How the Growing Gap in Life Expectancy May Affect Retirement Benefits and Reforms

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Older Americans have experienced dramatic gains in life expectancy in recent decades, but an emerging literature reveals that these gains are accumulating mostly to those at the top of the income distribution. We explore how growing inequality in life expectancy affects lifetime benefits from Social Security, Medicare and other programmes and how this phenomenon interacts with possible programme reforms. We first project that life expectancy at age 50 for males in the two highest income quintiles will rise by seven to eight years between the 1930 and 1960 birth cohorts, but that the two lowest income quintiles will experience little to no increase over that time period. This divergence in life expectancy will cause the gap between average lifetime programme benefits received by men in the highest and lowest quintiles to widen by US$130,000 (in US$2009) over this period. Finally, we simulate the effect of Social Security reforms such as raising the normal retirement age and changing the benefit formula to see whether they mitigate or enhance the reduced progressivity resulting from the widening gap in life expectancy.
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Introduction

People with higher socio-economic status (SES) have historically enjoyed longer life expectancies than those with lower SES. While this phenomenon has been documented since the 1970s,[1] researchers have only recently begun to explore how the gap in life

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[1] Kitagawa and Hauser (1973).

expectancy by SES is evolving over time. Although there are some inherent challenges in this work, the emerging consensus of this nascent literature is that the gap is wide and has been increasing over time.[2] Recent well-publicised studies by Case and Deaton[3] and Chetty *et al.*[4] have helped to bring this issue to the attention of the general public.

While the widening gap in life expectancy in the U.S. is increasingly well documented, its impact on government programmes such as Social Security and Medicare has received far less attention. Yet the implications for these programmes are potentially quite substantial. These programmes provide benefits annually from the age of initial benefit claim, which occurs between ages 62 and 70 for Social Security retired worker benefits and at age 65 (or earlier, in the case of disability) for Medicare, until death. When life expectancy increases for those at the top of the income distribution, they collect additional years of benefits. There is little corresponding increase in taxes paid, except to the extent that having a longer life expectancy may induce people to work longer. By contrast, if those at the bottom of the income distribution are not experiencing a similar increase in life expectancy, there is no increase in their total lifetime benefits. Thus, the widening gap in life expectancy has the potential to greatly affect the lifetime progressivity of entitlement programmes as well as their long-term solvency.

A recent National Academies Panel on which we participated explored the growing gap in life expectancy by SES and its implications for government entitlement programmes (Committee on the Long-Run Macroeconomic Effects of the Aging US Population; hereafter, the Committee).[5] In this paper, we build upon the Committee's work and expand on the implications of its findings for the U.S. and other countries facing widening inequality in life expectancy.

Our analysis proceeds in three steps. First, we project how life expectancy at older ages is evolving over time by SES. We use lifetime income quintiles as our core measure of SES and estimate mortality models that allow for differential trends by income quintile, using data from the Health and Retirement Study (HRS) linked to Social Security earnings histories. From these models, we project survival after age 50 for the 1930 and 1960 cohorts, by income quintile. Next, we estimate the present value of lifetime benefits by cohort and income quintile. We include benefits from Social Security, Disability Insurance (DI), Supplemental Security Income, Medicare and Medicaid and look at benefits, benefits net of taxes and net benefits as a share of lifetime wealth.[6] These projections are based on the Future Elderly Model (FEM), a demographic and economic simulation model that uses data from the HRS and other sources and has been employed to project trends in health-care outcomes and costs in studies such as Goldman *et al.*[7] Finally, we use the FEM to estimate the effect of potential reforms to Social Security and Medicare. In each case, we simulate the reform's effect on lifetime benefits and discuss how this compares to and interacts with the changes in benefit progressivity that are occurring due to changing life expectancy by income quintile. All of the FEM simulations assume that Social Security and Medicare

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[2] Waldron (2007); Bound *et al.* (2015).

[3] Case and Deaton (2015).

[4] Chetty *et al.* (2016).

[5] Committee on the Long-Run Macroeconomic Effects of the Aging US Population (2015).

[6] Here and elsewhere in the paper, we use the term "Social Security" to refer to old-age benefits (OASI), rather than as an inclusive term that also includes Disability Insurance.

[7] Goldman *et al.* (2005).

benefits will continue to be paid in the future, even though the trust funds from which these benefits are provided are projected to be exhausted.[8] Assuming that benefits will be paid as written under current law is the approach used by the Congressional Budget Office in its long-term budget projections and seems more in accordance with Congressional intent than assuming an abrupt cut in benefits in the future when the trust funds run out.

Our paper offers a number of contributions relative to the previous literature. First, we summarise the complex methodological issues involved in projecting life expectancy by SES and provide new estimates to complement those in other studies.[9] Second, we assess the progressivity of government benefits and how this is changing over time due to the widening gap in life expectancy by SES. While there are studies that explore the progressivity of individual programmes such as Social Security or Medicare,[10] this is the first study of which we are aware that estimates the progressivity of government benefits for the older U.S. population (those aged 50 and above) as a whole. Moreover, the previous literature has tended to look at progressivity at a point in time, rather than how it evolves over time with a widening gap in life expectancy, which is the primary focus of this study.[11] Finally, there are relatively few studies that focus on the distributional effects of possible reforms to Social Security or other government programmes (Gustman *et al*. 2014; Coronado *et al*. 2002[12] are examples), and those few do not focus on how this might be changing over time with the growing gap in life expectancy.

We have several major findings. First, consistent with other recent studies, we confirm that life expectancy at older ages has been rising fastest for the highest socio-economic groups. For those born in 1930, the gap in life expectancy at age 50 between males in the bottom 20 per cent and top 20 per cent of lifetime income is five years, according to our estimates. For males born 30 years later (in 1960), the projected gap at age 50 between the highest and lowest quintiles widens to almost 13 years, an increase of nearly eight years. Second, we find that there is a growing gap by lifetime income in projected lifetime benefits from programmes such as Social Security and Medicare. For the 1930 cohort, the present value of lifetime benefits at age 50 is roughly equal for those in the highest and lowest quintiles of lifetime income, as those at the top receive more from Social Security while those at the bottom receive more from DI, Supplemental Security Income (SSI) and Medicaid. For the 1960 cohort, by contrast, there is a US\$130,000 gap in benefits between the highest and lowest quintiles, as those in the top quintile are increasingly likely to receive benefits over longer periods of time, relative to those at the bottom. Finally, we show that a number of commonly discussed Social Security reforms would make the programme more progressive, although their impact on progressivity tends to be small compared to the changes arising due to differential changes in life expectancy.[13]

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[8] See OASDI Trustees (2016).

[9] Bound *et al*. (2015) also discuss some of these methodological issues, while Waldron (2007) and Bor *et al*. (2017) include useful reviews of the literature.

[10] For example, Liebman (2002); Bhattacharya and Lakdawalla (2006).

[11] Guo and Moon (2017) is a recent exception, as they examine the return from Social Security and Medicare for a sample low, median and high wage earner from three different birth cohorts.

[12] Gustman *et al*. (2014); Coronado *et al*. (2002).

[13] Here and elsewhere in the paper, we use the term "progressive" as it is traditionally defined in economics—that is, that a tax (benefit) is progressive if the average tax (benefit) rate rises (falls) with income—and not as it is sometimes used in political discussions in the U.S. (e.g. as a synonym for liberal).

