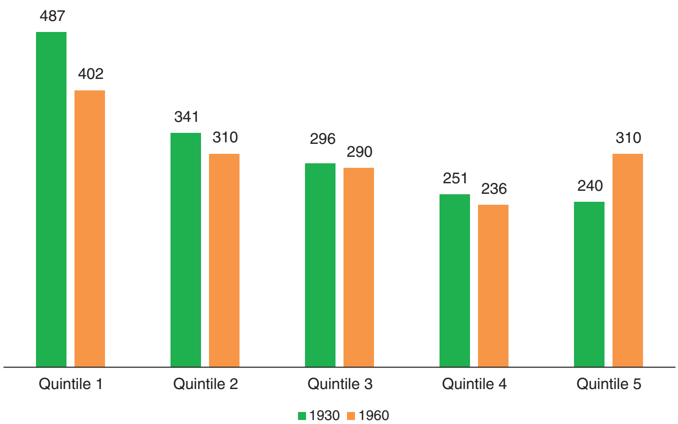

FIGURE 4-18 Average lifetime total net benefits for females (present value in thousands of dollars), by lifetime earnings quintile. Net benefits equal total benefits minus taxes, all from age 50 onward. Total benefits include those from Medicare, Medicaid, Social Security (including retirement and disability), and Supplemental Security Income. Taxes include personal income taxes and payroll taxes (both employer and employee).
SOURCE: Committee generated using Health and Retirement Study data and cohort assumptions.

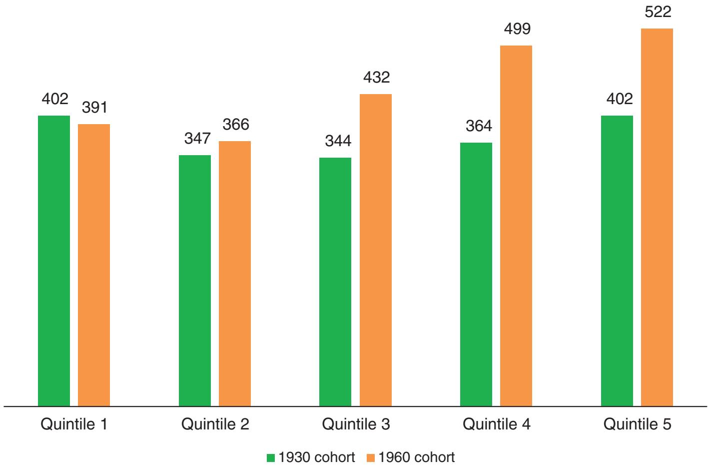

FIGURE 4-19 Average lifetime total benefits for males (present value in thousands of dollars), by lifetime earnings quintile. Total benefits include those from Medicare, Medicaid, Social Security (including retirement and disability), and Supplemental Security Income.
SOURCE: Committee generated using Health and Retirement Study data and cohort assumptions.

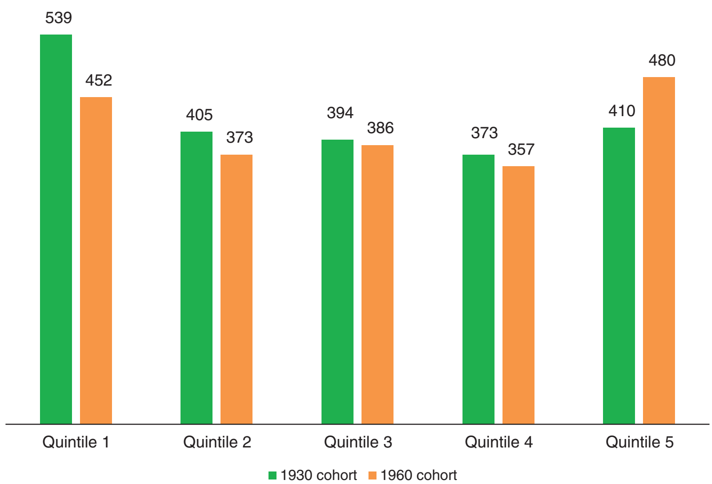

FIGURE 4-20 Average lifetime total benefits for females (present value in thousands of dollars), by lifetime earnings quintile. Total benefits include those from Medicare, Medicaid, Social Security (including retirement and disability), and Supplemental Security Income.
SOURCE: Committee generated using Health and Retirement Study data and cohort assumptions.

est in the 1930 cohort was zero for males and –$129,000 for females, for the 1960 cohort the gap is projected to become $132,000 for males and $28,000 for females. Thus the advantage in lifetime total benefits for the top quintile grew by $132,000 for males and by $157,000 for females.

Figures 4-21 and 4-22 illustrate the tax side, at least for taxes paid at age 50 and above. As seen, higher earners pay more in taxes than lower earners. However, the pattern is not markedly different between the 1930 and the 1960 cohort. In other words, the changes in mortality do not generate substantial changes in taxes paid. The implication is that almost all of the change in the pattern of lifetime net benefits shown in Figures 4-17 and 4-18 is due to the impact of mortality on benefits and not taxes. (Because the committee had anticipated this result, which makes intuitive sense, and because the focus here is on the impact of a steeper mortality gradient rather than the level of net benefits, the committee's initial work had excluded taxes altogether.)

We now turn to measures of progressivity. Figures 4-23 and 4-24 show how total net benefits change as a share of the committee's inclusive wealth measure because of the change in the mortality gradient. For both males and females, three features of the progressivity measures are noteworthy. First, these government programs represent a substantial share of inclusive wealth at age 50; net benefits amount to greater than half of inclusive

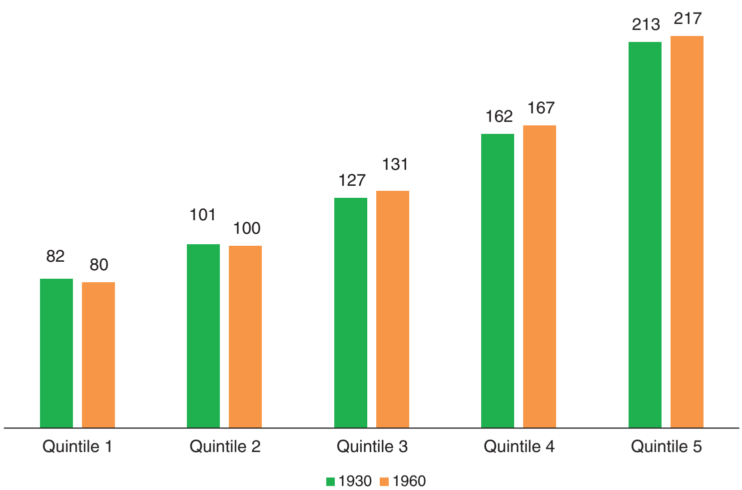

FIGURE 4-21 Average lifetime total taxes paid for males (present value in thousands of dollars), by lifetime earnings quintile, from age 50 onward. Taxes include personal income taxes and payroll taxes (both employer and employee).
SOURCE: Committee generated using Health and Retirement Study data and cohort assumptions.

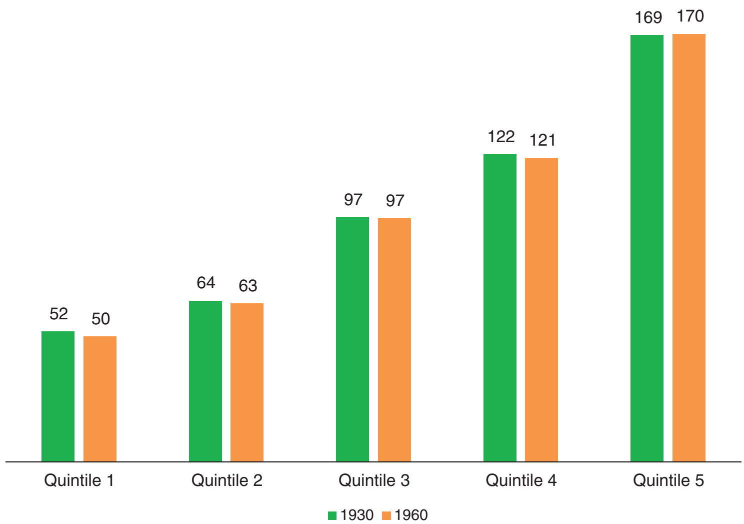

FIGURE 4-22 Average lifetime total taxes paid for females (present value in thousands of dollars), by lifetime earnings quintile, from age 50 onward. Taxes include personal income taxes and payroll taxes (both employer and employee).
SOURCE: Committee generated using Health and Retirement Study data and cohort assumptions.

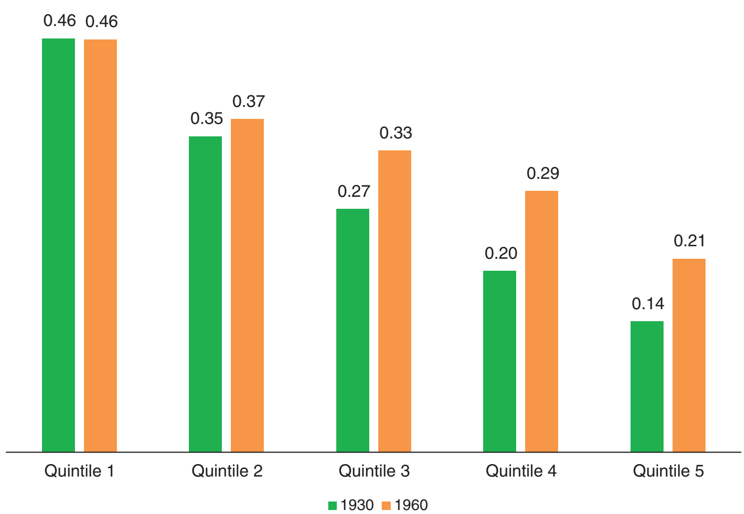

FIGURE 4-23 Total net benefits as share of inclusive wealth as of age 50 for males.
SOURCE: Committee generated using Health and Retirement Study data and cohort assumptions.

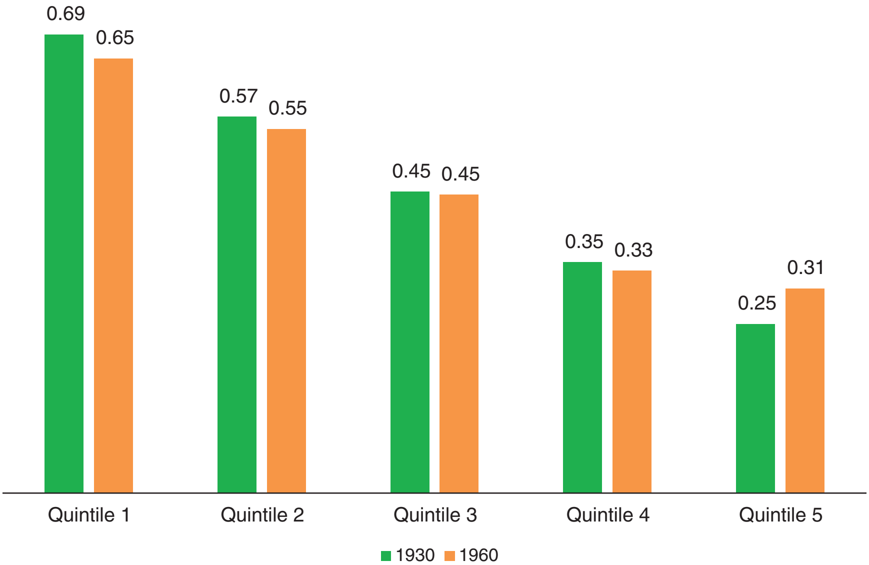

FIGURE 4-24 Total net benefits as share of inclusive wealth as of age 50 for females.
SOURCE: Committee generated using Health and Retirement Study data and cohort assumptions.

wealth for females in the lowest quintile and almost half for males in the lowest quintile. Even for the middle quintile of earnings, net benefits represent one-quarter to one-half of wealth. Second, for both the 1930 and the 1960 cohorts, net benefits are a larger share of inclusive wealth for lower earners than higher earners, suggesting that at least on this measure, the government programs as a whole are progressive for both cohorts. Third, our focus is mostly on the change in progressivity, not its level. And on that score, the change in mortality has made these government programs less progressive; the difference between the highest quintile and the lowest quintile has fallen by 7 percentage points (from 31 to 24) for males and by 9 percentage points (from 44 to 35) for females because of the more rapid rise in life expectancy for higher earners than lower earners.

SENSITIVITY OF RESULTS TO MORTALITY CHANGE

As discussed in Chapter 3, there is considerable uncertainty about whether the differences in life expectancy by midcareer earnings will continue to widen. The committee's baseline projection or simulation, referred to in this report as the mortality regime of the 1960 birth cohort, is based on the estimated mortality model. The actual mortality differences, though, could be larger or smaller than these estimates. How would that affect the results? Suppose, for example, that the actual differences for this cohort turn out to be substantially smaller than in the estimated model. To assess this possibility, we constructed a scenario, described in Chapter 3, in which the widening of the life expectancy differences between the 1930 and 1960 birth cohorts is only half as great as our fitted model would imply. We have called this the "half dispersion" regime. We have investigated how this alternate mortality outcome would affect our results for the differences in the present value of benefits, taxes, and their difference, net benefits.

Figures 4-21 and 4-22 show that the present values of taxes paid after age 50 under the mortality regimes of 1930 and 1960 barely differ at all. Therefore it will come as no surprise that the same is true for the half dispersion regime, which lies between the other two. The largest percentage difference between the 1960 and half dispersion mortality regimes is 1.3 percent, and all other differences are less than 1 percent. The real question is how the half dispersion regime affects the present value of benefits and net total benefits.

Figure 4-25 plots the difference between the present value of total benefits for the top income quintile and the bottom quintile, for the mor-

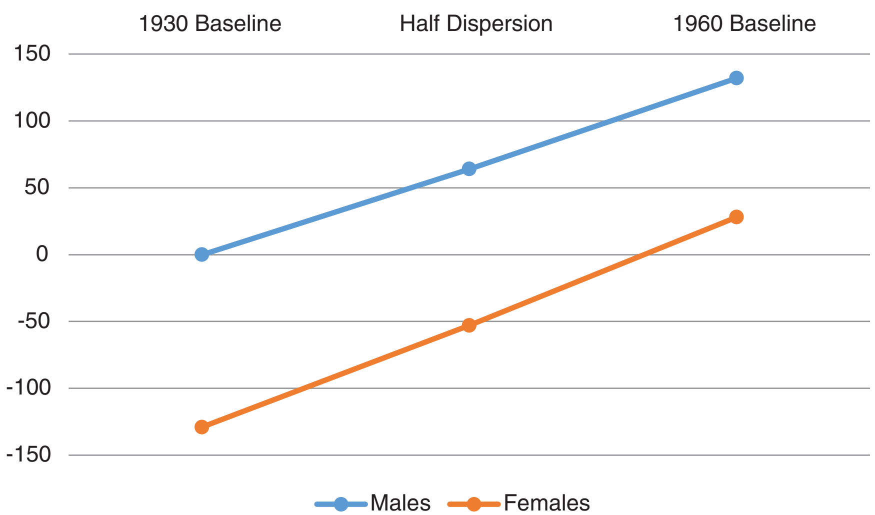

FIGURE 4-25 Difference in present value (in thousands of dollars) of total lifetime benefits between top and bottom income quintiles, for three mortality regimes: 1930 cohort, half dispersion, and 1960 cohort.
SOURCE: Committee generated using Health and Retirement Study data and cohort assumptions.

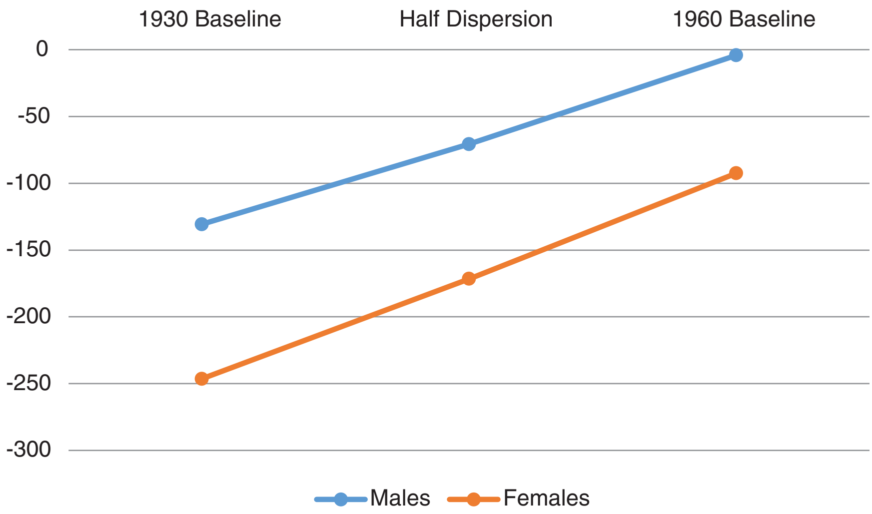

FIGURE 4-26 Difference in present value (in thousands of dollars) of total lifetime benefits net of taxes between top and bottom income quintiles, for three mortality regimes: 1930 cohort, half dispersion, and 1960 cohort.
SOURCE: Committee generated using Health and Retirement Study data and cohort assumptions.

tality regimes of 1930, half dispersion, and 1960. The lines are very nearly straight, which means that the effect of mortality dispersion on the gap in the present value of benefits is approximately linear. The gap is about half as great in the half dispersion regime as it is for the 1960 cohort. Because mortality and survival rates enter into the calculation of the present value of benefits in a nonlinear way, this result was not obvious before the half dispersion scenario was run. It is convenient, however, because it means that one can evaluate the outcomes for any degree of change in the mortality dispersion that one believes to be appropriate.

Similarly, Figure 4-26 plots the gap between top and bottom income quintiles for total benefits net of taxes for the three mortality regimes. The result is the same. The relationship is approximately linear. When the mortality dispersion increases only half as much, the increase in the gap in present value of net total benefits is only half as great.

The committee is not able to provide a probability distribution for the size of the increase in mortality-income dispersion between the 1930 and 1960 birth cohorts, but we note that all the evidence reviewed in Chapter 3 indicates that the mortality-income differential has continued to widen during the past two decades.

5

Policy Responses to an Aging Population

The long-term fiscal imbalance in the Social Security system will ultimately require policy makers to make changes to put the system on firmer financial footing. Many reform proposals have been advanced to improve solvency; most involve some form of tax increase or benefit reduction (at least relative to the level promised in the past), which are fundamentally the only ways to address Social Security's long-term imbalance. The complexity of the Social Security program, though, means that there are many different options for reform within these categories of adjustments, and they can be combined in multiple ways. A Congressional Budget Office study, for example, evaluated 30 possible reforms (Congressional Budget Office, 2010), and an October 2014 update on the website of the Office of the Chief Social Security Actuary considers the impact of 37 long-range Social Security policy provisions.[1] Box 5-1 considers the direct indexation of benefit levels to changes in mortality within a population.

SOCIAL SECURITY POLICY SIMULATIONS

The committee's analysis simulates six possible Social Security reforms. We believe these reforms are particularly relevant because either they are frequently discussed in policy circles or they meet objectives that many stakeholders would agree with, such as that benefit reductions should be crafted so as to avoid harming low-income workers. The choice of reforms to analyze has also been influenced by what is possible given the current

[1]See http://www.socialsecurity.gov/OACT/solvency/provisions/index.html [March 2015].

BOX 5-1
Indexing Social Security Benefit Levels to Mortality Changes

An alternative to raising the normal retirement age (NRA) in response to increases in longevity is to directly index initial benefits (i.e., the annual benefit received by a worker when initially claiming benefits) instead. For example, Diamond and Orszag (2004) proposed that both initial benefit levels and the payroll tax rate be indexed each year to offset the impact on Social Security's finances from observed changes in life expectancy. Under their proposal, Social Security's chief actuary would compute each year the net impact on Social Security's actuarial imbalance from the change in life expectancy for a typical worker claiming benefits at the NRA. Half of this net impact would then be offset by raising the payroll tax rate, and half by reducing initial benefit levels for cohorts of workers who have not yet reached the early entitlement age. Diamond and Orszag argued that this approach is preferable to raising the NRA itself, because it incorporates both benefit reductions and revenue increases as adjustments to increases in life expectancy and because directly adjusting initial benefit levels avoids many of the anomalies in the pattern of benefit reductions by age associated with raising the NRA.

In theory, this approach could be used to adjust benefit levels at each lifetime earnings quintile and thereby offset not only the change in average life expectancy but also the change in the distribution of life expectancy with respect to lifetime earnings. Furthermore, this approach could be applied for any given mix of revenue and benefit adjustments to the actuarial impact from the change in average life expectancy. In particular, within the benefit component of the annual adjustment, the chief actuary could estimate the change in life expectancy by

structure of the Future Elderly Model (FEM); for example, Although the committee would have liked to simulate the effect of raising the taxable maximum earnings base—a popular proposal on the revenue side—this was not feasible within the existing FEM.

The Social Security reforms simulated for this report include

1. raising the Social Security early entitlement age (EEA) by 2 years, to age 64;
2. raising the Social Security normal retirement age (NRA) by 3 years, to age 70;
3. raising both the EEA as in policy 1 and the NRA as in policy 2;
4. reducing the cost-of-living adjustment (COLA) applied to benefits by 0.2 percent per year, starting at age 62;
5. reducing the top primary insurance amount (PIA) factor by one-third, from 15 percent to 10 percent (applies to average indexed

quintile of average indexed monthly earnings, based on mortality experience over the previous 12 months for retirees in that quintile of earnings, and also estimate the impact on Social Security's lifetime benefits from that change. The chief actuary would then apply adjustment factors to the benefit levels across quintiles in order to offset, at least approximately, the impact of the change in life expectancy distribution on the pattern of lifetime benefits. For example, if the top quintile accounted for 50 percent of the increase in the present value of lifetime benefits from the overall changes in mortality, the top quintile's annual benefit would be reduced such that, on average, those reductions accounted for 50 percent of the overall reduction in annual benefits from the adjustment. The goal of the process would be to keep the distribution of lifetime benefits invariant to changes in the distribution of life expectancy. As noted in Chapter 4 of this report, whether or not that goal is desirable is debatable.

In practice, this approach would have several implementation challenges. First, the mortality experience by earnings quintile in each year will be more variable than the average. To mitigate this variability, the adjustment by quintile could be done less often, perhaps every 5 years rather than every year. Second, the adjustment factors would have to be smoothed to avoid discontinuities just above and below the quintile threshold, and the smoothing process would have to be specified ahead of time. Third, the process would need to reconcile the adjustment factors by quintile and the bend points in the Social Security benefit formula, which is technically challenging. Finally, because the process would introduce some uncertainty around benefit levels for workers nearing retirement, it might be desirable to apply the adjustment factors only to future retirement benefits for workers below a certain age (such as 55 or 60).

monthly earnings [AIME] amounts beyond the second bend point, currently $4,917); and

6. reducing the top PIA factor from 15 percent to 0 percent (applies to AIME amounts beyond the second bend point) and reducing the second bend point to the median AIME.

Note that, with the exception of simulation 3, the analysis changes just one policy per simulation while holding other policies constant. For example, in simulation 1, the EEA rises by 2 years while all other thresholds (the NRA, the age of eligibility for Medicare benefits, etc.) remain unchanged.

There are two mechanisms by which a policy change may translate into an increase or decrease in Social Security and other benefits relative to the baseline scenario. The first channel, which can be characterized as the "mechanical effect," results directly from the policy change, holding behavior constant. For example, consider the reform in simulation 2, which raises the NRA by 3 years. A worker claiming Social Security benefits at age 67 would receive 100 percent of his PIA before the NRA reform and 80 percent of his PIA after the reform, so he experiences a 20 percent benefit reduction if he maintains the same claiming age of 67.

The second channel, which can be characterized as the "behavioral effect," results from any changes in individual behavior in response to the policy.[2] Facing an NRA of 70 rather than 67 changes an individual's incentives and may lead that individual to claim Social Security later, work longer, or even claim disability insurance (DI) benefits. Such behavioral responses can be captured by the FEM. As described earlier, the committee's analysis first estimated transition models (over a 2-year period) between benefit-related states including working, Social Security claiming, and DI claiming using data from the Health and Retirement Study (HRS). Then the estimates from these models were used to simulate a particular cohort's patterns of work, claiming, etc. and that cohort's resulting Social Security and other benefits under the baseline (no reform) scenario. Finally, the policy change(s) for the specific simulation were imposed and the resulting FEM estimates were used to simulate the cohort's new patterns of behaviors and benefits.[3]

Predicting new patterns of retirement behavior and how retirement decisions might change in response to various policy changes is a challenging modeling exercise. The approach the committee adopted for predicting retirement choices is based on what economists call a "reduced-form model." The annex to this chapter provides a discussion of this approach compared to alternative approaches; it also discusses the sensitivity of the results to the committee's choice of approach.

The post-reform benefits presented in the figures below for each simula-

[2]Gruber and Wise (2007) discussed the impact of Social Security reforms in terms of mechanical and behavioral effects, and they conducted simulations that decompose the total effect into these two components.

[3]To continue with the example of the NRA increase, one of the variables in the Social Security claiming model is the number of months until the claimant reaches the NRA. For a worker at age 67, the value for this variable would be changed from 0 to 36 months as one simulates the policy change of a 3-year increase in NRA. The estimated-months-until-NRA coefficient from the Social Security claiming model would be used to predict this individual's new probability of claiming Social Security at age 67. If that coefficient suggests that the claiming probability increases as an individual approaches the NRA, then moving that person from 0 to 36 months away from the NRA will reduce his or her estimated probability of claiming this year. Claiming later will raise expected benefits if the actuarial adjustment is more than fair, potentially mitigating some of the benefit cut that occurs via the mechanical channel.

tion reflect the combined effect of mechanical and behavioral effects.[4] The discussion below contrasts post-reform benefits to the baseline benefits presented in Chapter 4 (see Box 5-2). The committee's primary focus is on how these simulations affect the progressivity of Social Security and other programs for the elderly. We define progressivity in terms of the ratio of net benefits to inclusive wealth, which the committee views as a good summary measure of an individual's ability to pay. In particular, net benefits (i.e., benefits minus taxes after age 50, in present value) are progressive if the ratio of benefits in present value to wealth falls as income increases. Based on this definition, a policy change increases progressivity if the net benefit-wealth ratio falls more, or rises less, for those in higher lifetime earnings quintiles than for those in lower quintiles.

Policy Simulation 1: Raising the EEA to Age 64

An increase in the EEA is a frequently discussed policy reform. The 1983 Social Security amendments that legislated increases over time in the NRA did not change the EEA but did increase the penalty for claiming at the EEA. Beneficiaries claiming at age 62 receive a benefit equal to 70 percent of PIA with an NRA of 67, versus 80 percent of PIA under the old NRA of 65. Discussions of potential further increases in the NRA inevitably raise the question of whether the EEA should also be raised, and, if not, what would happen to the penalty for claiming at the EEA. There has also been a related discussion about whether eligibility for retirement benefits, particularly at a relatively early age, might be based on factors other than age (see Box 5-3).

At first glance, it would seem that raising the EEA should have little effect on Social Security's finances, given the common belief that the actuarial adjustment for early claiming is roughly actuarially fair.[5] An increase in the EEA to age 64 would force individuals who would otherwise claim at ages 62 and 63 to claim at age 64 (or later); these individuals would have a higher monthly benefit but would receive benefits for fewer years, and the two effects would essentially cancel each other out. To be sure, even if the adjustment is actuarially fair for the beneficiary population as a whole, it

[4]Although it is a common practice to associate changes in benefits with changes in well-being, one should use caution in doing so. In particular, although the mechanical changes in benefits may provide an accurate measure of the changes in individual well-being in the absence of behavioral responses, changes in benefits associated with behavioral responses do not fully account for associated changes in well-being because they do not take into account the impact of changes in leisure and other consumption because of, for example, changes in retirement or benefit take-up decisions.

[5]As noted in Chapter 4, Shoven and Slavov (2013) argue that the actuarial adjustment for the population as a whole is becoming more than fair (indicating that there are greater expected benefits available by delaying claiming) over time.

BOX 5-2
The Experiment

The committee's simulation experiment calculates the net present value (NPV) of expected taxes paid and government benefits received by a generation over the rest of its life, starting at age 50. The program rules are assumed to remain as defined in 2010 and to persist through subsequent years until all members of the generation have died. The taxes and benefits by age are projected forward, conditional on these rules and on additional assumptions including income growth and health care cost growth. The NPV depends on the proportion of the generation surviving to each future year because only survivors pay taxes and receive benefits. The actual experiment the committee carried out is described under C below, but as an aid to readers we describe two simpler experiments under A and B, to build up to the conditions simulated in C.

A. Calculate the NPV at age 50 under two different mortality assumptions: (1) the mortality regime experienced by the cohort born in 1930 (actual, fitted, and projected) and alternatively, and (2) the mortality projected for the cohort born in 1960. Because the mortality projected for the 1960 generation is lower than for the 1930 cohort, the NPV calculated based on its mortality will be higher because benefits are received for more years and at older ages benefits tend to exceed taxes. In this experiment *everything other than mortality is held constant*.
B. This experiment is identical to A except that it is carried out separately by income quintile for each of the two generations. In this experiment, as in A, everything other than mortality is held constant across the two simulations for each income quintile.
C. Because mortality differs between the two experimental scenarios for each income quintile, one can expect that health and disability may differ between them as well. A person who dies younger and therefore receives Social Security benefits for fewer years would likely also receive more health care benefits during those years and would be more likely to have received disability benefits. Ignoring these associated variations in health-related benefits would risk overestimating the differences in NPV under the two mortality regimes. These variations in health and functional status by age and sex across the income quintiles will also alter to some degree the simulated trajectories of labor income, benefits, and tax payments. Therefore, in the experimental simulations actually used for the report, the mortality regime for each gender-quintile-birth cohort is paired with its own initial health status and subsequent health and functional status trajectories. With this approach, differences in NPV arise not only because of differences in survival but also because of differences in benefits arising from the associated differences in health and disability status and to the effects of health and disability on earnings trajectories and tax payments.

BOX 5-3
Should Eligibility for Retirement Benefits Be Based on Factors Other Than Age?

In some countries, eligibility for retirement benefits can occur through years of work rather than age. In Brazil, for example, in addition to an eligibility criterion based on age, the country provides an alternative based on years worked: men can retire after 35 years of contributions and women after 30 years, regardless of age.

A team of researchers associated with the Center for Retirement Research at Boston College has examined similar proposals, which would link the early entitlement age (EEA) in the United States to years of work (Haverstick et al., 2007). Their results showed a positive correlation between lifetime earnings (or wealth or education) and years of work, so linking eligibility to years of work may disproportionately impede access to benefits for low-income workers relative to high-income ones.

For example, among male workers at age 62 between 1992 and 2004, 80 percent of those in the top quintile of the wealth distribution and 67 percent of college graduates attained 35 or more years of covered earnings under Social Security. Among workers in the bottom quintile of the wealth distribution, the share was only 46 percent, and among workers with less than a high school degree, the share was 60 percent. Tying the EEA to years of work would thus pose greater challenges for low-wealth and less-educated workers than others.

Haverstick and colleagues (2007) instead proposed tying the EEA to the AIME. Specifically, they proposed dividing workers into three groups based on their AIME at age 55. Group 1 would include workers with an AIME no higher than 50 percent of the average monthly earnings for all workers. Group 2 would include those with an AIME between 50 and 100 percent of the average, and Group 3 would include workers with above-average AIME. Under the proposal, the first group's EEA would remain at 62; the second group's EEA would increase by about one-half month for each percentage point increase in the AIME as a percentage of average earnings above the 50 percent threshold, and the third group's EEA would increase to 64.

An innovative component of this proposal is to base the EEA for each worker on the value of the worker's AIME measured at age 55. As the authors noted, "A primary reason for this approach is to allow individuals time to adjust their retirement plans….over half of men ages 50 to 55 have a financial planning horizon of less than 5 years" (Haverstick et al., 2007, p. 15). So, finalizing an individual's EEA at age 55 should provide sufficient time for individuals to adjust their retirement planning in response to their applicable EEA. In some cases, being notified of one's EEA at age 55 might also provide a useful "wake up call" to plan for retirement.

will not be fair for every individual or for identifiable subsegments of the population. The earlier discussion of *ex ante* and *ex post* redistribution is relevant here. An individual who ends up dying, say, at age 65 is made worse off when the EEA is raised because he receives the higher benefit for only a short time. But Social Security always involves transfers between the short and long lived, and this type of *ex post* redistribution is generally not viewed as problematic, as discussed above. However, if there are identifiable groups with different life expectancies, then delayed claiming is a better deal for some groups than others on an *ex ante* basis. In this case, a policy that forces people to claim later than they otherwise would have will raise expected benefits for groups with longer life expectancies while lowering them for groups with shorter life expectancies.