Background on socio-economic status and mortality

For the U.S., research on differences in mortality by SES has a long history, including the landmark study by Kitagawa and Hauser[1] that found important differences in 1969 mortality by educational attainment. Differences in the mortality of African Americans and Whites also have been documented throughout the 20th century, with a gap of 7.1 years in 1993. That gap has declined since then, to 3.4 years in 2014. Given this, one might have expected that SES differences had narrowed in general, but the opposite is the case. Study after study has found that SES differences have been widening in recent decades, whether SES is measured by educational attainment or by income. Before reviewing these studies, we will briefly consider some of the methodological difficulties in this area.

Methodological issues

One of the biggest problems is reverse causality: while differences in SES may lead to differences in health and survival through various routes, it is also true that differences in health may lead to differences in income by affecting the ability of adults to work, by incurring out-of-pocket health-care costs and perhaps by affecting the educational attainment of children early in life and thereby earnings throughout life.[14] Education-based measures of SES are at less risk in this regard than income-based measures, because unlike income, education is largely fixed early in life. For our purposes here, reverse causality is not necessarily an issue, because if ill health causes both lower income and shorter life, the consequence is nonetheless that the lower-income person in question receives government old-age benefits over fewer years. The one possibility that we do need to exclude is that a short-term illness causes both a short-term decline in income and a higher risk of death, because this association of short-term changes will exaggerate the implications for receipt of government benefits over the longer term. Use of a long-term measure of income, as will be discussed later, greatly reduces this problem, particularly if it describes incomes earlier in life relative to the survival outcome.

When the analysis period spans many years, there is a different problem: the meaning of an inflation-adjusted dollar of income changes over time, and the relative position in the income distribution of each year or generation may be a more meaningful measure. For this reason, the standard approach has been to use income quantiles, rather than absolute income, as the SES measure.

While measuring SES by educational attainment reduces the problem of reverse causality, it brings a new problem: increasing adverse selection for those in low-attainment categories such as less than high school graduation, as the general level of attainment in the population rises. Increasing adverse selection at lower attainment levels and decreasing positive selection for the higher attainment levels make it difficult to interpret changes over time and could, for example, lead to estimates of declining life expectancy for the lower attainment groups.[15] One way to avoid this problem is to define attainment by percentile position in the educational distribution for each birth cohort.[16]

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[14] Smith (2004, 2007).

[15] Dowd and Hamoudi (2014).

[16] Bound *et al.* (2015).

The use of quantile measures for education or income helps to avoid some problems, but it also has a drawback. Finding a relationship between the quantile of education or income and mortality still leaves us not knowing whether a widening dispersion in income or earnings is causing a widening dispersion in mortality by SES.

Recent literature on education and mortality

Many studies in the past eight years have reported life expectancy differences by educational attainment that are both strikingly wide and increasing. Meara *et al.*[17] compare remaining life expectancy at age 25 for men (denoted e_{25}) with at least some college to that of men with high school or less in 2000. For African American men, the difference was 8.4 years and for White men it was 7.8 years, and in both cases the differences had increased by one or two years since 1990. Rostron *et al.*[18] compared e_{45} for the highest and lowest education category in the early 2000s, finding a difference of 10–12 years for females and 11–16 years for males. Olshansky *et al.*[19] found that life expectancy at birth for White women with less than a high school education actually declined by four or five years from 1990 to 2008. This study also found that e_0 for men with more than 16 years of education was 13.4 years more than those with less than high school in 1990, rising to 14.2 years by 2008, with an increase for women from 7.7 to 10.3 years. None of these studies addressed the problem of increasing adverse selection. Bound *et al.*[2] address this issue by analysing education quartiles for 1990 and 2010. With this approach, they find no decline in life expectancy for low-education women, but they do find a difference of six to seven years in the median age at death in 2010 between the bottom quartile of males and the top three quartiles, and this difference had roughly doubled since 1990. Hendi[20] also explicitly addresses the selection problem using different methods. This study finds a difference in e_{25} between less than high school and college of about 10 years for both White men and women, and that the difference is growing. It also finds that e_{25} declined for least-educated White women, with only some of the measured decline accounted for by selection. A study by Goldring *et al.*[21] reported no evidence that mortality declines were numerically greater for high education men than for low, but they did not consider whether *proportional* declines may have been greater for them, so it is not clear whether their findings are inconsistent with the other studies. Case and Deaton[3] found a significant increase between 1999 and 2013 in all-cause mortality of middle-aged non-Hispanics, with more dramatic increases for those with less education and for Whites. They suggest a potential connection with the opioid epidemic and, more broadly, with economic distress. Overall, the findings of the studies using educational measures are very consistent in showing very large and widening differences.

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[17] Meara *et al.* (2008).
[18] Rostron *et al.* (2010).
[19] Olshansky *et al.* (2012).
[20] Hendi (2015).
[21] Goldring *et al.* (2015).

Recent literature on income and mortality

A seminal study by Waldron[2] based on mortality and earnings data from Social Security and Medicare engendered a wave of closely related studies using a similar design based on the Health and Retirement Survey (HRS) linked to Social Security earnings histories. Waldron measured income as the average of non-zero Social Security earnings at ages 45–55. It was not possible to use full lifetime earnings because many workers joined Social Security later in their careers when coverage was expanding. For those reporting zero earnings in a year, it was not possible to distinguish between those with no earnings and those whose earnings were not covered by Social Security. Waldron related quantiles of this earnings measure to mortality observed in later years in the age range 60–89 in the years 1972–2001, with ages depending on the birth cohort.[22] She projected future mortality for each birth cohort in order to get a measure of e_{65}. A striking chart shows that for the birth cohort of 1913, there was only a half-year difference in e_{65} between the top half of the earnings distribution and the bottom half. For the cohort born 28 years later in 1941, however, this difference had grown to 4.6 years, and while e_{65} for the bottom half of the earnings distribution rose by only a bit over one year, for the top half it rose by about six years.

While Social Security data cover a huge population and have rich earnings histories, it also has very few covariates. Bosworth and Burke,[23] building on Waldron's studies, chose to use the HRS. Its sample is relatively small, but it is linked to the Social Security earnings histories and it has exceptionally rich information on health, disability, assets, pensions, and many other variables of potential interest. Bosworth and Burke measure income as quantiles of the average of non-zero earnings for ages 41–50 and relate this to mortality above age 50. For couples, they allocate to each the sum of their individual incomes divided by the square root of two, to adjust for economies of scale in household consumption. A later study by Bosworth *et al*.[24] uses a similar design but analyses data from both HRS (through the 2012 wave) and Survey of Income and Program Participation. The results are quite similar to Waldron. There is a difference in e_{50} between the highest and the lowest earnings decile of 9–12 years for males and females born in 1940, a big increase relative to the difference for the birth cohort of 1920.

Chetty *et al*.[4] use tax data to study the gradient in life expectancy in different geographies. The results suggest not only a growing gradient by income, but that the magnitude of the gradient is smaller in more affluent, more educated areas than in less affluent, less educated ones.

One recent exception to the growing body of literature showing expanded life expectancy gaps is Currie and Schwandt,[25] who find that low-income counties have narrowed the gap in life expectancy at birth (but not at age 50) with high-income counties. An important research agenda involves reconciling the results for children with those for adults, including by examining differences in childhood mortality at the individual rather than county level. In general, however, the literature points to substantial increases in life expectancy differentials for adults.

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[22] Fewer and fewer years are observed for the more recent cohorts, ending in only one year for the 1941 birth cohort.

[23] Bosworth and Burke (2014).

[24] Bosworth *et al*. (2016).

[25] Currie and Schwandt (2016).