Figure 5-1 shows the average Social Security benefits by earnings quintile for males in the 1930 and 1960 cohorts under the policy experiment that the EEA has been raised to age 64; results from the baseline scenario with an EEA of 62 are shown for comparison. Benefits for the lowest-income males (quintile 1) in the 1930 cohort rise modestly by $1,000 when the EEA is increased, from $126,000 to $127,000. Thus, the adjustment of Social Security benefits is close to actuarially fair for the lowest-income quintile (the change in benefits is well under 1 percent of expected lifetime benefits), which also has the lowest life expectancy. The increase in expected benefits is just slightly larger in the higher income quintiles that have lon-

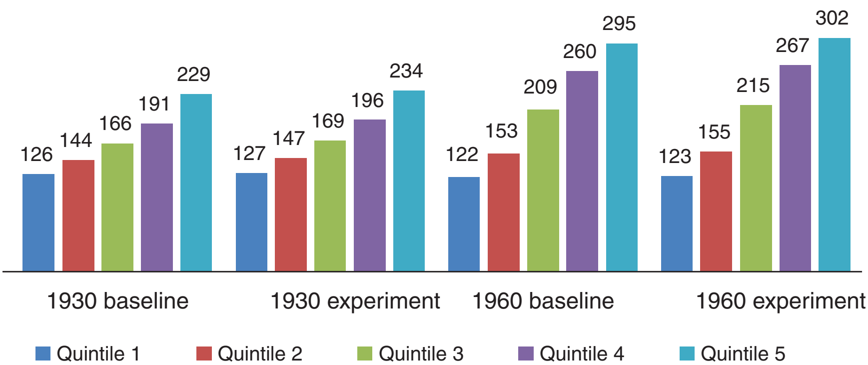

FIGURE 5-1 Average lifetime Social Security benefits for males (in thousands of dollars). Baseline compared with raising the early entitlement age to 64.
SOURCE: Committee generated using Health and Retirement Study data and cohort assumptions.

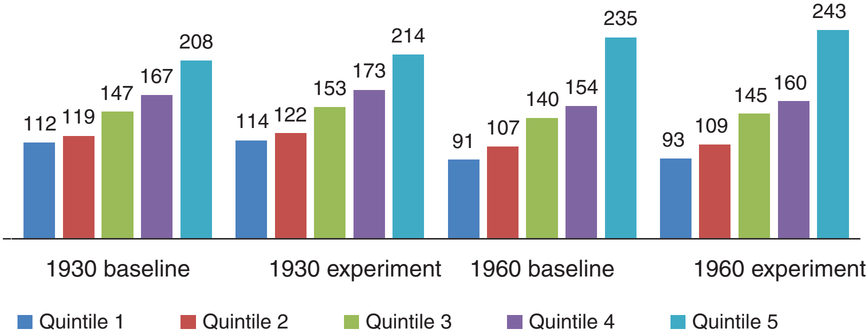

FIGURE 5-2 Average lifetime Social Security benefits for females (in thousands of dollars). Baseline compared with raising the early entitlement age to 64.
SOURCE: Committee generated using Health and Retirement Study data and cohort assumptions.

ger life expectancies ($3,000 for quintile 3 and $5,000 for quintiles 4 and 5) and represents 2 to 3 percent of baseline lifetime benefits. In essence, the delayed claiming that results from an increase in the EEA is slightly more beneficial to these higher-income groups because of their longer life expectancies.

In the 1960 cohort, the effect is similar, with benefits for the lowest-income quintile rising by $1,000 while benefits for the highest-income quintile rising by $7,000. The difference between lowest and highest quintiles (which is larger for the 1960 cohort than for the 1930 cohort for reasons discussed in Chapter 4) is 145 percent of bottom quintile benefits after the EEA increase, versus 142 percent in the baseline scenario.

The results for females, shown in Figure 5-2, are similar. For the 1930 cohort, the policy change raises benefits by $2,000 for the lowest-income quintile and by $6,000 for the highest-income quintile. As a result, the difference between the top and bottom quintiles rises from 86 percent of bottom quintile benefits in the baseline scenario to 88 percent after the EEA increase. For the 1960 cohort, the difference between top and bottom quintiles rises from 158 percent of the bottom quintile value at baseline (as for males, the gap between quintiles 1 and 5 is much larger for the 1960 cohort) to 162 percent after the policy change.

The effect of this policy change on total benefits, shown in Figures 5-3 and 5-4, is essentially the same as the effect on Social Security benefits alone. Total benefits increase by $10,000 or less for all quintiles and cohorts as a result of the policy change, with somewhat larger increases in the higher-income quintiles and for the 1960 cohort.

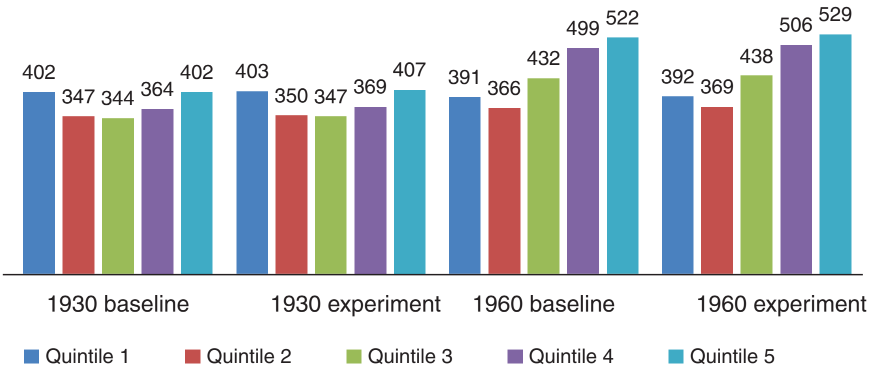

FIGURE 5-3 Average lifetime total benefits for males (in thousands of dollars). Baseline compared with raising the early entitlement age to 64.
SOURCE: Committee generated using Health and Retirement Study data and cohort assumptions.

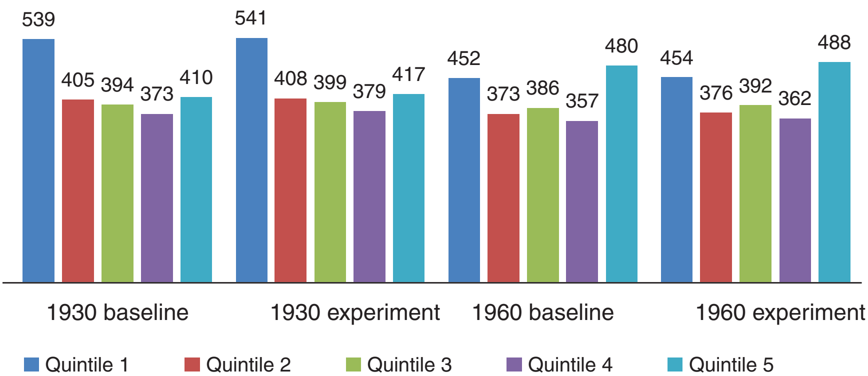

FIGURE 5-4 Average lifetime total benefits for females (in thousands of dollars). Baseline compared with raising the early entitlement age to 64.
SOURCE: Committee generated using Health and Retirement Study data and cohort assumptions.

As noted above, the percentage point change in net benefits as a share of wealth is a useful metric for examining the distributional effect of a policy change. Table 5-1 shows how the policy change would affect lifetime benefits by earnings quintile, based on 1960 mortality rates and relative to the committee's measure of inclusive wealth. For both males and females, the policy shift would increase benefits as a share of wealth by more for higher earners than for lower earners. For males in the top quintile, for example, the change would increase benefits by 0.4 percent of baseline wealth

TABLE 5-1 Impact of Raising the Early Entitlement Age to 64

	Present value of net benefits at age 50, relative to wealth, based on the mortality profile for those born in 1960		
Earnings Quintile	Baseline	Under Policy Experiment	Percentage Point Change
Males			
Lowest	45.6	45.7	0.1
2	36.8	37.0	0.2
3	33.3	33.8	0.5
4	28.9	29.3	0.5
Highest	21.4	21.7	0.4
Females			
Lowest	65.4	65.6	0.2
2	54.8	55.1	0.3
3	44.9	45.5	0.6
4	33.5	34.1	0.6
Highest	30.8	31.4	0.6

SOURCE: Committee generated using Health and Retirement Study data and cohort assumptions.

based on the 1960 mortality projections; for those in the bottom quintile, in contrast, the change would increase benefits by 0.1 percent of baseline wealth. The patterns are broadly similar for females. In all cases, though, the change amounts to less than 1 percent of baseline wealth. The key take-away point is that an increase in the EEA would make the Social Security system, and thus old-age benefits in general, slightly less progressive.

It is important to recall that the committee's analysis focuses on the change in net benefits. If a worker chooses to work longer in response to a policy change, then his or her AIME may rise and this will be reflected in a further change to the Social Security benefits. But our analysis does not focus on the additional earnings that might result from a policy change, even though they may raise the worker's overall well-being.

It is worth noting that this policy change, if enacted on its own, would not generate any savings for the Social Security system, because the projections suggest that benefits would in fact increase slightly. The implication is that individuals tend to claim a little "too early" relative to what would maximize lifetime benefits; on average, therefore, their lifetime benefits would increase if they were forced to delay their claiming. The total cost of benefits would rise by 2 percent for the male population and by 3 percent for the female population. We next discuss the effect of raising the NRA, a policy that would generate substantial savings, before exploring the scenario where the EEA and NRA are raised simultaneously.

Policy Simulation 2: Increasing the NRA to Age 70

The second simulation analyzed by the committee raises the NRA to age 70. The fact that Social Security's long-run fiscal imbalance is due in part to rising life expectancy may help to explain why this is a frequently suggested reform. As individuals live longer, the argument goes, it may not be feasible for them to spend all of these additional years of life in retirement; rather, it may be necessary to lengthen one's work life as well as the period of retirement. Although the NRA is not a "retirement age" in the traditional sense of the word, an increase in the NRA may signal to workers the need to remain in the labor force longer and claim benefits later.

The potential effect on benefits of an NRA increase was explained in the simulation overview above. Absent any change in behavior, the NRA increase functions as a benefit reduction and expected Social Security benefits will fall. Workers may also choose to respond to the policy change by working longer and claiming later; if the actuarial adjustment is more than fair, then doing so will increase benefits, offsetting to some (perhaps small) extent the mechanical effect of the policy change. See Box 5-4 for another view of eligibility ages, one which might allow workers to access benefits before the EEA or to claim benefits before the NRA with a smaller than usual actuarial reduction if they meet certain conditions.

Figures 5-5 and 5-6 show expected Social Security benefits under the simulation's NRA-increase policy for males and females, respectively. As expected, benefits are noticeably lower than in the baseline scenario. For males in the 1930 cohort, the policy reduces benefits by $31,000, or nearly 25 percent of baseline benefits, for the lowest-income group and by $50,000, or 22 percent of benefits, for the highest-income group.

Because the lowest-income group experiences a proportionately larger decline in benefits, the gap between top and bottom quintiles as a share of bottom quintile benefits grows from 82 percent in the baseline to 88 percent in this simulation. The ratio of top quintile to bottom quintile lifetime benefits similarly rises from 1.82 to 1.88. In other words, although benefits fall for all groups, they decline by a bit more, relative to their initial value, for the lowest-income group.

As the mechanical effect of the cut would be largely the same for all groups in percentage terms,[6] the differences in the effect of the policy by income group must result mostly from some combination of two factors.

[6]Though not precisely the same, because of different proportions of claimers above and below the previous NRA by quintile.

BOX 5-4
Eligibility for Retirement Benefits Based on Years of Contributions

Several of the policy proposals explored in this chapter involve raising the early entitlement age (EEA), normal retirement age (NRA), or both. Implicit in such proposals is the principle that as longevity increases, workers should expect to spend more years in the labor force and to retire later. Yet workers' ability to extend their work lives is likely to be heterogeneous. For example, those who have physically demanding jobs may have difficulty working into their mid and late 60s. Similarly, there may be workers who have experienced a late-career job loss and struggled to find new work, particularly in times of economic downturn. Although the disability insurance (DI) program exists to assist those who are too sick to continue working, there may be individuals who do not meet DI eligibility criteria yet would struggle to support themselves while waiting to reach a later EEA or NRA.

One possible way to address this concern is to allow workers to access benefits before the EEA or to claim benefits before the NRA with a smaller than usual actuarial reduction if they meet certain conditions. This practice has been adopted by some other countries. As a Social Security Administration (2012, p. 6) report on programs in Europe noted, "some countries pay a full pension before the regular retirement age if the applicant meets one or more of the following conditions: work in an especially arduous, unhealthy, or hazardous occupation (for example, underground mining); involuntary unemployment for a period near retirement age; physical or mental exhaustion (as distinct from disability) near retirement age; or, occasionally, an especially long period of coverage."

Such a policy might, for example, allow people to claim benefits after 45 years of contributions and to receive full benefits (without actuarial adjustment) after 50 years of contributions. This would mean that someone who entered the labor force at age 18 could claim benefits at age 63 and receive full benefits at age 68, even if the EEA and NRA had been raised beyond those ages. Periods of time when the individual was receiving unemployment insurance benefits might be treated as years of contributions for this purpose.

Such an approach would have the advantage of offering some protection to those with long work careers who were struggling to keep working into their late 60s, but there would be drawbacks as well. Such a policy could make the system more complicated and confusing. If the policy allowed some workers to claim benefits before the NRA with a smaller actuarial reduction than usual, then the policy would have a negative impact on the system's finances. Furthermore, if the required number of years of contributions was set fairly low or the list of occupations covered by the policy was long, then the early retirement option might be used by many workers who have the capacity to work longer and retire later. Policy makers would need to weigh all these factors carefully when considering this option.

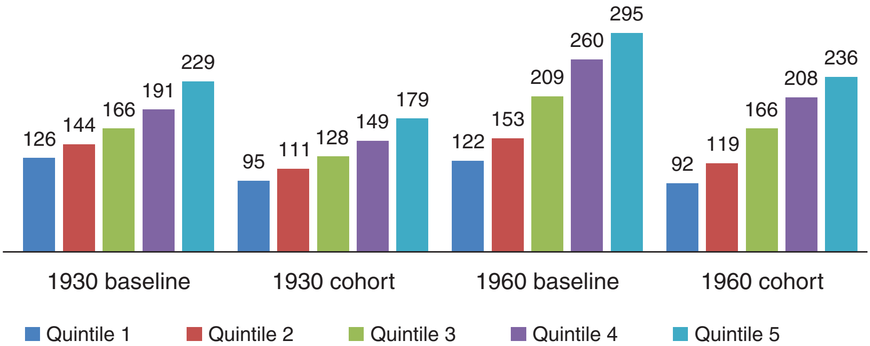

FIGURE 5-5 Average lifetime Social Security benefits for males (in thousands of dollars). Baseline compared with raising the normal retirement age to 70.
SOURCE: Committee generated using Health and Retirement Study data and cohort assumptions.

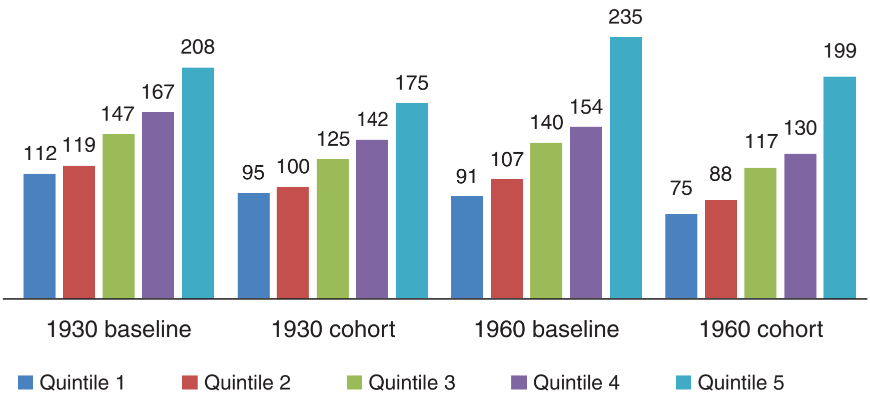

FIGURE 5-6 Average lifetime Social Security benefits for females (in thousands of dollars). Baseline compared with raising the normal retirement age to 70.
SOURCE: Committee generated using Health and Retirement Study data and cohort assumptions.

First, the policy may encourage workers to increase their work effort and delay retirement (behavioral responses that the FEM can incorporate), and this effect may be stronger for top quintile workers than for bottom quintile workers. Second, even if the policy motivates workers in all quintiles to increase work effort by the same amount, the fact that top quintile workers have a longer life expectancy means that any delays in claiming Social Security benefits will result in a larger gain in lifetime benefits for those workers.

For the 1960 cohort of males, the story is similar: benefits fall by $30,000 (25%) for bottom quintile workers and by $59,000 (20%) for top quintile workers. As a result, the gap between top and bottom quintiles rises from 142 percent to 157 percent of quintile 1 benefits when the NRA is raised. The policy change increases the gap in lifetime benefits by more for the 1960 cohort, as reflected in the fact that the gap between quintiles 1 and 5 grows by 15 percentage points (from 142% to 157%) versus 6 percentage points (from 82% to 88%) for the 1930 cohort.