Background on the progressivity of government programmes

Conceptual issues

The growing gap in life expectancy by SES forces society to grapple with a key question—is it "fair" for groups that experience larger gains in life expectancy to receive larger gains in the present value of government benefits? For most government programmes, policymakers do not focus on lifetime benefits because there is no obvious time dimension: in any given year, people who are alive pay taxes and receive benefits such as national defence and clean air. But for programmes where the ages at which taxes are paid and benefits received differ significantly, this issue becomes critical. For brevity, we discuss this issue in terms of Social Security only, although similar arguments may apply to Medicare and other programmes.

With Social Security, two concepts dominate discussions regarding fairness in the economics literature.[26] The first is the expected rate of return on payroll tax contributions. In a system with an actuarially fair rate of return, the present value of real benefits received is equal to the present value of real contributions. In the U.S., early cohorts received more than fair average rates of return due to the transfers inherent in starting a pay-as-you-go system; current and future cohorts receive less than fair returns because of the costs of these transfers.[27] Of greater relevance here is whether the average rates of return for different SES groups within a cohort are similar. Similar rates of return across groups may align with basic notions of fairness, enhance political support for the system and minimise work disincentives. As the gap in life expectancy grows, the average rate of return for the high SES group increases because longer life does not much increase tax payments by members of the group but it does raise their years of benefits. If societal notions of fairness dictate that all groups should receive an equal rate of return, then the effects of the growing gap in life expectancy on the distribution of lifetime benefits are undesirable.

The second key consideration for society is the extent to which Social Security should redistribute from those with high lifetime earnings to those with low lifetime earnings. Any such action naturally tends to make the rates of return unequal across groups, but may nonetheless be desired by society, motivated by a utilitarian concern for the poorest members of society. While the growing gap in life expectancy does not reduce the absolute benefits received by low-SES groups (unless their life expectancy is declining), it does render the system relatively less generous to such groups; moreover, it may threaten absolute benefits of low-SES groups by straining the programme's finances. In practice, the U.S. system seems to embrace both the rate-of-return framing of Social Security (by referring to payroll taxes as contributions and tracking each worker's contributions over his or her life) and its redistributive role (by employing a progressive benefit formula, as discussed below).

Another salient feature of Social Security is that it is an annuity. Such a system necessarily redistributes from the short-lived to the long-lived, generating *ex post* inequality in the rate of return. This may be contrasted with the *ex ante* inequality that would arise, for example, if one group paid more in taxes but received the same benefit amount as another. *Ex post* inequality does not offend notions of fairness because it is

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[26] For discussions that incorporate the perspective of behavioural economics and disciplines other than economics, see Aaron (1999, 2011) and Waldron (2015).

[27] Leimer (1995).

unpredictable—some 60-year-olds live a long time, some do not—and the fact that the system provides larger lifetime benefits to those who live longer is what it is designed to do, in order to insure against the risk of having a long life and many years of consumption to finance. This may become problematic, however, if there are identifiable groups that vary in life expectancy, as this introduces a non-random aspect to the inequality.

Background on government programmes

While a discussion of the institutional features of all major entitlement programmes with beneficiaries age 50 and above is impractical, we provide a few details that are most salient for the programmes' distributional impact. We focus on Social Security, since most reform proposals we later consider concern it.

Individuals are eligible for Social Security if they have 40 quarters of covered earnings. To calculate benefits, past earnings are multiplied by a wage index and an average of the top 35 years of indexed earnings is calculated (average indexed monthly earnings, or AIME). A piecewise linear formula is applied to the AIME to create the primary insurance amount (PIA), the basis for the monthly benefit. The formula introduces progressivity because the rate at which AIME is translated into PIA declines as AIME increases. In 2016, each dollar of AIME up to the first bend point of US$856 is converted into 90 cents of PIA; the conversion factor is 32 per cent until the next bend point of US$5,157, and 15 per cent for earnings beyond this value.

The monthly benefit depends on the age at initial benefit claim. Workers may claim as early as 62, the earliest eligibility age (EEA) and as late as 70. Workers receive the PIA if they claim at the normal retirement age (NRA), which has been rising over time from age 65 (for those born by 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.[28],[29] Dependent and surviving spouses and children of insured workers are eligible for benefits; individuals who are dually entitled receive the larger of the benefits to which they are entitled.

The DI programme is integrated with Social Security, and its benefit is similar, except there is no reduction for early claiming; eligibility requires passing a medical screening and meeting recent work requirements. When DI recipients reach the NRA, they move to Social Security. Social Security and DI benefits are funded by payroll taxes of 6.2 per cent of earnings by both employers and employees, up to a taxable maximum of US$118,500 in

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[28] A workers whose NRA is 67 receives 70 per cent of the PIA if he claims at age 62 and 124 per cent of the PIA if he claims at age 70. 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 due to a combination of low interest rates, increasing longevity and legislated increases in the gain for claiming delays beyond the NRA (the "Delayed Retirement Credit").

[29] 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 (US$15,720 in 2016). 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 that the earnings test may affect claiming behaviour (Gruber and Orszag, 2003), it does not affect the (*ex ante*) progressivity of Social Security, and so we abstract from it in our discussion.

2016. The supplemental security (SSI) programme provides cash benefits to low-income individuals who are age 65 and up, or who are blind or disabled. Benefits are US$733 for a single person and US$1,100 for a couple but are reduced dollar-for-dollar against other benefits and income.

Medicare is available at age 65. Individuals are eligible if they or a spouse has worked 40 quarters. Medicare includes hospital insurance (part A) as well as optional supplemental insurance that pays for physician services and prescription drugs (parts B–D). Part A is financed by payroll taxes on earnings, while other parts are financed by premiums and (mostly) general revenues. Medicaid provides health insurance to low-income individuals; it is the primary payer of long-term care services, which are not generally covered by Medicare.[30]

Recent literature on progressivity

Estimating the progressivity of Social Security and other programmes raises new challenges, starting with how to measure it. One option is to compare the replacement rate (ratio of benefits to average earnings) at different points in the income distribution.[31] The OASDI Trustees[32] find the replacement rate for a worker is 42 per cent for an average-wage worker, 56 per cent for a low-wage worker and 35 per cent for a high-wage worker. Naturally, the benefit amount rises with past earnings, even though the replacement rate falls. By this measure, Social Security is highly progressive.

The replacement rate excludes contributions, however, yielding an incomplete picture of progressivity.[33] Some alternatives that address this[34] include the internal rate of return (IRR; the rate at which an individual must be willing to trade off between present and future income in order for the present value of benefits and taxes to be equal), benefit/tax ratio (ratio of these present values, calculated at the market rate of discount), and the net transfer (difference of these present values). As before, one can compare these measures at different points in the income distribution. Liebman[6] finds that the IRR is much higher for low-income workers.

The results from any analysis of progressivity depend, to some extent, on decisions the researcher must make in order to carry out the calculations, including the earnings measure used to determine an individual's place in the income distribution. Gustman and Steinmeier[35] and Coronado *et al*.[36] find that the progressivity of Social Security is reduced or eliminated when using lifetime rather than annual earnings, household rather than

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[30] As this brief summary makes clear, the programmes we incorporate in our analysis include self-financed programmes (Social Security and DI), programmes financed out of general revenues (SSI and Medicaid) and a programme whose financing is a hybrid of the two (Medicare).

[31] While it is typical to use career earnings, some use final earnings or an average of earnings in the years just before retirement; Goss *et al*. (2014) compare replacement rates using alternative earnings measures.

[32] OASDI Trustees (2013).