The results for females, shown in Figure 5-6, are less dramatic with respect to the relative patterns of lifetime benefits. For the 1930 cohort, benefits fall by about 15 percent for quintiles 1 and 5 workers (by $17,000 and $33,000, respectively), leaving the benefit gap ratio between them essentially unchanged (0.86 at baseline and 0.85 after the policy change). The results for the 1960 cohort are more in line with those for males: the relative decline in benefits is larger for quintile 1 (17%) than for quintile 5 (15%), so the gap ratio between quintiles 1 and 5 rises from 158 percent to 164 percent of quintile 1 benefits. The bottom line is that this policy change expands the gap in lifetime benefits by quintile of lifetime earnings.

Total benefits (i.e., including Medicare, Medicaid, and other programs in addition to Social Security) in the baseline and NRA increase scenarios are shown in Figures 5-7 and 5-8 for males and females, respectively. Total benefits at baseline are slightly *U*-shaped for males in the 1930 cohort; $402,000 for quintiles 1 and 5 males but somewhat lower for males in quintiles 2 through 4. As discussed in Chapter 4, lower-income (lifetime earnings) males receive higher DI, Supplemental Security Income, and Medicaid benefits, while higher-income males receive higher Social Security and Medicare benefits, and these differentials in benefits happen to exactly offset each other for quintiles 1 and 5 males in the base case. For the 1960 cohort, the growth in Social Security and Medicare benefits for high-income workers that is driven by increases in life expectancy changes the pattern so that total benefits rise across the income groups, except that quintile 2 workers continue to have lower benefits than quintile 1 workers.

Because the NRA-increase policy in this simulation reduces Social Security benefits by a larger amount in dollar terms for high-income workers, the *U*-shaped pattern for the 1930 cohort changes to one where benefits are lower for quintile 5 males than for quintile 1 males. For the 1960 cohort, benefits are still higher for quintile 5 workers than for quintile 1 workers, but the difference ($99,000) is smaller than it was in the baseline scenario with an NRA of 67 ($131,000). Thus, the NRA increase would offset roughly a quarter of the widening gap in benefits between the top and bottom quintiles for the 1930 and 1960 cohorts that is driven by the increase

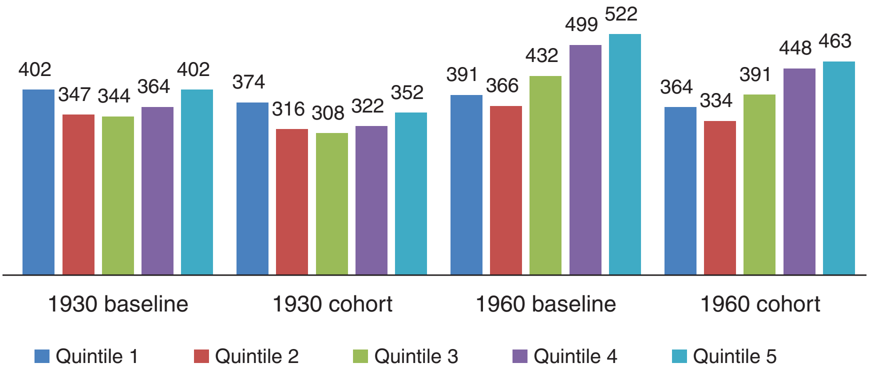

FIGURE 5-7 Average lifetime total benefits for males (in thousands of dollars). Baseline compared with raising the normal retirement age to 70.
SOURCE: Committee generated using Health and Retirement Study data and cohort assumptions.

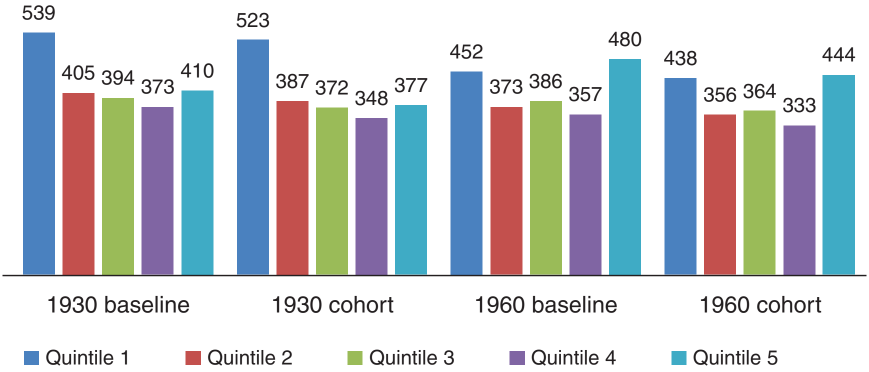

FIGURE 5-8 Average lifetime total benefits for females (in thousands of dollars). Baseline compared with raising the normal retirement age to 70.
SOURCE: Committee generated using Health and Retirement Study data and cohort assumptions.

in differential life expectancy (because the gap had risen about $130,000 due to life expectancy differences and the policy change would reduce it by about $30,000).

The baseline results for females look a bit different in that total benefits for the 1930 cohort are much larger for quintile 1 workers than for quintile 5 workers, reflecting greater Medicare, Medicaid, DI, and Supplemental

Security Income benefits for low-income females. Because of rising life expectancy, by the 1960 cohort total benefits are larger for the quintile 5 group. Implementing the NRA-increase policy in simulation 2 widens the gap between quintiles 1 and 5 benefits in the baseline scenario. Quintile 1 females in the 1930 cohort have $129,000 more in benefits than quintile 5 females at baseline, but they have $146,000 more than the top quintile under the NRA increase. By contrast, quintile 1 females in the 1960 cohort have $28,000 less than quintile 5 workers at baseline but have only $6,000 less under the NRA-increase scenario. Once again, the NRA increase offsets a portion of the trend toward higher benefits for higher-income workers in later cohorts.

Table 5-2 summarizes these effects of the NRA increase in simulation 2 relative to wealth. Benefits fall across the board, but the decline represents a modestly larger share of baseline wealth for male higher earners than for male lower earners. For females, the decline is noticeably larger for higher earners than lower earners. The differential change between the highest and lowest earnings quintiles is less than 0.5 percentage points for males and almost 2 percentage points for females; the net impact is thus progressive, though with some difference in the pattern for males and females.

Unlike the EEA-increase policy in simulation 1, this policy change would generate substantial savings for the Social Security system. Total

TABLE 5-2 Impact of Raising the Normal Retirement Age to 70

	Present value of net benefits at age 50, relative to wealth, based on the mortality profile for those born in 1960		
Earnings Quintile	Baseline	Under Policy Experiment	Percentage Point Change
Males			
Lowest	45.6	40.8	–4.8
2	36.8	31.3	–5.5
3	33.3	27.7	–5.7
4	28.9	23.4	–5.5
Highest	21.4	16.2	–5.2
Females			
Lowest	65.4	62.3	–3.1
2	54.8	50.8	–4.0
3	44.9	40.2	–4.7
4	33.5	28.6	–4.9
Highest	30.8	25.9	–4.9

SOURCE: Committee generated using Health and Retirement Study data and cohort assumptions.

benefit expenditures for males fall by 23 percent, while total benefits for females fall by 15 percent. This simulation therefore suggests that raising the NRA to 70 would enhance the overall solvency of the Social Security system while modestly increasing the progressivity of total benefits.

Policy Simulation 3: Raising Both the EEA and NRA

This simulation essentially combines the first two simulations, enacting a simultaneous increase in the EEA by 2 years and the NRA by 3 years. The results are displayed in Figures 5-9 through 5-12 and Table 5-3. Not surprisingly, the total effect is very similar to what one would obtain by summing the effect of the two reforms individually; because the changes in benefit amounts were much smaller for the EEA increase, the combined effect of the two policies is similar to the effect of the NRA increase alone. This policy reduces benefit expenditures by 22 percent for males and 14 percent for females.

Policy Simulation 4: Reducing Social Security COLAs

Another policy option that has received considerable attention from policy makers is reducing the automatic COLA for Social Security and other benefits. Legislation enacted in 1973 specified that Social Security benefit payments increase every year to keep pace with inflation. The amount of the increase is based on the Consumer Price Index for Urban Wage Earners and Clerical Workers (CPI-W).

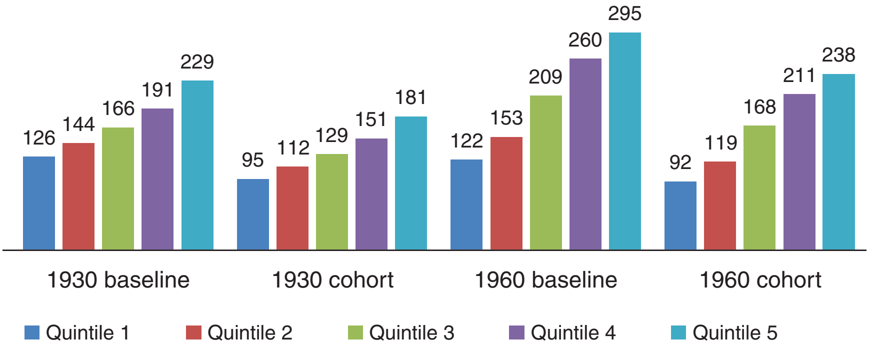

FIGURE 5-9 Average lifetime Social Security benefits for males (in thousands of dollars). Baseline compared with raising the early entitlement age to 64 and the normal retirement age to 70.
SOURCE: Committee generated using Health and Retirement Study data and cohort assumptions.

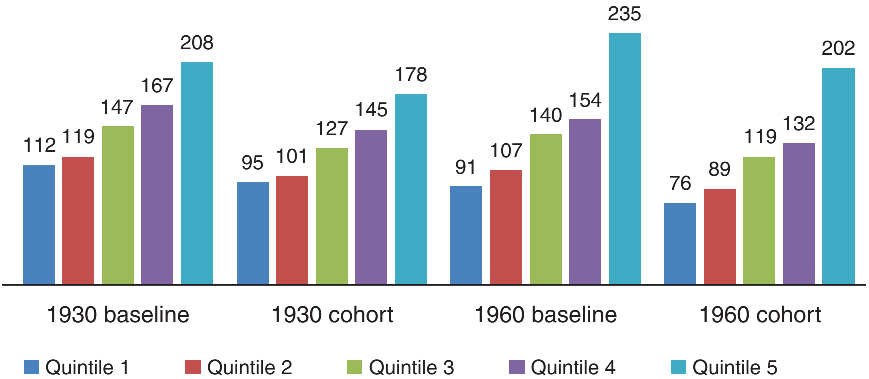

FIGURE 5-10 Average lifetime Social Security benefits for females (in thousands of dollars). Baseline compared with raising the early entitlement age to 64 and the normal retirement age to 70.
SOURCE: Committee generated using Health and Retirement Study data and cohort assumptions.

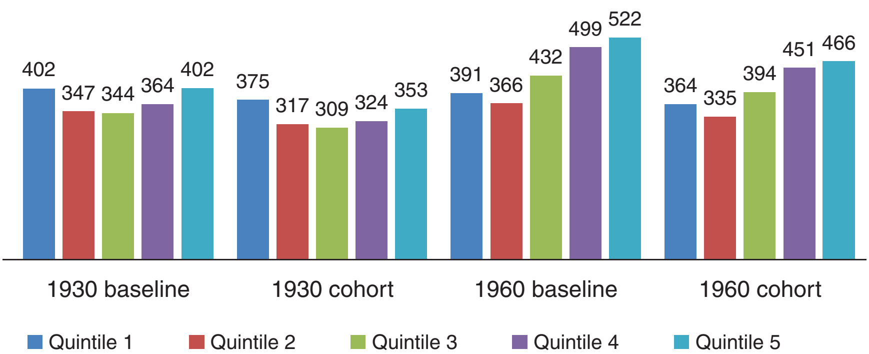

FIGURE 5-11 Average lifetime total benefits for males (in thousands of dollars). Baseline compared with raising the early entitlement age to 64 and the normal retirement age to 70.
SOURCE: Committee generated using Health and Retirement Study data and cohort assumptions.

An alternative proposal is to use the Chained Consumer Price Index for All Urban Consumers (Chained CPI). The Chained CPI takes into account substitutions that consumers make in response to price increases. As a result, the annual increase in the Chained CPI is smaller than the increase in the CPI-W. If Social Security and other benefits were indexed to the Chained CPI, then benefits would grow more slowly over time as retirees age. The

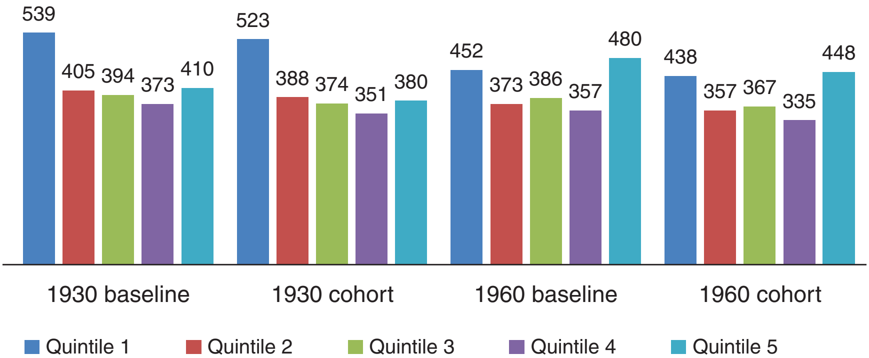

FIGURE 5-12 Average lifetime total benefits for females (in thousands of dollars). Baseline compared with raising the early entitlement age to 64 and the normal retirement age to 70.
SOURCE: Committee generated using Health and Retirement Study data and cohort assumptions.

TABLE 5-3 Impact of Raising the Early Entitlement Age to 64 and the Normal Retirement Age to 70

	Present value of net benefits at age 50, relative to wealth, based on the mortality profile for those born in 1960		
Earnings Quintile	Baseline	Under Policy Experiment	Percentage Point Change
Males			
Lowest	45.6	40.9	–4.8
2	36.8	31.4	–5.5
3	33.3	27.9	–5.5
4	28.9	23.5	–5.3
Highest	21.4	16.3	–5.1
Females			
Lowest	65.4	62.4	–3.0
2	54.8	50.9	–3.9
3	44.9	40.4	–4.5
4	33.5	28.8	–4.7
Highest	30.8	26.1	–4.7

SOURCE: Committee generated using Health and Retirement Study data and cohort assumptions.

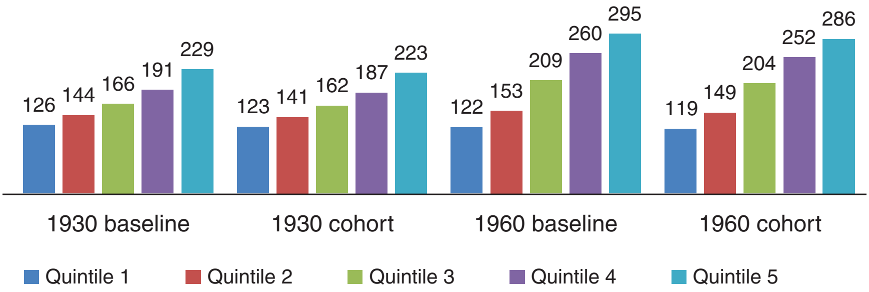

FIGURE 5-13 Average lifetime Social Security benefits for males (in thousands of dollars). Baseline compared with reducing real benefits by 0.2 percent annually. SOURCE: Committee generated using Health and Retirement Study data and cohort assumptions.

impact of this change compounds over time, so groups with longer life expectancies would be more affected.

To simulate the impact of switching from the CPI-W to a Chained CPI, this simulation reduces real benefits by 0.2 percent annually, in contrast to the baseline scenario where benefits rise to keep pace with inflation.[7] The effect of this change on Social Security benefits for males can be seen in Figure 5-13. Benefits fall for all quintiles, but the drop is larger on average for the higher income quintiles, as expected because of their longer life expectancy. For the 1930 cohort, benefits fall by $3,000 for quintile 1 and by $6,000 for quintile 5. For the 1960 cohort, benefits fall by $3,000 for quintile 1 and by $9,000 for quintile 5. These declines translate into relatively small changes in the gap between highest and lowest quintiles as a share of quintile 1 benefit, which falls from 0.82 to 0.81 for the 1930 cohort and from 1.42 to 1.40 for the 1960 cohort.

The effect for females, shown in Figure 5-14, is very similar to that for males; there is a larger drop in benefits for quintile 5 than for quintile 1, but the dollar amounts are small. The effect on total benefits, shown in Figures 5-15 and 5-16, is quite similar to the effect for Social Security only. Table 5-4 shows the impact relative to wealth; on average, net benefits fall by a larger share of wealth for top earners than lower earners, but the effect is relatively small. The overall impact is thus to make entitlement benefits slightly more progressive.

[7]In reality, the impact of the policy change would depend on the difference in the future between the Chained CPI and CPI-W. That difference has been smaller over the past 2 years than 20 basis points.

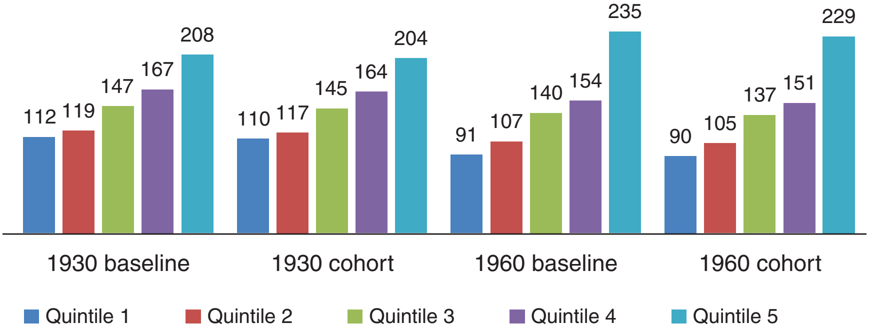

FIGURE 5-14 Average lifetime Social Security benefits for females (in thousands of dollars). Baseline compared with reducing real benefits by 0.2 percent annually.
SOURCE: Committee generated using Health and Retirement Study data and cohort assumptions.

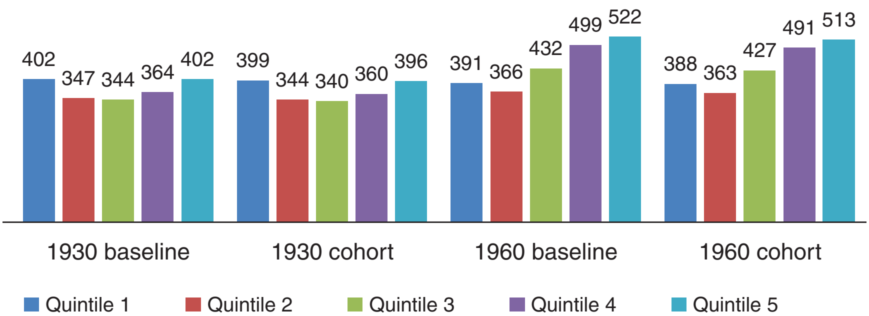

FIGURE 5-15 Average lifetime total benefits for males (in thousands of dollars). Baseline compared with reducing real benefits by 0.2 percent annually.
SOURCE: Committee generated using Health and Retirement Study data and cohort assumptions.

The effect of the policy on system finances is similarly modest, because it reduces program expenditures by about 2 percent. In terms of thinking about how this policy affects individual retirees, it is worth remembering that the values reported here are averages for the cohort. Those individuals who end up being particularly longer lived will experience larger decreases in benefits than the average. There are more of these individuals in higher-income groups, and so the average drop in benefits is larger for these groups, but there will be individuals in every quintile who experience large drops in benefits as a result of this policy.

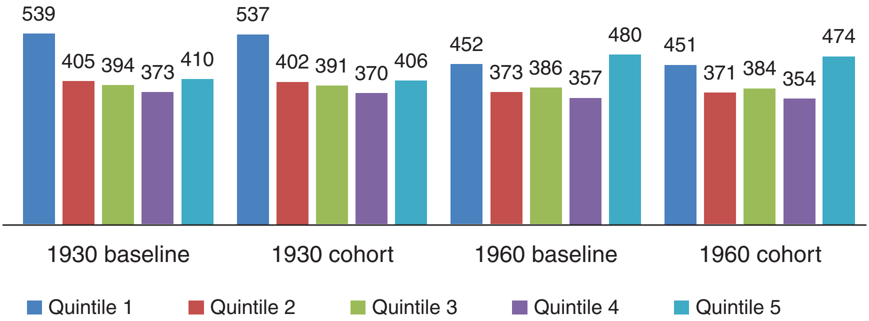

FIGURE 5-16 Average lifetime total benefits for females (in thousands of dollars). Baseline compared with reducing real benefits by 0.2 percent annually.
SOURCE: Committee generated using Health and Retirement Study data and cohort assumptions.

TABLE 5-4 Impact of Reducing Real Benefits by 0.2 Percent Annually

	Present value of net benefits at age 50, relative to wealth, based on the mortality profile for those born in 1960		
Earnings Quintile	Baseline	Under Policy Experiment	Percentage Point Change
Males			
Lowest	45.6	45.2	–0.4
2	36.8	36.3	–0.5
3	33.3	32.7	–0.6
4	28.9	28.2	–0.7
Highest	21.4	20.8	–0.6
Females			
Lowest	65.4	65.1	–0.2
2	54.8	54.4	–0.3
3	44.9	44.5	–0.4
4	33.5	33.1	–0.4
Highest	30.8	30.3	–0.5

SOURCE: Committee generated using Health and Retirement Study data and cohort assumptions.

Policy Simulation 5: Reducing the Top PIA Factor to 10 Percent

The final two policy simulations reduce benefits in ways that primarily affect higher-income workers. As previously noted, many proposals designed to restore the Social Security program to long-term solvency involve some kind of benefit cut; there may be political support for reducing benefits in a way that protects lower-income workers, because lower-income older households on average rely on Social Security for a large share of their retirement income. A second rationale for enacting benefit reductions in this way is that the reductions might offset some of the decrease in benefit progressivity that is occurring naturally because of rising inequality in life expectancy.

The first such policy simulated by the committee changes the replacement rate on the third leg of the AIME-to-PIA conversion formula from 15 to 10 percent. Thus, each dollar of the AIME beyond the second bend point (currently $4,917 of monthly earnings) would provide only an additional 10 cents of monthly Social Security benefit, instead of an additional 15 cents as under the current formula.

The results of this policy-change simulation are shown in Figures 5-17 and 5-18 for males and females, respectively. For the 1930 cohort, Social Security benefits fall by $1,000 for males in quintiles 3 and 4 and by $3,000 for quintile 5 males; benefits for males in quintiles 1 and 2 are unaffected. The effect for the 1960 cohort is slightly larger: $2,000 for quintile 4 and $4,000 for quintile 5. The effects for females are much smaller because of their lower average earnings: Social Security benefits fall by $1,000 for quintile 5 but are otherwise unchanged. The effect on total benefits, seen in Figures 5-19 and 5-20, is essentially the same, a drop of at most $4,000 for workers in the top quintile. Thus, this policy change is too modest to offset much of the increase in benefits accruing to higher-income workers in the 1960 cohort as a result of their longer life expectancy. Table 5-5 shows the

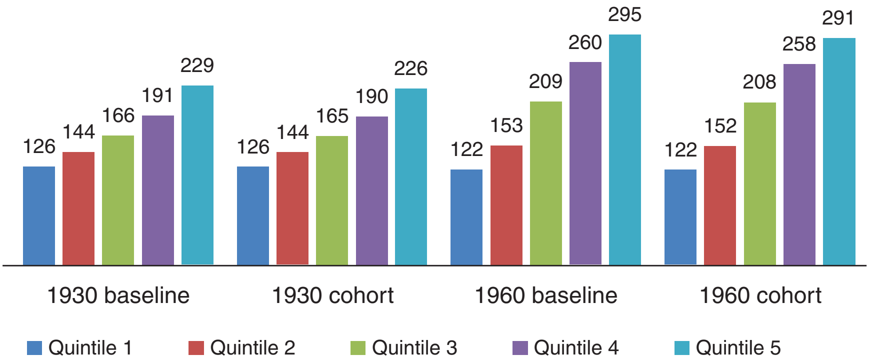

FIGURE 5-17 Average lifetime Social Security benefits for males (in thousands of dollars). Baseline compared with reducing the top primary insurance amount factor by one-third.
SOURCE: Committee generated using Health and Retirement Study data and cohort assumptions.

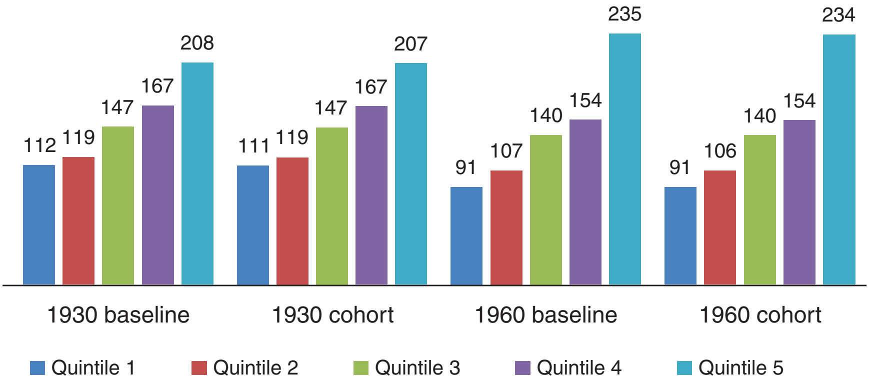

FIGURE 5-18 Average lifetime Social Security benefits for females (in thousands of dollars). Baseline compared with reducing the top primary insurance amount factor by one-third.
SOURCE: Committee generated using Health and Retirement Study data and cohort assumptions.

impact relative to wealth; net benefits fall by a slightly larger proportion of wealth for higher earners than lower earners, so the impact is slightly progressive. The savings to the Social Security system are similarly modest, less than 1 percent of program expenditures.

Policy Simulation 6: Lower Initial Benefits for Top 50 Percent of Earners

The final Social Security policy change simulated for the committee's analysis is intended to reduce benefits to workers in the top half of the AIME distribution. It moves the second bend point in the AIME-to-PIA formula (currently $4,917) to the median level of the AIME and changes the replacement rate for income beyond the second bend point from 15 percent to zero. Thus, this policy should have at least three times the effect of simulation 5, because it reduces the replacement rate above the second bend point all the way to zero rather than just to 10 percent, plus an additional effect from moving the bend point itself.

The effects of this policy on Social Security benefits for males and females are shown in Figures 5-21 and 5-22, respectively. This policy lowers benefits for quintile 1 males in the 1930 cohort by $8,000[8] but lowers them

[8]To understand how this is possible, recall that our income measure is the average of nonzero earnings at ages 41 to 50, whereas benefits are based on lifetime earnings. Also, the quintiles in this analysis are based on household incomes, whereas the benefits are based on individual earnings.

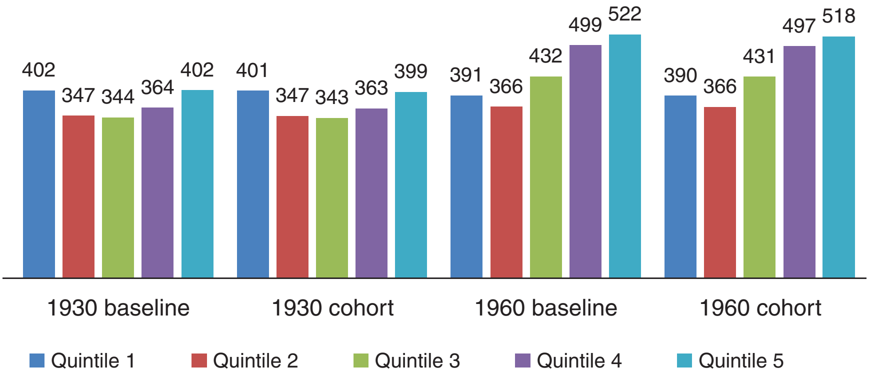

FIGURE 5-19 Average lifetime total benefits for males (in thousands of dollars). Baseline compared with reducing the top primary insurance amount factor by one-third.
SOURCE: Committee generated using Health and Retirement Study data and cohort assumptions.

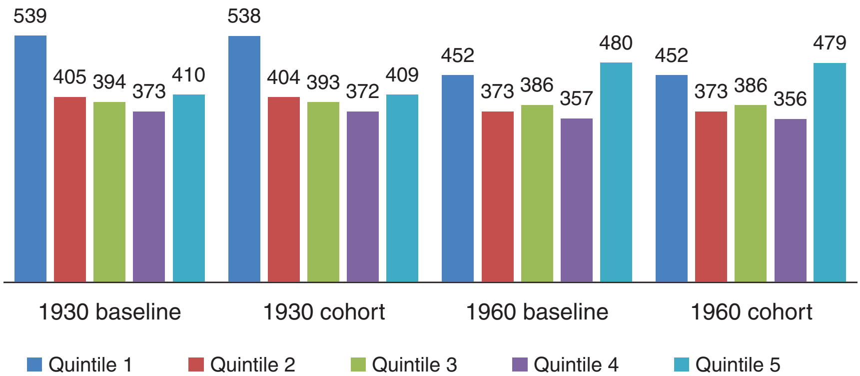

FIGURE 5-20 Average lifetime total benefits for females (in thousands of dollars). Baseline compared with reducing the top primary insurance amount factor by one-third.
SOURCE: Committee generated using Health and Retirement Study data and cohort assumptions.

by much more for higher-income males: Quintiles 4 and 5 males experience a drop in lifetime benefits of $23,000 and $38,000, respectively. The fall in benefits is even larger for men in the 1960 cohort, where quintiles 4 and 5 males now see benefits fall by $32,000 and $49,000, respectively. Effects for females are smaller, as might be expected because of their lower earnings. Quintile 5 females experience a $14,000 decline in benefits in both the 1930 and 1960 cohorts.

TABLE 5-5 Impact of Reducing the Top PIA Factor by One-Third

	Present value of net benefits at age 50, relative to wealth, based on the mortality profile for those born in 1960		
Earnings Quintile	Baseline	Under Policy Experiment	Percentage Point Change
Males			
Lowest	45.6	45.6	–0.1
2	36.8	36.8	–0.1
3	33.3	33.2	–0.1
4	28.9	28.7	–0.2
Highest	21.4	21.1	–0.3
Females			
Lowest	65.4	65.4	0.0
2	54.8	54.8	0.0
3	44.9	44.8	–0.1
4	33.5	33.4	–0.1
Highest	30.8	30.7	–0.1

SOURCE: Committee generated using Health and Retirement Study data and cohort assumptions.

The effects on total benefits can be seen in Figures 5-23 and 5-24. The most interesting aspect of these figures is how the policy change helps to offset the increase in benefits resulting from rising inequality in life expectancy. For males in the 1930 cohort, total benefits for quintiles 1 and 5 in the baseline scenario are the same, while for the 1960 cohort, benefits in the baseline scenario are $131,000 higher in quintile 5 than quintile 1. Thus, a gap between top and bottom quintiles of $131,000 emerges between these two cohorts in the baseline scenario. If this policy were implemented, then the gap between the top and bottom quintiles for the 1960 cohort would be only $90,000, or 70 percent as large. For females, the gap between the top and bottom quintiles is $28,000 for the 1960 cohort at baseline, versus $16,000 under the simulated policy change.

Table 5-6 shows the change in net benefits relative to wealth. The decline is much larger for higher earners than lower earners, so the effect is to make overall benefits from the entitlement programs examined in this analysis more progressive. Note that for males in the top quintile of lifetime earnings, the effect of the policy is to reduce net benefits by 3.4 percent of inclusive wealth. This is about half the gain enjoyed by this group of earners (6.9 percent of wealth) from the steeper mortality gradient between the 1930 and 1960 cohorts.

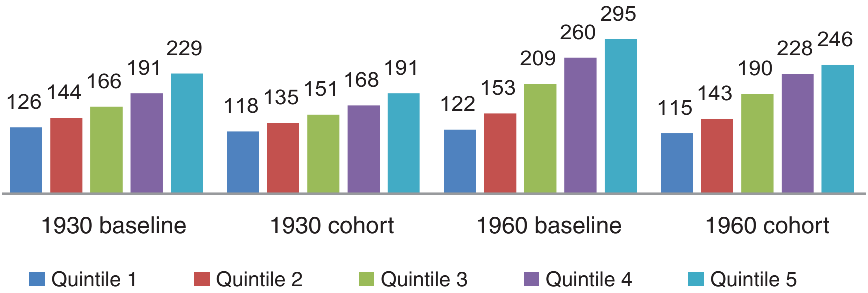

FIGURE 5-21 Average lifetime Social Security benefits for males (in thousands of dollars). Baseline compared with reducing benefits to workers in the top half of the average indexed monthly earnings distribution.
SOURCE: Committee generated using Health and Retirement Study data and cohort assumptions.