[33] 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.

[34] Geanakoplos *et al*. (1999).

[35] Gustman and Steinmeier (2001).

[36] Coronado *et al*. (2011).

individual earnings, and potential (with full-time work at the current hourly wage) rather than actual earnings.[37]

Another factor that is of particular interest here is differential mortality. As discussed earlier, large and growing differences in mortality by SES are expected to reduce progressivity. Liebman[6] shows that when using mortality probabilities that vary only by age and sex, low-SES groups gain more from Social Security than do high-SES groups (as measured using the IRR or net benefits); however, when race- and education-specific mortality tables are used, the progressive effect of the non-linear benefit formula is considerably smaller, due to the shorter life expectancy of low-SES groups.[38]

Turning to other programmes, DI benefits are even more progressive than Social Security because low-income workers are more likely to go on DI. A CBO analysis[39] finds much of the progressivity of the overall OASDI system is due to DI benefits. Analyses of Medicare progressivity come to differing conclusions—Bhattacharya and Lakdawalla[6] find that Medicare Part A expenditures are much larger for the less educated, while McClellan and Skinner[40] find total Medicare expenditures to be roughly similar by zip code income level. Medicaid expenditures are unsurprisingly skewed towards low-SES groups, though De Nardi *et al.*[41] find that use of Medicaid by high-income groups rises markedly with age, as individuals spend down their assets and become eligible. Missing from all of these analyses is an analysis of how much people value the benefits they receive. This is particularly important for programmes like Medicare and Medicaid that provide in-kind benefits rather than cash, because it is unclear whether people value health spending at its cost. But all these programmes offer more than cash—because they are annuities, they also offer longevity insurance—the value of which might vary across income groups.

Empirical methods

We now turn to discussing our own projections of the gap in life expectancy by SES and the progressivity of Social Security and other government programmes. We begin with our definition of lifetime income, a measure that is based on household earnings. In the work of the Committee[5] that we discuss here, we follow the approach of Bosworth and Burke[23] in using waves of the HRS from 1992 to 2008, covering cohorts born 1912–1957 (with different years of coverage by cohort) and calculating mid-career earnings as the average of

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[37] 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 non-working spouse (higher household than individual earnings). Progressivity also falls when including earnings above the taxable maximum or using a higher discount rate (Fullerton and Mast, 2005) or using only workers who survive to age 62 in the analysis (CBO, 2006).

[38] Tah and Koedel (2017) confirm that differential mortality dampens the progressivity of Social Security and show that this dampening effect is becoming stronger over time in the case of education (as the life expectancy gap by education is growing) but weaker in the case of race (as the Black–White life expectancy gap is narrowing).

[39] CBO (2006).

[40] McClellan and Skinner (2006).

[41] De Nardi *et al.* (2013).

annual earnings over ages 41–50, using those years with positive earnings only.[42] For HRS respondents for whom Social Security earnings records are unavailable or incomplete, we impute earnings based on regressions.[43] Earnings above the taxable cap were estimated based on the month in which the cap was reached. Individual members of couples were assigned lifetime income values equal to the sum of their individual mid-career earnings divided by the square root of two, an adjustment commonly made to reflect the fact that the living expenses of a two-person household are somewhat greater than those for a one-person household, so a larger household would need a larger income to be as well off in consumption terms.[44] Finally, individuals are assigned to a lifetime income quintile based on this value.

For our mortality model, we estimate probit equations where the dependent variable is the death over a two-year period (between waves of the HRS). Our key regressors include a linear time trend to capture the general improvement of health and mortality, the income quintile and a quintile-specific time trend to capture changes in mortality dispersion. We did not include other available covariates such as education or race/ethnicity, because to do so would work at cross-purposes of the goal of our study. For our purposes, it does not matter whether such variables are associated with differences in health and mortality, as they surely are; even if these associations accounted for all the difference in mortality, it would still be true that lower-income people have shorter lives and receive government benefits for fewer years in old age. For similar reasons, we do not include biomarkers or measures of health status as covariates. We carried out a number of robustness and sensitivity checks with alternative model specifications.

In this analysis, we estimate models and show results for men only. In Committee,[5] we estimate gender-specific mortality models and present results for both men and women. Unfortunately, the estimates for women appear to be less reliable than those for men. For example, the results point to a continued narrowing of the male–female life expectancy gap in the future, which is plausible, but also suggest that male life expectancy will be higher than female, an outcome that is not consistent with projections by the Social Security Administration. Estimates of mortality differences by income for females are often unstable or present other problems[2,23] and analysts typically focus on results for men. We follow the literature in doing so, but direct interested readers to Committee.[5]

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[42] Including years with zero earnings in the calculation of average earnings does not change the assignment to income quintile for the vast majority (over 85 per cent) of the sample, suggesting that our key results are likely robust to this assumption.

[43] We have complete earnings data for 68 per cent of our sample. For the 5 per cent of our sample that was born before 1910, we lack complete data on earnings at ages 41–50, since the Social Security Administration only began recording annual earnings in 1951. An additional 27 per cent of our sample did not give the HRS permission to use their Social Security earnings records.

[44] When we assign quintiles without making this adjustment, we find that people remain in the same quintile 89 per cent of the time and move by more than one quintile in less than 0.5 per cent of cases. Based on this, we conclude that our results are unlikely to be sensitive to this assumption. In addition, while we acknowledge that there might be other people in the household (e.g. children) and that one might theoretically wish to make an adjustment for this as well, we do not do so due to the difficulty of properly incorporating financial support to children in college in any such adjustment. We implicitly view the couple (or individual, for a single person) as the unit whose consumption needs will have to be supported in the long term and thus is most relevant for the analysis.

For our analysis of progressivity, we make use of the FEM, a demographic and economic simulation model designed to predict the future costs and health of the older population and to estimate how this could be affected by health trends or policy reforms.[45] The FEM begins with a cohort of Americans at age 50 drawn from the HRS data. Each individual in the cohort has a measure of lifetime income (measured as described above) and an initial health status. The FEM features models that relate characteristics like age, income and health status to the probability of transitioning into various health and financial states, including retirement, Social Security claiming, DI claiming, disease, and death. These models are inherently associative rather than causal, although exogenous variation that occurs during the sample period can help to identify model parameters—for example, individuals in the HRS face different NRAs, which helps to identify the effect of being exactly at versus younger than the NRA on the probability of transitioning to Social Security receipt. While the HRS (1992–2008 waves) is the primary data source for the FEM, information from the 2002–2004 Medicare Current Beneficiary Survey and 2002–2004 Medical Expenditure Panel Survey is used for estimating health expenditures. The estimates from the transition models are combined with individual characteristics to estimate the probability that individuals will transition across the various health and financial states over a two-year period. Using updated characteristics, the model predicts transitions over the next period, and this process is repeated until everyone in the cohort has died.

The baseline scenario is based on the initial health status distribution of the 1930 cohort and its estimated mortality gradient. We then modify the initial health status distribution and mortality gradient to that of the (simulated/projected) 1960 cohort and contrast the new results to the baseline. Health status does not enter directly into the mortality or medical spending equations and, hence, these outcomes are driven entirely by the mortality gradient. Health does influence some economic outcomes and, thus, the differences in initial health prevalence will lead to some cohort differences in trajectories after age 50 in earnings, labour force participation and claiming of Social Security, DI and SSI, although the two cohorts have the same earnings up to age 50 by construction. We also use the 2010 policy environment for both calculations, to isolate the effect of the changing mortality gradient alone. As a final step, we modify the policy environment and simulate new results to contrast to the baseline, in order to show the effect of the reforms on lifetime benefits.