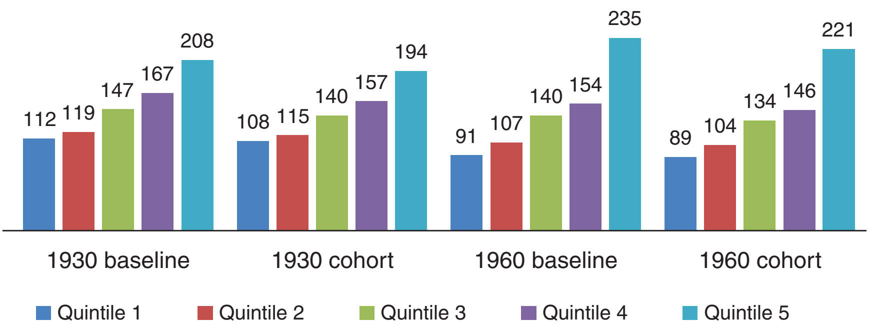

FIGURE 5-22 Average lifetime Social Security benefits for females (in thousands of dollars). Baseline compared with reducing benefits to workers in the top half of the average indexed monthly earnings distribution.
SOURCE: Committee generated using Health and Retirement Study data and cohort assumptions.

This policy change generates much larger savings for the Social Security system than the policy change in simulation 5. Benefit expenditures fall by 11 percent for males and by 5 percent for females.

Box 5-5 considers another approach to offsetting the differential effects on lifetime benefits by quintile, one which would apply different factors to workers who defer claiming benefits depending on their position within the lifetime earnings distribution.

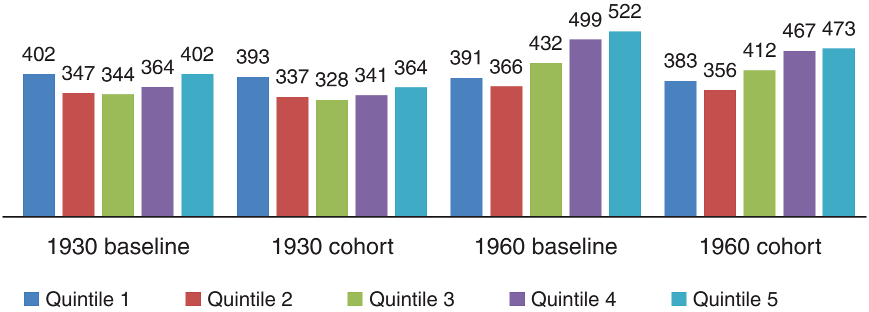

FIGURE 5-23 Average lifetime total benefits for males (in thousands of dollars. Baseline compared with reducing benefits to workers in the top half of the average indexed monthly earnings distribution.
SOURCE: Committee generated using Health and Retirement Study data and cohort assumptions.

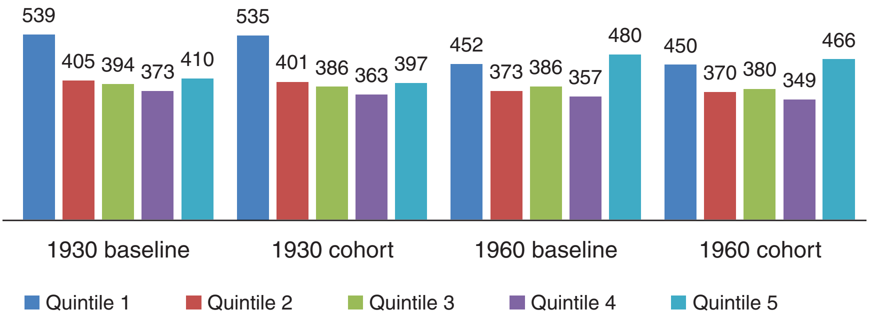

FIGURE 5-24 Average lifetime total benefits for females (in thousands of dollars). Baseline compared with reducing benefits to workers in the top half of the average indexed monthly earnings distribution.
SOURCE: Committee generated using Health and Retirement Study data and cohort assumptions.

A MEDICARE POLICY SIMULATION: RAISING THE ELIGIBILITY AGE FOR MEDICARE

Medicare faces long-term fiscal imbalances that result from both population aging and rapidly rising per capita health care spending. As with Social Security, these fiscal imbalances likely will lead policy makers to consider various options to improve Medicare financing. One option that has been discussed is to raise the usual eligibility age for Medicare from 65 to 67 (Congressional Budget Office, 2013a). When Social Security and

TABLE 5-6 Lower Initial Social Security Benefits for Top Half of Earners (by average indexed monthly earnings)

	Present value of benefits at age 50, relative to present value of consumption, based on the mortality profile for those born in 1960		
Earnings Quintile	Baseline	Under Policy Experiment	Percentage Point Change
Males			
Lowest	45.6	44.5	–1.1
2	36.8	35.4	–1.4
3	33.3	31.2	–2.1
4	28.9	26.2	–2.7
Highest	21.4	18.0	–3.4
Females			
Lowest	65.4	65.1	–0.3
2	54.8	54.3	–0.5
3	44.9	44.0	–0.9
4	33.5	32.4	–1.1
Highest	30.8	29.5	–1.3

SOURCE: Committee generated using Health and Retirement Study data and cohort assumptions.

Medicare were enacted, the age of eligibility was 65 for both programs. Since then, the normal retirement age for Social Security has been increased to 67, whereas the usual Medicare age has remained unchanged.[9]

Some Medicare beneficiaries, however, qualify for Medicare by virtue of being disabled, rather than at age 65, and they would not be affected by a change in "usual" Medicare eligibility age.[10] In addition, were the Medicare eligibility age to change, some 65- and 66-year-olds would become eligible for health insurance subsidies under the new Affordable Care Act[11] health exchanges. However, because the FEM is calibrated with data preceding the enactment of the Affordable Care Act, the simulation performed by the committee (simulation 7) does not capture this possibility.

[9]One significant difference between Medicare and Social Security, however, is that Medicare provides an in-kind benefit, health insurance, that at least prior to the implementation of the Affordable Care Act, was difficult to purchase on the private market, particularly for those with preexisting health conditions.

[10]In particular, Medicare is available to people under age 65 with end-stage renal disease and to those who have been eligible for Social Security disability benefits for at least 2 years.

[11]As noted in Chapter 2, the formal name of the legislation is the Patient Protection and Affordable Care Act of 2010.

BOX 5-5
Differential Increases in Subsequent Benefits Based on Average Indexed Monthly Earnings

Social Security encourages people to defer claiming their benefits by raising the annual benefit level for those who delay claiming beyond their early entitlement age. The goal of this system is to keep lifetime benefits approximately constant regardless of the age at claiming, so the higher benefit at, say, age 67 is intended to offset (in expected present value) the effect of not receiving benefits at ages 62 through 67.

Social Security implements this approach through early retirement adjustments and the Delayed Retirement Credit. For workers who claim benefits before their normal retirement age (NRA), the benefit level is reduced by 6.67 percent for each year up to 3 years prior to the NRA, and then 5 percent for each additional year thereafter. So if the benefit level at the NRA is $10,000 per year and the NRA is 67, then the annual benefit for a worker who claims at age 62 is $7,000 and the annual benefit for a worker who claims at age 64 is $8,000. The extra $3,000 and $2,000, respectively, per year for waiting to claim until age 67 is intended to offset the present value impact of not receiving benefits until that age.

For those who defer claiming their benefits until after their NRA, Social Security has a similar goal, but a different mechanism (the Delayed Retirement Credit) for implementing the adjustment. For workers born in 1943 or later, Social Security raises the annual benefit level by 8 percent for each year of delayed claiming beyond the NRA, up to age 70. So if the normal retirement age is 67 and the benefit level at that age is $10,000 per year, then a worker who delays claiming until age 70 would receive $12,400 per year.

Both the adjustment prior to the NRA and the Delayed Retirement Credit are intended to keep the present value of lifetime benefits roughly constant, on average, for workers who claim benefits at different ages. Yet, as this report has documented, life expectancies vary systematically from the average, and the gap in life expectancies for identifiable groups by income and education has been expanding. The result of these differences is that even if the system is roughly actuarially neutral on average, workers in low earnings categories who defer claiming their benefits will tend to experience a reduction in the present value of their lifetime benefits (because their life expectancy is lower than average), as will workers in high earnings categories who claim their benefits early (for the opposite reason). These effects are becoming larger as the gap in life expectancy between lower and higher earners increases.

In theory, the differential effects on lifetime benefits by earnings quintile could be offset by applying different factors to workers who defer claiming benefits, depending on their position within the lifetime earnings distribution. For example, one could calculate the adjustment factor by quintile that would keep lifetime benefits constant across claiming age, given the mortality projections for workers in that quintile. In practice, as with a structure of adjusting initial benefit levels for differential life expectancy experience, some smoothing process would be required to avoid big jumps in adjustment factors immediately below and above the quintile thresholds; it may also be desirable to give workers nearing retirement certainty about the benefit structure they will face in retirement.

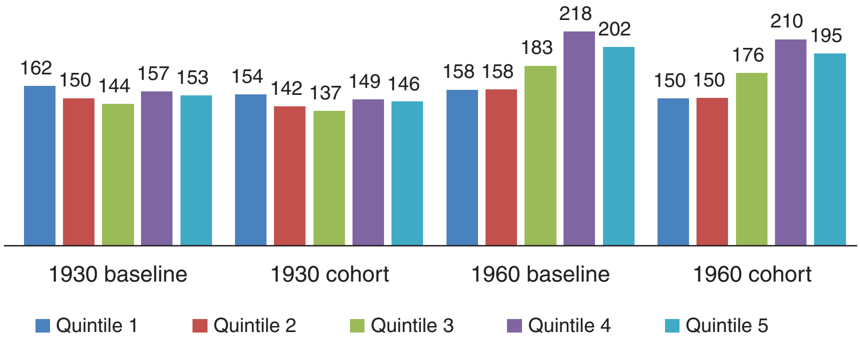

FIGURE 5-25 Average lifetime Medicare benefits for males (in thousands of dollars). Baseline compared with raising the Medicare eligibility age to 67.
SOURCE: Committee generated using Health and Retirement Study data and cohort assumptions.

The results for the committee's simulation of how this policy change would affect lifetime Medicare benefits for males and females are shown in Figures 5-25 and 5-26, respectively. Overall, the delay in eligibility age has a very small effect on lifetime Medicare benefits, mostly because health spending at ages 65 and 66 is quite low relative to later in life. The effect is only a bit larger for those in the lowest-income groups. Although these beneficiaries have significantly higher Medicare spending at ages 65 and 66 and significantly lower life expectancy, both of which increase the effect on lifetime benefits, they are also more likely to qualify for Medicare through their disability status and hence be unaffected by the policy change.

For example, for males in the 1930 cohort, those in quintile 1 lose $8,000 in lifetime benefits when the eligibility age is delayed, compared to a loss of $7,000 for those in quintile 5. The differences are somewhat larger for females, particularly in the 1960 cohort. For this cohort, the increase in the Medicare eligibility age decreases lifetime Medicare benefits by $11,000 for females in quintile 1 and by $7,000 for females in quintile 5.

Table 5-7 shows the results relative to wealth. The decline in net benefits for the lowest quintile is 0.8 to 0.9 percentage points of wealth larger than for the highest quintile. The result is thus regressive.

SUMMARY OF RESULTS FROM THE POLICY SIMULATIONS

This chapter presented seven simulated policy experiments that have an impact on the receipt of lifetime benefits from various entitlement programs. Table 5-8 summarizes some of these effects in terms of how a given policy change affects (1) progressivity, given the health and mortal-

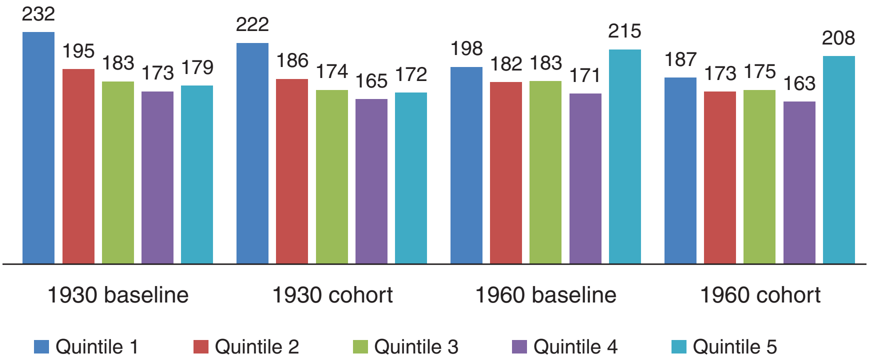

FIGURE 5-26 Average lifetime Medicare benefits for females (in thousands of dollars). Baseline compared with raising the Medicare eligibility age to 67.
SOURCE: Committee generated using Health and Retirement Study data and cohort assumptions.

TABLE 5-7 Impact of Raising the Medicare Eligibility Age to 67

	Present value of benefits at age 50, relative to present value of consumption, based on the mortality profile for those born in 1960		
Earnings Quintile	Baseline	Under Policy Experiment	Percentage Point Change
Males			
Lowest	45.6	44.2	–1.4
2	36.8	35.7	–1.1
3	33.3	32.5	–0.8
4	28.9	28.2	–0.7
Highest	21.4	20.9	–0.5
Females			
Lowest	65.4	63.9	–1.5
2	54.8	53.3	–1.5
3	44.9	43.5	–1.4
4	33.5	32.3	–1.2
Highest	30.8	30.1	–0.7

SOURCE: Committee generated using Health and Retirement Study data and cohort assumptions.

TABLE 5-8 Progressivity of Policy Options for Improving the Solvency of Social Security and Medicare: Effect on Present Value of Benefits Relative to Consumption for Top and Bottom Quintiles Based on Average Indexed Monthly Earnings

Policy Experiment	Impact on Progressivity	Impact on Present Value of Net Benefits Relative to Wealth for Bottom/Top Quintiles for Males	Impact on Solvency
Raise EEA from age 62 to 64	Somewhat less progressive	+0.1 +0.4	Small
Raise NRA to age 70	Somewhat more progressive	–4.8 –5.2	Significant (23% reduction in present value benefits for males; 15% reduction for females)
Raise EEA and NRA as above	Somewhat more progressive	–4.8 –5.1	Significant (22% reduction in benefits for males; 14% for females)
COLA based on chained CPI	Somewhat more progressive	–0.4 –0.6	Small (reduces benefits by less than 2%)
Marginal benefit 10% at top	Somewhat more progressive	–0.1 –0.3	Small (reduces benefits by less than 1%)
Marginal benefit after median	Substantially more progressive	–1.1 –3.4	Medium (11% reduction in benefits for males, 5% for females)
Raise Medicare eligibility to age 67	Less progressive	–1.4 –0.5	Modest (in part because 65- and 66-year-olds are much less expensive than older beneficiaries, and in part because some would qualify through disability insurance)

NOTE: COLA = cost-of-living adjustment, CPI = consumer price index, EEA = early entitlement age, NRA = normal retirement age.
SOURCE: Committee generated using Health and Retirement Study data and cohort assumptions.

ity experience of people born in 1960 and (2) the solvency of the current Social Security (for simulations 1 through 6) or Medicare (simulation 7) systems.

ANNEX TO CHAPTER 5: THE COMMITTEE'S RETIREMENT MODEL

Predicting when people are going to retire and how those decisions might change in response to various policy changes is a challenging modeling exercise. In this annex the committee provides a nontechnical overview of its approach, explains the merits of this approach compared to alternatives in the retirement literature, and provides some indication of the sensitivity of the results to its choice of approach.

The approach adopted in this report for predicting retirement choices is based on what economists call a "reduced-form model." To estimate such a model, the analyst first identifies an outcome of interest and all of the variables that might be expected to influence that outcome. To be specific, we defined our outcome to be employment, which allows us to analyze situations in which individuals may return to as well as exit from employment. The explanatory variables in the model include age, sex, AIME quintile, and health variables, as well as whether the individual was working during the previous 2 years. The data we use to estimate this model come from the HRS, a longitudinal panel survey that interviews individuals aged 50 and older every 2 years.

The model is estimated via statistical methods in which the projected relationship between each explanatory variable and employment is chosen so that the model as a whole predicts actual employment behavior as closely as possible. To give a flavor of the results, the model finds, for example, that a male is 5 percentage points more likely to be working than a female and that someone who was working 2 years ago is 60 percentage points more likely to be working currently than someone who was not.

Reduced-form models such as this one are commonly used in economic analyses of retirement behavior. They have been used, for example, to study the effect of financial incentives from Social Security and private pensions, health and health insurance, and wealth and unemployment (see, e.g., National Research Council, 1996; Gustman and Steinmeier, 2002; Belloni, 2008; Chetty, 2008). Such models essentially estimate correlations between each factor and the outcome of interest, holding the other factors constant. Despite their popularity, however, they are subject to critique. One critique pertains to the validity of the results. If the analyst fails to include in the model all the factors that might affect the outcome measure, then the estimates may be biased, although the best studies are careful to use strategies to mitigate this concern. A more fundamental concern, perhaps, is that a reduced-form model is by its nature "atheoretical," in the sense that the model simply measures the connection between variables, say age and work. It does not uncover the underlying drivers of that connection, such as the discount rate: the rate at which individuals would be willing to trade off between income today and income in the future.

An alternative approach is to estimate a "structural model." In this approach, the analyst writes down an equation (or system of equations) that he or she believes is an appropriate characterization of how individuals approach a decision such as retirement, with only a few unknown parameters such as the discount rate. The analyst then uses datasets such as the HRS to estimate the parameter values that will make predicted behavior match observed behavior as closely as possible. The advantage of such an approach is that the process generates estimates of parameters such as the discount rate, which may be valuable if the analyst wants to do a simulation well outside the range of actual experience, such as how retirement behavior would change if Social Security were eliminated.[12] Proponents of this approach point out that while reduced-form models generally must include age indicator variables to be able to explain the tendency of people to retire at ages such as the Social Security EEA and NRA, a structural model can explain this behavior without them.[13] On the other hand, the validity of structural estimation fundamentally rests on whether the analyst has correctly specified the relationships governing individual behavior, an assumption that cannot be formally tested, and must rather be assessed in relation to theory, the plausibility of the resulting parameter estimates, and the ability of the estimated model to make plausible predictions of responses to change.

[12]For large changes (such as eliminating Social Security altogether), the structural form estimate is only valuable in this way if the underlying parameter would remain unchanged. It is possible, however, to imagine that the underlying parameter varies in some way; if that variation occurs outside the observed data, then it is unlikely the structural form estimation will reflect it.

[13]One natural question that may occur with the committee's approach is how we treat the "excess" tendency to retire at the EEA and NRA in policy simulations where those ages are changed. In our model, the age indicators are defined relative to the EEA and NRA, not to actual ages. So for example, an individual in the simulation who is age 62 and who faces a NRA of 67 will have a value of 1 for the "at EEA" age indicator and a value of 1 for the "5 years before NRA" indicator. In a policy simulation that moves the EEA to age 64 but leaves the NRA unchanged, this individual's EEA indicator is reset to zero because he is no longer at the EEA; another individual who is age 64 would have her "at EEA" indicator set to 1. Beecause the model estimates reflect that people are less likely to work once they reach the EEA, this change will tend to raise the probability that the age-62 individual is working and lower the probability that the age-64 individual is working, relative to the base case. To the extent that 62-year-olds retire at age 62 for reasons other than their proximity to the EEA and NRA, this approach will tend to overstate the change in retirement behavior that will result from this policy change.

A number of authors have popularized the use of structural estimation in the retirement context, including Gustman and Steinmeier (1986), Rust and Phelan (1997), French (2005), and Van der Klaauw and Wolpin (2008). The authors of these studies generally validate their model based on its ability to generate reasonable parameter estimates and to match known features of retirement behavior, like the increased tendency to retire at the EEA and NRA. In many cases, authors also use their models to project the effect of changes to Social Security or other government policies on retirement behavior.

Although in theory it is appealing to use results from these studies to validate the committee's policy simulations, challenges emerge in practice. First, the results from different studies are not always consistent with each other. For example, Gustman and Steinmeier (2005) predict that raising the EEA to 64 would cause many people to delay retirement from age 62 to 64, while French (2005) estimates that increasing the EEA would have little effect on retirement. Also, the policy simulations may not be identical to those used for this report. Gustman and Steinmeier (2009), for example, simulate the effect of recent changes to Social Security, including the increase in the NRA, increase in the Delayed Retirement Credit (which raises the value of delays in claiming Social Security), and elimination of the earnings test for early claiming years prior to the NRA, but they do not report the effect of these changes separately, as would be necessary for comparison to the simulations presented here.

There are other ways of assessing whether the committee's approach is likely to generate reliable estimates of the effect of policy change. First, one can explore how well our model's predictions match observed real-world behavior. We begin by calculating employment rates and rates of Social Security receipt for males and females in the 1930 birth cohort using data from the 1980-2010 March Current Population Surveys (CPS) of the U.S. Census Bureau.[14]

We then predict these same outcome measures using our models (the employment model described above and analogous reduced-form models for claiming of Social Security retired worker and DI benefits). The results from our models, along with the CPS data, are presented in Figures 5-27 and 5-28. The CPS does not distinguish between receipt of Social Security retirement benefits and DI benefits, so the models' results for these benefits are combined in the figures. Figure 5-27 shows that Social Security receipts as predicted from our models match reasonably well with actual receipts

[14]See https://www.census.gov/mp/www/cat/people_and_households/current_population_survey.html [July 2015].

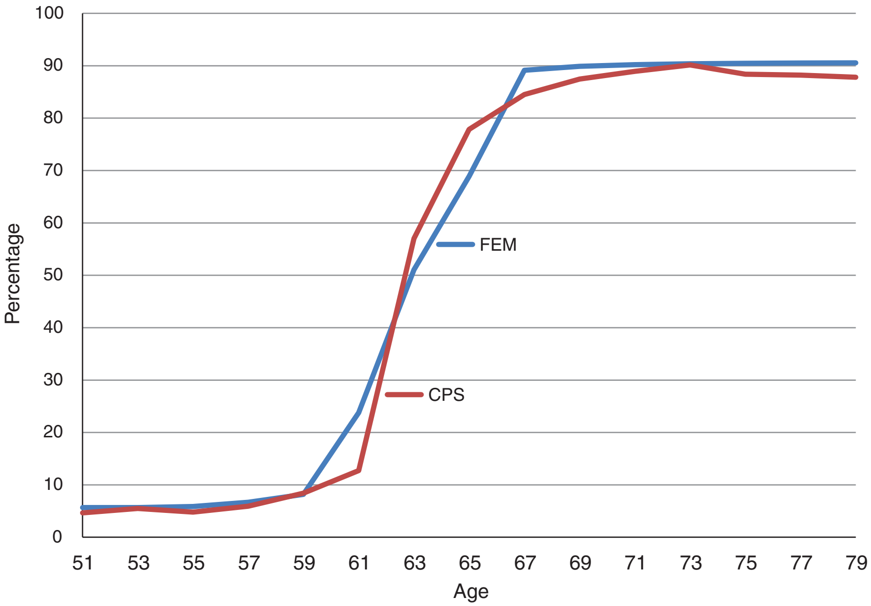

FIGURE 5-27 Percentage of 1930 cohort receiving Social Security benefits, by age. Estimates from the Future Elderly Model and the 1980-2010 March Current Population Surveys.
SOURCE: Committee generated using Health and Retirement Study data, data from the 1980-2010 March Current Population Surveys, and cohort assumptions.

as reported in the CPS.[15] Figure 5-28 shows that our models predict a somewhat higher share of the population working at any given age relative to that observed in the CPS (the average difference is about 5 percentage points), but the pattern of employment decline by age is similar in the two series.

Finally, one can explore how the model behaves "out of sample" by looking more closely at how working and claiming behavior are projected to change in one of this report's policy simulations. Figure 5-29 compares receipt of Social Security benefits (retired worker benefits and DI benefits) under the base case scenario and in simulation 2, in which the NRA is raised from 67 to 70. The model projects that this policy change would lead to significant delays in claiming relative to the baseline scenario—for example, the age at which half of the sample has claimed rises by 3 years,

[15]The committee's model estimates transition over a 2-year period (corresponding to one survey wave), so a spike in behavior that occurs at age 62 in the real world may end up being partly reflected in the age 61 value and partly in the age 63 value in that model.

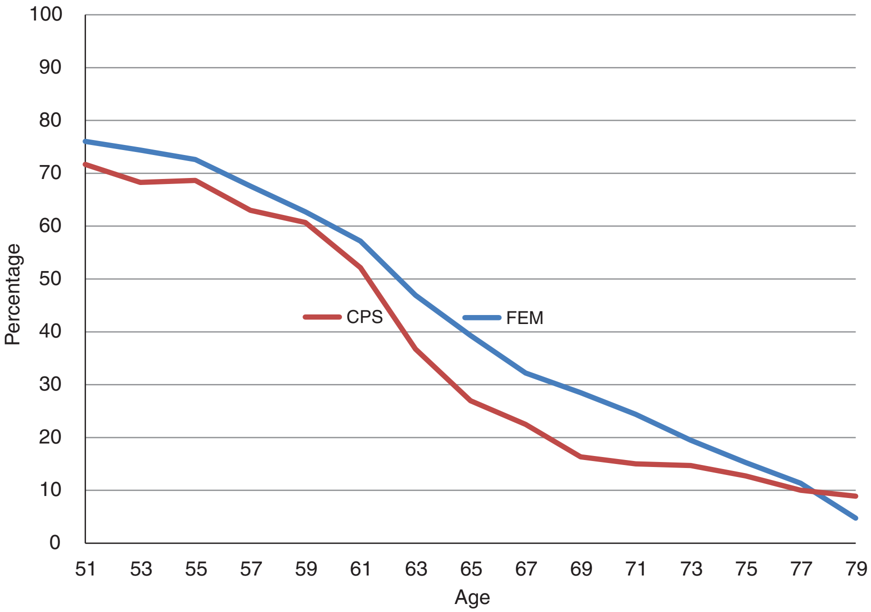

FIGURE 5-28 Percentage of 1930 cohort employed, by age, Future Elderly Model baseline scenario versus raising the normal retirement age to age 70.
SOURCE: Committee generated using Health and Retirement Study data, data from the 1980-2010 March Current Population Surveys, and cohort assumptions.

from age 62 to 65. This is broadly consistent with results reported by Song and Manchester (2008), who found that the increase in the NRA from 65 to 66 was associated with declines in the probability of claiming at ages 62 to 64, and with Behaghel and Blau (2012), who found that the spike at age 65 in the claiming hazard migrated to follow the NRA. Figure 5-30 shows employment under the committee's baseline and NRA increase (simulation 2) scenarios. The increase in the NRA leads to increases in employment, but the gap between the base case and policy simulation is smaller than in Figure 5-29. This difference is in line with Mastrobuoni (2009), who found that the increase in NRA from age 65 to 66 led the age of retirement claiming to increase by about half as much.

Despite the broad consistency between the results presented here for this specific policy change and other published results, it remains true that the results generated from any model should be treated with caution when assessing the effects of policy changes. Such caution is particularly warranted for results from reduced-form models, such as the one used in this report, because the behavioral response to a policy change may differ from the correlations embodied in the historical data used to estimate the model.

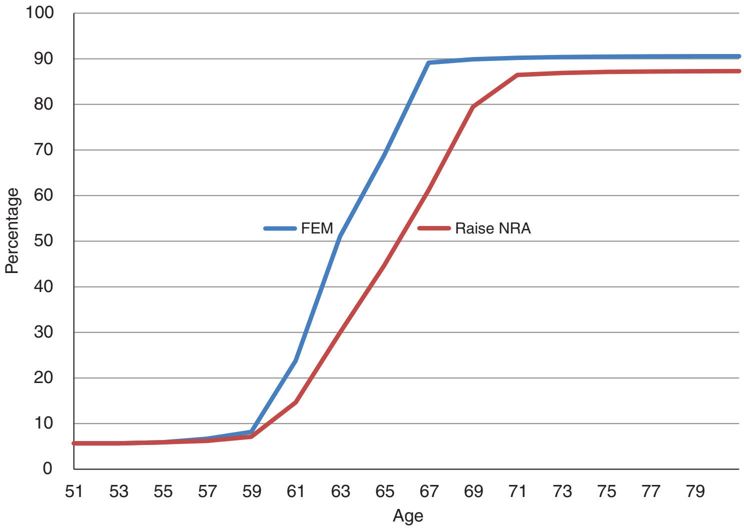

FIGURE 5-29 Receipt of Social Security benefits, by age, Future Elderly Model baseline scenario versus raising the normal retirement age to age 70.
SOURCE: Committee generated using Health and Retirement Study data and cohort assumptions.

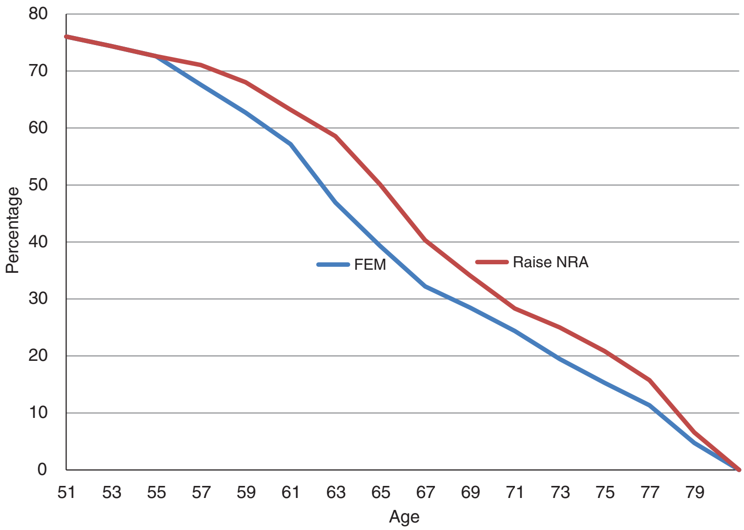

FIGURE 5-30 Percentage of 1930 cohort employed, by age, Future Elderly Model baseline scenario versus raising the normal retirement age to age 70.
SOURCE: Committee generated using Health and Retirement Study data and cohort assumptions.

6

Conclusions

This report presents new estimates and projections of the widening spread in life expectancy by income group. It also provides the first comprehensive estimates and projections of how lifetime net benefits (defined as the present value of benefits after age 50 minus the present value of taxes after age 50) under the major U.S. entitlement programs—Medicare, Medicaid, Social Security (including Old-Age, Disability, and Survivors Benefits), and Supplemental Security Income—are likely to be affected by the changing distribution of life expectancy by lifetime earnings. More specifically, the report suggests that from the cohort born in 1930 (who are mostly in retirement today) to those born in 1960 (who are mostly still in the midst of their working years), life expectancy rises markedly for higher earners but increases much less, or even declines, for lower earners. As a result, inequality in longevity is rising substantially, in tandem with rising inequality in income. For example, male workers born in 1930 who were in the top fifth of lifetime earnings were expected, at age 50, to live 5 years longer than those in the bottom fifth of lifetime earnings. For the 1960 cohort, the committee projects that the gap between top and bottom quntiles will widen to 12.7 years. The projected changes are even more substantial for females.

The report investigates how the progressivity of net benefits changes under the health and mortality conditions by socioeconomic class (as measured by lifetime earnings) of the 1930 birth cohort compared to those of the 1960 birth cohort, for which lifetime earnings gradients by earnings quintile are much steeper. For the mortality regime of the 1930 cohort, our estimates suggest that the major entitlement programs will deliver net lifetime benefits that are larger for those in the lower earnings categories than those in higher earnings categories. For the mortality regime of the 1960 cohort, however, net lifetime benefits are projected to be roughly flat across the earnings distribution for males; for females the differences between lower and higher earners become less pronounced than in the 1930 cohort. In these projections, the ratio of net benefits in the highest quintile to those in the bottom quintile, for example, rises from 0.6 to 1.0 for males and from 0.5 to 0.8 for females. The reason is that life expectancy is rising rapidly at the top end of the earnings distribution, so those earners receive their benefits over a longer number of years relative to lower earners, whereas the change has little effect on taxes paid.

Because of the steepening gradient, the present value of net benefits for males in the highest earnings quintile is projected to rise by $125,000 relative to the lowest quintile; for females this rise is $150,000. The changing mortality pattern has also reduced the progressivity, measured by the present value of expected lifetime benefits relative to inclusive wealth, of the federal entitlement programs. That ratio rises by 7 percentage points for males in the top quintile and by 5 percentage points for females, relative to a slight decline for males in the bottom quintile and a 4 percentage point decline for females in the bottom quintile. There is, to be sure, considerable uncertainty in the amount of widening of the distribution of mortality by income projected by the committee. To gauge the sensitivity of the model and assumptions used, we also considered the case in which only half as much widening takes place, and we found that the effects on the gap in benefits would then be only half as great. Box 6-1 contains a further discussion of potential sources of errors in the report's analyses.

The committee's analysis also explores possible policy responses to these growing gaps in expected lifetime benefits. Seven such responses were compared with the baseline scenario, as a means of illustrating the likely impact of changes in life expectancy by income quintile. These potential reforms were selected from a long list of possible changes that have emerged from policy discussions during past years. Analyses of the seven reforms, using the same model approach as the baseline scenario, were produced for illustrative purposes and should not be seen as indicative of committee preferences or recommendations.

These analyses show only modest effects on the distribution of lifetime benefits from increasing the eligibility ages—either the earliest eligibility age under Social Security of 62 or the eligibility age under Medicare of 65. They also show a small but nonetheless progressive effect from shifting the indexation of Social Security to the Chained Consumer Price Index (defined in Chapter 5), in the sense of reducing the gap in the present value of expected lifetime benefits.