We report our results in terms of three related outcome measures: the present value of benefits at age 50 (expected benefits received after age 50, discounted back to that age using a real rate of 2.9 per cent); the present value of net benefits (same but net of all taxes paid after age 50); and the present value of net benefits as a share of inclusive wealth (net benefits relative to a measure that includes asset holdings at age 50, after-tax earnings after age 50 and net benefits after age 50, all in present value at age 50). We measure benefits received and taxes paid after age 50, as opposed to on a full lifetime basis, because the FEM starts with a cohort of 50-year-olds drawn from the HRS. Our measure of benefits should be quite similar to a lifetime measure, since most benefits from Social Security, Medicare, and the other programmes are received after age 50, although our net benefit measure will overstate the extent of net transfers from the government because it excludes

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taxes paid before age 50. However, the focus of our study is on the *change* in gross and net benefits resulting from mortality changes after age 50, which is unaffected by the exclusion of taxes earlier in life.

Results

Mortality projections

Later we will report the results of simulation experiments that isolate the effect of the widening mortality dispersion on the lifetime value of government benefits received after age 50. These simulations contrast these values under the mortality regimes of the birth cohort of 1930 and 1960. For this reason, we will present our results for these two birth cohorts. However, it is important to keep in mind that we do not actually observe even one year of deaths at age 50 or above for the 1960 birth cohort, because it turns age 50 in 2010 and the latest wave of the HRS that we use is 2008. Thus, the mortality results for this birth cohort are slightly out-of-sample estimates based on the fitted model. For the 1930 birth cohort, turning 50 in 1980, we have observations or within sample simulations from age 62 in 1992 to age 78 in 2008. To estimate e_{50}, we must extrapolate mortality to older ages until the cohort has died out, and this we do by assuming that the trends estimated in the model continue, including the quintile divergence. The quintile divergence applies to birth cohorts, not periods, so the amount of extrapolation is modest—from cohorts born up to 1950 or so to the cohort of 1960. There is a further assumption, built into the model specification, that a cohort's income quintile has an age-dependent effect on its mortality over the rest of its lifetime. Because some may find these assumptions too strong, the Committee also calculated the implications of a trend in dispersion that was only half this large, finding a convenient proportionality that permits the reader to consider other scenarios.

While the Committee's analysis of mortality differentials was cohort based and longitudinal, like those of Bosworth *et al.*[24] and Waldron,[2] there have been a number of careful cross-sectional studies that have found continuing widening of the differentials up to the present (e.g.[4,25] above age 50), and we are aware of no studies indicating a recent narrowing of differentials or a slowdown in their widening.

The trends and projections for overall life expectancy arrived at in this way are quite similar to those in the Social Security Administration projections, which were also used by Waldron[2] for this purpose. But because those Social Security projections assume some deceleration of mortality decline as time passes, the Committee's projections of e_{50}, which do not, are slightly higher.

There is some evidence that the upward trend in U.S. life expectancy has slowed in the last few years. Ma *et al.*[46] report that declines in overall mortality and mortality due to various causes of death slowed from 2010 through 2013 relative to earlier years. Consistent with this finding, Xu et al.[47] report that U.S. life expectancy declined by 0.1 years from 2014 to 2015, primarily due to rising mortality for non-Hispanic White males and females and Black males. Life expectancy declines of this sort have occurred 12 times for U.S.

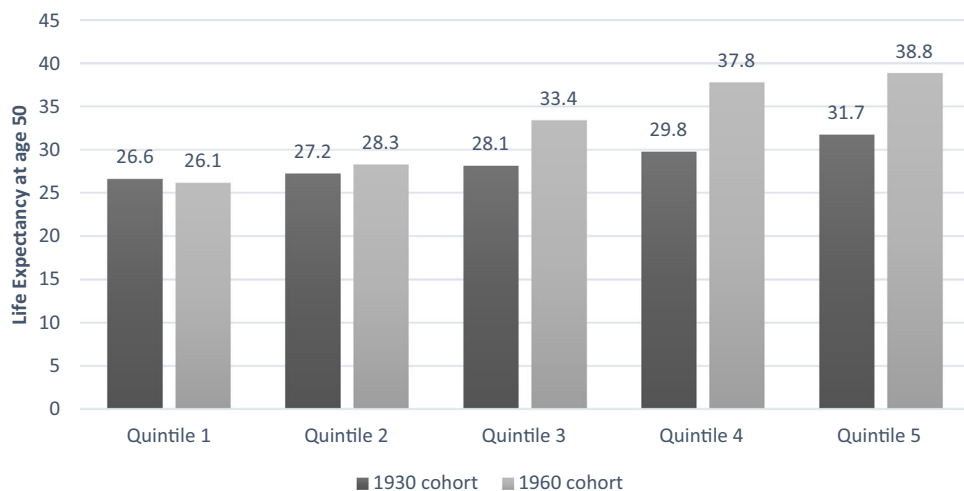[46] Ma *et al.* (2015).
[47] Xu *et al.* (2016).

Figure 1. Life expectancy for men at age 50, actual and projected, for birth cohorts of 1930 and 1960, by income quintile.

females since 1933 and 14 times for males.[48] Whether this slowdown in mortality decline persists or proves transitory would not in itself matter much for our main results which depend on the inter-quintile differences much more than on the average level.

Our estimates of remaining life expectancy at age 50 by income quintile are shown in Figure 1. Life expectancy at 50 is a convenient summary measure, but, for our simulations, we of course used the survival probabilities to each age, which are not shown here. For the male birth cohort of 1930, e_{50} is lowest for the bottom quintile and rises steadily as we move to higher quintiles, reaching a level 5.1 years higher for the top quintile. For the 1960 male birth cohort, the lowest quintile has slightly lower e_{50} than the 1930 cohort, but then rises to a level 12.7 years higher for the top quintile, indicating a very large increase in the dispersion.

There are, of course, many sources of uncertainty in our estimates of mortality differences by income quintile, and even more so in the growth in these differences between the cohorts of 1930 and 1960. While we were not able to assess this uncertainty formally, we did also prepare mortality projections for the 1960 cohort on the assumption that the dispersion increased only half as rapidly as in our baseline projection shown in Figure 1, as mentioned earlier. We also carried out simulation experiments based on these alternative projections.

Progressivity of lifetime benefits

Next, we discuss our findings with respect to the progressivity of lifetime benefits from government programmes, contrasting the experience under the mortality conditions of the 1930 and 1960 cohorts. Recall that this exercise is not meant to obtain a projection of actual benefits for these two cohorts, but rather to isolate the effect of the changing mortality gradient and initial health distribution on lifetime benefits. In our simulation experiments, the policy environment and earnings up to age 50 are the same for both

[48] Thanks to Josh Goldstein for this observation (personal communication).
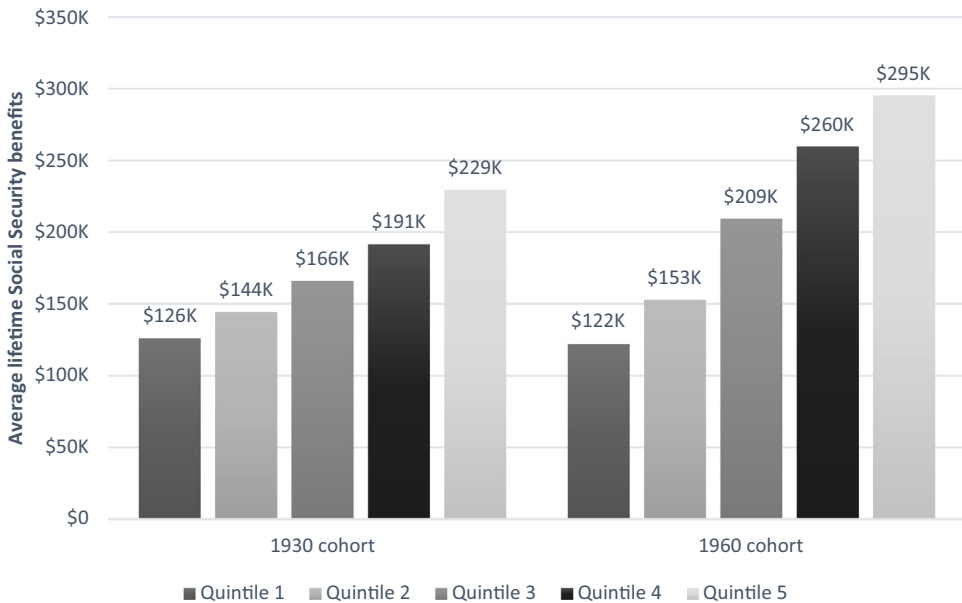
Figure 2. Average lifetime Social Security benefits for men by lifetime income quintile, 1930 versus 1960 mortality regime (in thousands of dollars).

cohorts, though the actual two birth cohorts had different experiences. Results are reported in 2009 dollars.

We begin with Social Security, reporting results in Figure 2. For males in the 1930 cohort, benefits rise with income quintile—workers in the lowest quintile can expect to receive, on average, US$126,000 of benefits over the rest of their lives (discounted to age 50), while workers in the top quintile can expect to receive US$229,000, or 82 per cent more than the lowest income workers. The fact that those in the top quintile receive higher benefits is not surprising, since the monthly benefit amount rises with AIME, albeit non-linearly. As these benefit values are not scaled by earnings (as with a replacement rate measure) and do not include taxes (as with money's worth measures), we cannot directly infer the progressivity of Social Security from these estimates.

More interesting for our purposes is how the results change when we move from the mortality regime of the 1930 cohort to that of the 1960 cohort. The additional six to eight years of life expectancy for the top three quintiles leads to large increases in expected Social Security benefits, with benefits for the top quintile in 1960 reaching US$295,000. The difference between the highest and lowest quintiles is US$173,000, or 142 per cent of the lowest income worker's benefit. These results suggest that Social Security is becoming significantly less progressive over time due to the widening gap in life expectancy.[49]

Expected DI benefits (Figure 3) are smaller than expected Social Security benefits because the probability of ever receiving DI is far lower. While Social Security benefits rise with income quintile, DI benefits decline sharply—for males with the mortality regime of

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[49] These figures refer to gross benefits; we discuss benefits net of taxes below.

Figure 3. Average lifetime Disability Insurance benefits for men by lifetime income quintile, 1930 versus 1960 mortality regime (in thousands of dollars).

the 1930 cohort, benefits are US$25,000 for the lowest quintile, US$11,000 for the middle quintile and US$4,000 for top 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. Unlike Social Security, expected DI benefits are stable across cohorts, since increases in life expectancy are concentrated in the third through fifth quintiles, which have relatively low probabilities of DI claiming.[50] Thus, the progressivity of DI benefits is unchanged over time.

SSI benefits (Figure 4) are also larger for the lower quintiles because of a higher probability of receipt. For men in the 1930 cohort, expected benefits are US$11,000 in the lowest quintile, US$4,000 in the second and negligible for the others. Here too, changes across cohorts are small.

Moving to health-care benefits, we first note that those with lower lifetime income have higher annual Medicare expenditures. For example, for 67-year-old males, Medicare expenditures in the lowest income quintile are 48 per cent higher than in the top quintile; for females at this age, the increase is 69 per cent. This ratio attenuates somewhat with age, likely because the least healthy people in the bottom quintile die earlier.

For the 1930 cohort, total lifetime Medicare benefits are relatively flat by income quintile (Figure 5). Males in the lowest quintile can expect to receive US$162,000 in lifetime benefits, only 6 per cent more than those in the top quintile, as the higher annual Medicare expenditures of the lower-income group are roughly offset by their shorter life expectancy. But widening disparities change this picture considerably for the regime of the 1960 cohort

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[50] In results not shown here, the FEM model predicts that the probability of claiming DI over a two-year period for the 1930 cohort peaks around age 62 at nearly 20 per cent for Q_1 males, versus roughly 10 per cent for Q_2 and Q_3 males and 5 per cent or less for Q_4 and Q_5 males; predicted claiming behaviour for later cohorts is similar.
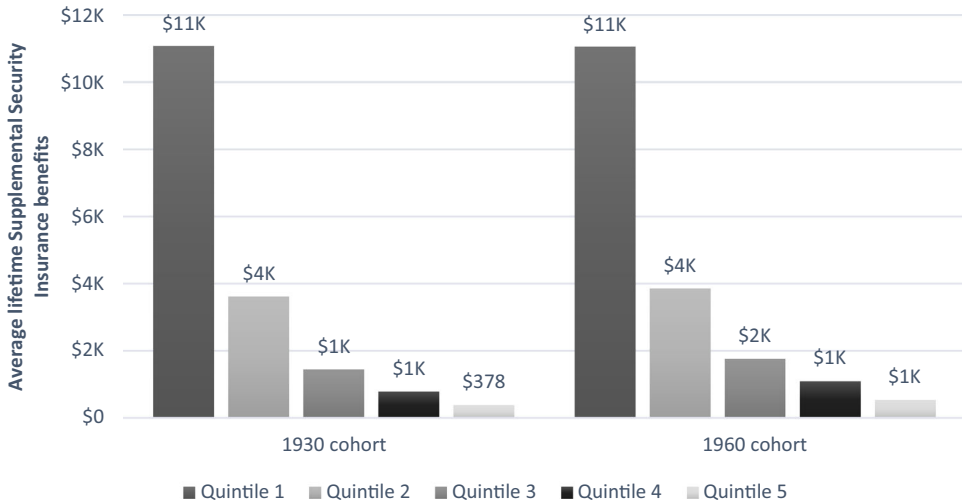
Figure 4. Average lifetime Supplemental Security Income benefits for men by lifetime income quintile, 1930 versus 1960 mortality regime (in thousands of dollars).
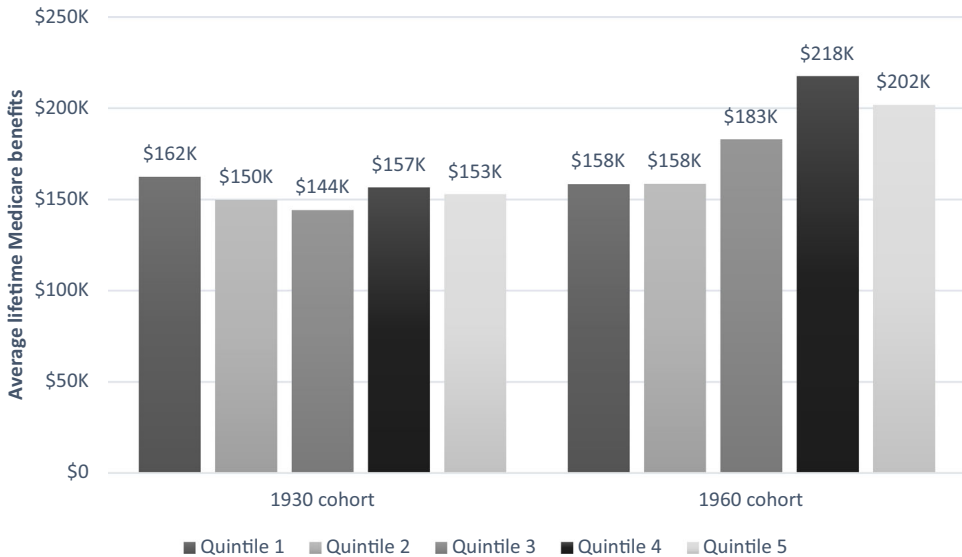

Figure 5. Average lifetime Medicare benefits for men by lifetime income quintile, 1930 versus 1960 mortality regime (in thousands of dollars).

of males, where those in the bottom quintile can expect to receive just 78 per cent of the lifetime benefits for those in the top quintile.