BOX 6-1
Potential Sources of Projection Error in this Report

Broadly speaking, errors in the committee's analyses might arise either (1) in the simulated trajectories of taxes and benefits by income quintile for survivors at each age by sex and health status (generated by the Future Elderly Model based on data from the Health and Retirement Study and other sources) or (2) in the simulated trajectories of mortality and health status (generated by analysis of data from the Health and Retirement Study). The effects of errors from each of these two sources are discussed below.

1. The report's simulations are intended neither to replicate actual historical trajectories nor to project future ones. Instead, the goal was to construct hypothetical trajectories based on the assumption, contrary to fact, that the program and tax structures of 2010 persist for many decades into the future, subject to general increase in income and health costs. These trajectories are then used to analyze the effect of differential mortality changes on the net present value (NPV) of benefits received by different income groups, taking this structure of taxes and benefits as a given. Unless the simulation is badly off the mark from what in fact transpires in future decades, the exact details of these simulated trajectories should not have a large influence on either the qualitative or quantitative aspects of the differences among the NPVs across mortality regimes because the same simulated trajectories for each income quintile are used for both mortality regimes.

   Errors in the trajectories of taxes and benefits for survivors by health status would certainly lead to errors in the calculated NPVs and their differences. However, because these tax and benefit trajectories are held constant for the two experimental health-mortality scenarios (other than the effects on these trajectories of associated variations in health and disability), resulting errors should be limited and relatively small compared to those discussed in (2) below. For example, if the trajectories overstate the level of Medicaid payments for long-term care in later life per survivor, then the effect of greater longevity for the top quintile on the NPV would be overestimated as well. In this case, trajectory errors interact with longevity differences. Similarly, if the trajectories of taxes and benefits are all overestimated by the same proportion at all ages because of an overestimate of the growth rate of health costs, NPVs would be overestimated more for the longer-lived top quintile. In both these cases, although errors would occur, they would arise indirectly through interactions and are therefore expected to be smaller than errors described in (2).

2. Errors in the estimated, fitted, and projected levels of mortality by income quintile and sex for the birth cohorts of 1930 and 1960 are expected to have more important effects. These estimates and projections are intended to match historical and future outcomes, and errors could arise because of limitations in the data, incorrect model assumptions, and

continued

BOX 6-1 Continued

unforeseen changes in trend. Some kinds of error could seriously distort the results of the experiment while others would have smaller effects. If the projected downward trend in mortality were generally too rapid across all quintiles and both sexes, then future gains in longevity would be overestimated. This kind of error in trend would cause an exaggeration of the increase in NPVs between the mortality regimes of the 1930 and projected 1960 birth cohorts, and it would cause a smaller exaggeration of the inter-quintile range of NPVs within each of the mortality regimes. In its interpretation of results, the committee often focuses on the change between mortality regimes in these inter-quintile differences (which are not much affected by overall trend), rather than on change in quintile-specific NPV between regimes (which would be affected strongly by overall trend), so errors in the trend projections will not have a strong effect on this category of results and interpretations.

As reported in Chapter 3, the committee's long-term projections of life expectancy averaged across sex and income quintile are quite similar to those of the Social Security Actuary. However, when disaggregated by sex they show an eventual crossover of male and female life expectancy. Although projected differences in NPV by sex must be interpreted with caution for this reason, it is also true that an error in sex-specific trend projection should not have a large effect on the sex-specific change in inter-quintile NPV range, because the error would affect both top quintile and bottom quintile mortality in the same way, and so it would not have a large effect on the difference in survival and NPV. Additional issues with the estimated mortality models for females are discussed in Chapter 3.

There is one kind of error that matters most for the simulation results, their interpretation, and the conclusions drawn: errors in estimation of changes over time in the mortality-income gradient. Over- or under-estimation of actual and projected inter-quintile mortality differences would directly affect the report's estimates of the inter-quintile NPV differences and changes over time in the inter-quintile NPV range. In fact, as reported in Chapter 3, simulations show that if the inter-quintile mortality difference grows only half as fast as the simulations for the report project, then the inter-quintile NPV differences will also grow only half as fast. Because the report's results and conclusions are most sensitive to this kind of error, the committee looked particularly closely (see Chapter 3) at the variety of estimates in the literature for these mortality differences by income and by education and for trends in these differences.

The committee's results suggest larger effects on progressivity from two possible policy changes: one that increases the Social Security normal retirement age (NRA) and another that substantially reduces benefits, relative to baseline, for higher earners but not for lower earners. A simulated increase in the NRA to age 70 reduces benefits across the board under

Social Security, with the largest proportional decline for the lowest earners. However, an across-the-board reduction in Social Security benefits could still harm lower earners (who are closer to subsistence levels) more than higher earners, so the impact on the distribution of benefits by itself may not be the appropriate way to assess the change. Indeed, these results indicate that Social Security benefits represent a larger share of total net benefits at the top of the earnings distribution than at the bottom because Medicare and Medicaid benefits are relatively more important at the bottom. As a consequence, policy changes that disproportionately reduce Social Security benefits for lower earners may nonetheless have a larger effect at the top than the bottom for overall net benefits because Social Security's weight is smaller at the bottom. This is the case for the rise in the NRA, for example.

Another policy change the committee simulated reduces benefits only to workers in the top half of the lifetime earnings distribution; the details are in Chapter 5 (policy simulation 6). This change offsets much of the increase in benefits resulting from rising inequality in life expectancy. In other words, under the conditions and assumptions of the simulation, making the annual benefit more progressive could largely, if not entirely, offset the effect on lifetime benefits from differential changes in life expectancy by earnings quintile.

In summary, the committee's analyses suggest a substantial increase in inequality in life expectancy, a large effect of that increase on the distribution of lifetime benefits from the major U.S. entitlement programs, and a number of policy reforms that could, if desired, offset those changes.

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Acronyms

AIME	average indexed monthly earnings, a summary of lifetime earnings used to set a retiree's Social Security benefit level
BMI	body mass index, commonly used to distinguish underweight, overweight, and obese individuals. The index refers to weight in kilograms divided by height in meters squared.
CBO	Congressional Budget Office
COLA	cost-of-living adjustment
CPI	Consumer Price Index
CPI-W	Consumer Price Index for Urban Wage Earners and Clerical Workers
DI	the federal disability insurance program administered by the Social Security Administration
EEA	early entitlement age, the age at which an individual can begin receiving Social Security benefits at a reduced level relative to beginning benefit receipt at the normal retirement age

FEM	Future Elderly Model, a microsimulation model developed and maintained by the Roybal Center for Health Policy and Economics at the University of Southern California
HI	the federal hospital insurance program, also known as Medicare Part A. This program helps cover the costs of inpatient care in hospitals and skilled nursing facilities, hospice care, and some home health care services
HRS	Health and Retirement Study, a longitudinal, nationally representative survey of individuals aged 51 and older begun in 1992 and administered by the University of Michigan
IRR	internal rate of return, the rate at which an individual would need to be willing to trade off between present and future income in order for the present value of the stream of Social Security benefits to be exactly equal to the present value of the stream of taxes paid
MCBS	Medicare Current Beneficiary Survey, a continuous survey of a nationally representative sample of the Medicare population conducted by the Centers for Medicare & Medicaid Services
MEPS	Medical Expenditure Panel Survey, a set of large-scale federal surveys of families and individuals, their medical providers (doctors, hospitals, pharmacies, etc.), and employers across the United States
NHANES	National Health and Nutrition Examination Survey
NHIS	National Health Interview Survey
NPV	net present value
NRA	normal retirement age, the age at which an individual can begin receiving unreduced Social Security benefits
OASDI	the federal old-age, survivor, and disability insurance, commonly referred to as Social Security

OLS	ordinary least squares
PIA	primary insurance amount, the benefit a person would receive if he/she elects to begin receiving Social Security retirement benefits at his/her normal retirement age
SMI	Supplementary Medical Insurance, which consists of Medicare Parts B, C, and D, helps pay for physician, outpatient, prescription drug, and other services
SSA	Social Security Administration
SSI	the federal Supplemental Security Income Program, designed to assist low-income aged, blind, and/or disabled people

Appendix A

Biographical Sketches of Committee Members

Ronald Lee *(Cochair)* is a professor of demography, the Jordan Family professor of economics, and director of the Center on the Economics and Demography of Aging, all at the University of California, Berkeley. His current research focuses on intergenerational transfers and population aging, and he co-directs (with Andrew Mason) the National Transfer Accounts project, which includes 46 collaborating countries. He is an elected member of the National Academy of Sciences, the American Association for the Advancement of Science, the American Academy of Arts and Sciences, the American Philosophical Society, and a corresponding member of the British Academy. He has served on both the National Advisory Committee on Aging and the Eunice Kennedy Shriver National Institute on Child Health and Human Development (NICHD) Council. He holds an M.A. in demography from the University of California, Berkeley, and a Ph.D. in economics from Harvard University.

Peter R. Orszag *(Cochair)* is vice chairman of Global Banking at Citigroup. His research interests include health care reform, social security, public policy, global economics, and foreign relations. He is an elected member of the National Academy of Medicine. Prior to his current position at Citigroup, he served as the 37th director of the Office of Management and Budget under President Barack Obama. He also served as director of the Congressional Budget Office from January 2007 until November 2008. He holds a B.A. from Princeton University and an M.S. and Ph.D. from the London School of Economics.

Alan J. Auerbach is Robert D. Burch professor of economics and law at the University of California, Berkeley, and director of the Burch Center for Tax Policy and Public Finance. He was an assistant professor and associate professor of economics at Harvard University and a professor of law and economics at the University of Pennsylvania. He was elected to the American Academy of Arts and Sciences in 1999. He has authored numerous articles, books, and reviews and is the past or present associate editor of six journals, including the *Journal of Economic Literature*, *American Economic Review*, *National Tax Journal*, and *International Tax and Public Finance*. He holds a B.A. from Yale University and a Ph.D. in economics from Harvard University.

Kerwin K. Charles is the Edwin and Betty L. Bergman distinguished service professor in the Harris School at the University of Chicago and a research associate at the National Bureau of Economic Research. His research has examined such questions as how mandated minimum marriage ages affect young people's marriage and migration behavior; the effect of racial composition of neighborhoods on the social connections people make; the causes for the dramatic convergence in completed schooling between recent generations of American men and women; differences in visible consumption across racial and ethnic groups; the effect of retirement on subjective well-being; the propagation of wealth across generations within a family; and many dimensions of the effect of health shocks, including effects on family stability and labor supply. He holds a B.S. from the University of Miami and an M.S. and Ph.D. in economics from Cornell University.

Courtney C. Coile is the class of 1966 associate professor of economics at Wellesley College. She is also a research associate of National Bureau of Economic Research (NBER) and a member of the National Academy of Social Insurance. She is an editor of *The Journal of Pension Economics and Finance* and NBER's *Bulletin on Aging and Health* and has served as a consultant to the National Institute on Aging and the Social Security Administration. Her research centers on issues in the economics of aging, particularly the economic determinants of the retirement decision. She is the coauthor of *Reconsidering Retirement: How Losses and Layoffs Affect Older Workers* (2010), which examines how fluctuations in stock, housing, and labor markets affect workers' retirement decisions and well-being in retirement. Some of her earlier work explored how financial incentives from Social Security and private pensions affect retirement decisions and how couples make retirement decisions. She holds a B.A. from Harvard University and a Ph.D. in economics from the Massachusetts Institute of Technology.

William Gale is the Arjay and Frances Miller chair in federal economic policy in the Economic Studies Program at the Brookings Institution. His research focuses on tax policy, fiscal policy, pensions, and saving behavior. He is codirector of the Tax Policy Center, a joint venture of the Brookings Institution and the Urban Institute. He is the coeditor of several books, including *Automatic: Changing the Way America Saves* (Brookings, 2009); *Aging Gracefully: Ideas to Improve Retirement Security in America* (Century Foundation, 2006); *The Evolving Pension System: Trends, Effects, and Proposals for Reform* (Brookings, 2005); *Private Pensions and Public Policy* (Brookings, 2004); *Rethinking Estate and Gift Taxation* (Brookings, 2001), *and Economic Effects of Fundamental Tax Reform* (Brookings, 1996). He has also written extensively in policy-related publications and newspapers, including op-eds for CNN, the *Financial Times*, *Los Angeles Times*, *New York Times*, *Wall Street Journal*, and *Washington Post*. Dr. Gale holds a B.A. from Duke University and a Ph.D. in economics from Stanford University.

Dana P. Goldman is a professor and the Norman Topping chair in Medicine and Public Policy at the University of Southern California. Until fall 2009, he held RAND's distinguished chair in health economics and directed RAND's program in economics, finance, and organization. He is also an adjunct professor of health services and radiology at the University of California, Los Angeles, and a research associate of National Bureau of Economic Research. His research interests combine applied microeconomics and medical issues, with a special interest in the role that medical technology and health insurance play in determining health-related outcomes. Goldman was the recipient of the National Institute for Health Care Management Research Foundation award for Excellence in Health Policy, and the Alice S. Hersh New Investigator Award, which recognizes the outstanding contributions of a young scholar to the field of health services research. He is an elected member of the National Academy of Medicine. He earned a B.A. from Cornell University and a Ph.D. from Stanford University.

Charles M. Lucas heads his own firm, Osprey Point Consulting. He retired as corporate vice president and director of Market Risk Management at American International Group. Previously, he was the senior vice president and director of risk assessment and control at Republic National Bank of New York, where he headed the Risk Assessment and Control Department, reporting to the Risk Assessment Committee of the Board of Directors. He is a member of the Advisory Group on the Financial Engineering Program at the Haas School of Business, University of California, Berkeley. He is a member of the Corporation, Woods Hole Oceanographic Institution and is a director of Algorithmics, Incorporated. He holds a B.A. and a Ph.D. in economics from the University of California, Berkeley.

Louise M. Sheiner is a senior fellow in the Economic Studies Program and policy director for the Hutchins Center on Fiscal Monetary Policy at the Brookings Institution. Prior to this position, she served as an economist with the Board of Governors of the Federal Reserve System. Prior to this position, she was the deputy assistant secretary for economic policy at the U.S. Department of the Treasury and the senior staff economist for the Council of Economic Advisers. Sheiner's expertise covers a range of disciplines including health, education, fiscal policy, public economics, and welfare. Her recent publications include *Should America Save for Its Old Age? Fiscal Policy, Population Aging, and National Saving*; *Generational Aspects of Medicare*; and *Demographics and Medical Care Spending: Standard and Non-Standard Effects*. She holds a B.A. in biology and a Ph.D. in economics, both from Harvard University.

David N. Weil is a professor of economics at Brown University. Prior to this position, he was a research associate of National Bureau of Economic Research. Weil has written widely on various aspects of economic growth, including the empirical determinants of income differences among countries, the accumulation of physical capital, international technology transfer, and population growth. He has also written on assorted topics in demographic economics including population aging, Social Security, the gender wage gap, retirement, and the relation between demographics and house prices. His current work examines how differences in health contribute to income gaps among countries. He recently published an undergraduate textbook on economic growth. He holds a B.A. from Brown University and a Ph.D. in economics from Harvard University.

Justin Wolfers is a professor of public policy and economics at the University of Michigan. His research interests include labor economics, macroeconomics, political economy, economics of the family, social policy, law and economics, public economics, and behavioral economics. Prior to joining the University of Michigan, he was an associate professor of business and public policy at the University of Pennsylvania and a visiting associate professor at Princeton University. He is a research associate with National Bureau of Economic Research, a research affiliate with the Centre for Economic Policy Research in London, and a research fellow at the Kiel Institute for the World Economy in Germany. He holds a B.S. from the University of Sydney and an M.A. and Ph.D. in economics from Harvard University.

Rebeca Wong is the P. & S. Kempner distinguished professor of health disparities at the University of Texas Medical Branch (UTMB). She joined UTMB in 2008 to serve as director of the World Health Organization/Pan American Health Organization Collaborating Center on Aging and Health. She is also a professor of sociomedical sciences in the Preventive Medicine and Community Health Unit and senior fellow of the Sealy Center on Aging, also at UTMB. Prior to joining UTMB, she was on the faculty of the Johns Hopkins School of Public Health and the Georgetown University Department of Demography and served as associate director of the University of Maryland Population Research Center. Wong's research focuses on the economic consequences of population aging, in particular in Mexico and among immigrant Hispanics in the United States. She serves as principal investigator of the Mexican Health and Aging Study. She holds a B.S. from the Universidad Nacional Autonoma de Mexico and an M.A. and Ph.D. in economics from the University of Michigan.

Appendix B*

The Future Elderly Model: Technical Documentation

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Jeffrey Sullivan, Precision Health Economics, LLC
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*Appendix B and accompanying Excel Workbook are available to download at nap.edu/GrowingGap under the **Resources** tab.