As expected, Medicaid benefits (Figure 6) are highly skewed towards those with low income. For the regime of males in the 1930 cohort, the present value of Medicaid from age 50 on is US$77,000 for those in the lowest income quintile, US$35,000 in the second and
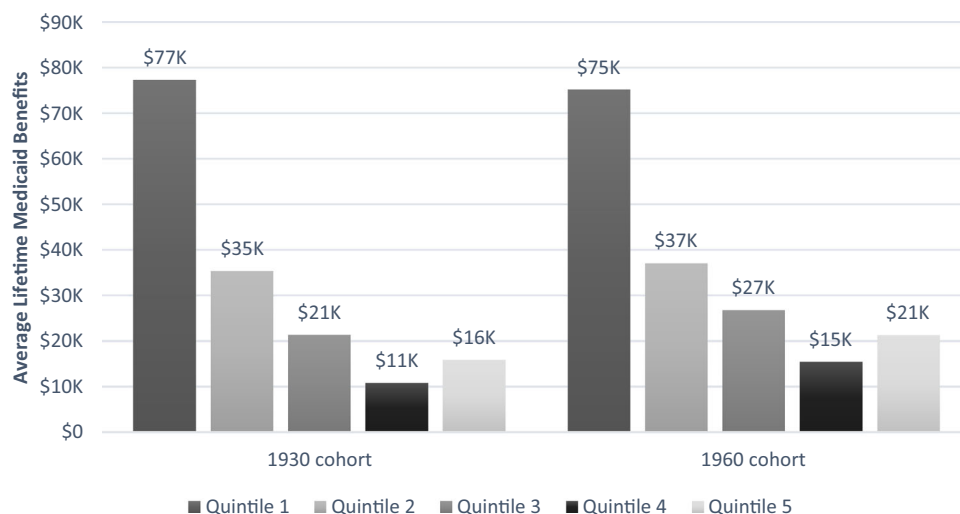
Figure 6. Average lifetime Medicaid benefits for men by lifetime income quintile, 1930 versus 1960 mortality regime (in thousands of dollars).

just US$16,000 for those in the highest quintile. Widening disparities in life expectancy over time have little effect on Medicaid benefits for men (as for DI and SSI).

Finally, we calculate the present value of total benefits from Social Security, DI, SSI, Medicare and Medicaid (Table 1). For the regime of males in the 1930 cohort, the present value of gross total benefits is about US$400,000 in both the bottom and top quintiles, with somewhat lower benefits for the middle quintiles. This pattern reflects the fact that high-income workers receive larger benefits from Social Security, while low-income workers receive more from DI, SSI and Medicaid. Moving to the regime of the 1960 cohort, gross benefits for males in the top quintile are US$132,000 higher than those for males in the bottom quintile. This is the effect of the larger Social Security and Medicare benefits received by high-income males under this regime.

When looking at net rather than gross benefits (Table 2), benefit levels are naturally lower. However, the effect of moving to the 1960 regime is nearly identical. While those in the top quintile pay more in taxes than those at the bottom, the pattern is not much different between the mortality regimes of the 1930 and 1960 cohorts. To summarise, our key finding is that changing the mortality and health regime from that of the 1930 to the 1960 cohort causes the gap between average lifetime benefits received by men in the highest and lowest quintiles to widen by about US$130,000. The change arises from the impact of mortality on benefits and not on taxes.

We also estimate the effect of the changing mortality gradient on net lifetime benefits as a fraction of inclusive wealth (Table 3). We find that the share of wealth accruing from net benefits rises by seven percentage points for the top quintile of men when we contrast the 1960–1930 mortality regime, but falls slightly for the lowest quintile. As a result, whatever the baseline pattern of progressivity, the overall progressivity of lifetime benefits as defined by this measure declines markedly. To put it another way, the switch to the 1960 mortality

Table 1 Present value of entitlement programme benefits at age 50, for men under the mortality regimes of the 1930 and 1960 birth cohorts

Income quintiles	Present value of benefits at age 50 based on the mortality profile for those	
	Born in 1930 (US$)	Born in 1960 (US$)
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

Table 2 Present value of net benefits (benefits received minus taxes paid after age 50) at age 50, for men under the mortality regimes of the 1930 and 1960 birth cohorts

Income quintiles	Present value of benefits at age 50 based on the mortality profile for those	
	Born in 1930 (US$)	Born in 1960 (US$)
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

regime increases the fraction of wealth represented by entitlement benefits by 7 per cent for the top quintile and reduces these resources very slightly for those at the bottom.

Two observations about these findings are noteworthy. First, the preceding discussion focused mostly on the top versus the bottom quintile. But the comparison applies also to roughly the top half of the income distribution relative to the bottom half. 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 those at the top is projected to rise significantly relative to the increase for those at the bottom) and Medicare (where the programme is projected to move from being roughly neutral with respect to lifetime income to one in which the present value of benefits for higher-income males is much larger than for their lower-income counterparts).

Policy reform simulations

Our final goal is to analyse policy reforms to determine how they would affect the progressivity of government programmes and interact with projected changes in life expectancy. The reforms we simulate—five that affect Social Security and one that affects Medicare—were chosen because they are either frequently mentioned in policy discussions or meet objectives with which many stakeholders would agree. Unfortunately, the structure of the FEM made it impossible to simulate certain reforms, such as raising the Social Security maximum taxable earnings amount. The policy simulations we study include: raising the Social Security EEA by

Table 3 Present value of net benefits as a share of present value of inclusive wealth at age 50, for men under the mortality regimes of the 1930 and 1960 birth cohorts

Income quintiles	Present value of net benefits at age 50, relative to inclusive wealth, based on the mortality profile for those		
	Born in 1930 (%)	Born in 1960 (%)	Percentage change
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

Table 4 Impact of policy reforms on net benefits as a share of inclusive wealth at age 50, for men under the mortality regimes of the 1960 birth cohorts

Income quintiles	Percentage point change					
	Raise EEA	Raise NRA	Lower COLA	PIA 10% rate	PIA 0% rate from median	Raise Medicare age
Lowest	0.1	−4.8	−0.4	−0.1	−1.1	−1.4
2	0.2	−5.5	−0.5	−0.1	−1.4	−1.1
3	0.5	−5.7	−0.6	−0.1	−2.1	−0.8
4	0.5	−5.5	−0.7	−0.2	−2.7	−0.7
Highest	0.4	−5.2	−0.6	−0.3	−3.4	−0.5

two years (to age 64), raising the Social Security NRA by three years (to age 70); reducing the cost-of-living adjustment (COLA) applied to benefits by 0.2 per cent per year; reducing the top PIA factor by one-third (from a 15 to 10 per cent rate); reducing the top PIA factor to 0 above median AIME; and raising the Medicare eligibility age by two years (to age 67).

There are two mechanisms by which a policy change may translate into change in benefits. The first, which can be characterised as the "mechanical effect", results directly from the policy change, holding behaviour constant. For example, if the NRA were raised by three years, a worker claiming benefits at age 67 would see the monthly benefit amount fall from 100 per cent of the PIA to 80 per cent, experiencing a 20 per cent reduction in benefits. The second channel, which can be characterised as the "behavioural effect", results from changes in individual behaviour in response to the policy. For example, the individual may claim Social Security later, work longer, or be more likely to claim DI. These responses can be captured by the FEM.

We show results for all reforms on Table 4, reporting only the change in net benefits as a fraction of inclusive wealth for brevity. We begin with the increase in the EEA. At first glance, it might seem that this policy would have little effect on the present value of benefits given the common belief that the actuarial adjustment is roughly actuarially fair. We find that this reform raises net benefits as a share of wealth by 0.1 for males in the lowest quintile under the 1960 mortality regime and by 0.4 for males in the highest quintile. Under our assumptions, the actuarial adjustment for delayed claiming is slightly more than fair, so when individuals are forced to claim later by this policy change, lifetime benefits

increase, particularly for high-income individuals who have longer life expectancies. The policy change is thus mildly regressive, although its effects are fairly small.

Raising the NRA has a much bigger effect—we estimate that lifetime Social Security benefits fall by US$30,000 (or 25 per cent of the pre-reform value) for the lowest quintile of males in the 1960 mortality regime and by US$59,000 (20 per cent) for the highest quintile. The percentage drop need not be the same in the two quintiles because the behavioural response of the two groups to the policy change (captured by the FEM) could differ; also, the same response—say, postponing retirement and claiming by one year— could have a different effect on lifetime benefits because of differences in life expectancy. As low-income males experience the larger percentage drop in benefits, this policy might be considered regressive. Yet the policy change reduces benefits as a share of wealth by 4.8 per cent for males in the lowest quintile and by 5.2 per cent for males in the highest quintile, as the larger dollar loss for high-income males ends up being a slightly larger share of their lifetime wealth (as captured by our inclusive wealth measure). Viewed by this metric, the policy change is progressive. Thus, the progressivity of this policy change is somewhat sensitive to the particular measure used.

Reducing the COLA has a modest effect on benefits, reducing them by 0.4 per cent of wealth for males in the lowest quintile under the 1960 mortality regime and by 0.6 per cent for males in the highest quintile. The larger effect for high-income men is due to their longer life expectancy, since the effect of a lower COLA is cumulative over time. Reducing the top PIA factor by one-third has a fairly modest impact of 0.1 per cent of wealth for low-income males and 0.3 per cent for high-income males; the larger effect on high-income males is expected, since the top PIA factor applies only to earnings past the second bend point of AIME (e.g. at higher earning levels). A related policy with a much bigger impact is reducing the top factor to zero and moving the second bend point to the median of AIME. This policy, which would reduce benefits for the top half of earners, is chosen as an example of a substantial benefit cut designed to have a smaller impact on low earners. We find that this policy would reduce benefits as a share of wealth by 1.1 per cent for males in the lowest quintile and by 3.4 per cent for men in the highest quintile. Finally, we simulate raising the Medicare eligibility age. This policy has a fairly similar effect across quintiles in dollar terms, reducing lifetime Medicare benefits by US$8,000 for low-income males in the 1960 mortality regime and by US$7,000 for high-income males. Measured as a share of inclusive wealth, there is a loss of 1.4 per cent for low-income males and 0.5 per cent for high-income males, indicating a regressive policy.

Overall, most of these policy changes would make overall net benefits more progressive. The exceptions are raising the EEA or the Medicare eligibility age, which make benefits less progressive. When compared to the changes in progressivity occurring due to mortality trends, however, the effect of these policies on progressivity is generally fairly small. For example, consider the policy reducing the top PIA factor to zero above median AIME, which is the most progressive of the policies we simulated. Absent any policy change, the gap in lifetime Social Security benefits between males in the highest and lowest income quintiles grows from US$103,000 in the 1930 mortality regime to US$173,000 in the 1960 mortality regime. Implementing this policy would eliminate 60 per cent of the increase, so that the gap under the 1960 regime would be US$131,000. This illustrates the scale of the policy reform that would be needed to counteract the changes in progressivity of government benefit programmes that we project are occurring due to the widening gap in life expectancy.

Discussion

Life expectancy at older ages has been growing steadily in the U.S. over the past several decades. Yet there is growing awareness that these gains are not being shared equally. Our study confirms a substantial increase in the life expectancy gap between those with higher and lower income. For men, we project that the gap in life expectancy at age 50 between males in the highest and lowest quintiles of lifetime income will grow from five years for the 1930 cohort to nearly 13 years for the 1960 cohort. Estimates for women (from Committee[5]) are somewhat less reliable, but show a similar if not larger change over time.

We also assess the effects of the growing gap in life expectancies among older adults on the major entitlement programmes. The larger life expectancy gap means that higher-income people will increasingly collect Social Security, Medicare and other benefits over more years than will lower-income people. We estimate the value of net lifetime benefits for different income groups from Social Security, DI, SSI, Medicare and Medicaid. Our estimates suggest that these net lifetime benefits are becoming significantly less progressive over time because of the disproportionate life expectancy gains among higher-income adults. The changes in life expectancy between the 1930 and 1960 mortality regimes generate an increase in benefits equivalent to an increase of 6.9 per cent of wealth (measured at age 50) for men in the highest income quintile, while benefits for men in the lowest income quintile are essentially unchanged. While we caution that one cannot rely too heavily on the specific numbers we estimate, since these are projections that necessarily rely on assumptions and our analysis does not allow us to construct confidence intervals around these projections, our results clearly indicate that lifetime benefits are increasingly accruing to those in the top of the income distribution due to the widening gap in life expectancy.

We then consider how the differential changes in mortality would affect analyses of some possible reforms to major entitlement programmes in the face of population ageing. For example, many proposals to increase the NRA under Social Security are motivated by the rise in mean life expectancy. The mean, however, masks substantial differences in mortality changes across income groups. We show the impact of that proposal and other possible Social Security and Medicare reforms on lifetime benefits across income groups and in a manner that reflects their different life expectancy trajectories. We find that while there are policy reforms that tend to raise the progressivity of government programmes, the effect of these reforms is fairly small when viewed next to the reduction in progressivity that is occurring due to the growing gap in life expectancy. This suggests that policy changes that (alone or in combination) are more progressive than those we simulate here would be needed to undo the effect of the widening longevity gap on the progressivity of government programmes.

Social Security, Medicare and the other programmes included in our study face rising expenditures over time, straining the ability of existing revenue sources to fully fund benefit promises at current tax rate. The U.S. is far from unique in this regard—rising longevity, falling birth rates and slowing economic growth threaten the long-term solvency of entitlement programmes in many countries, particularly where financed via a pay-as-you-go mechanism or out of general revenues. Many countries have already implemented reforms to public pension, DI and other social insurance programmes, for example, by raising retirement ages or altering benefit formulas in a way that reduces programme generosity, and many countries continue to contemplate implementing (further) reforms.

As policymakers continue to debate the future of social programmes in the U.S., they would do well to consider the welfare implications not only of improved longevity, but also the increasing gap in life expectancy by SES.

Acknowledgements

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