Please do not cite or quote without author's permission.

The Long-term Impact of Aging on the Federal Budget

Louise Sheiner

Hutchins Center on Fiscal and Monetary Policy

The Brookings Institution

lsheiner@brookings.edu

October 2017

I am grateful to Vivien Lee for excellent research assistance and Bill Gale, Ron Lee, and David Wessel for helpful comments.

The United States is in the midst of a demographic transition. Just 10 years ago, the share of the population that was 65 or older was only 12½ %. Today, it is 15%, and in just 20 years, it is projected to reach 21%. These demographic changes have aroused considerable concern about our fiscal future, as much of the budget of the federal government is allocated to old-age entitlement programs. In particular, Social Security, which provides public pensions, and Medicare, which provides health insurance to the aged, will rise as a share of GDP as the baby boom generation enters into retirement.

Although we often talk about aging as arising from the retirement of the baby boomers, that is somewhat misleading. The retirement of the baby boomers represents the beginning of a permanent transition to an older population, reflecting the fall in the fertility rate that occurred after the baby boom and continued increases in life expectancy. Because aging is not a temporary phenomenon, we can't simply smooth through it by borrowing. Instead, it is clear that population aging will eventually require significant adjustments in fiscal policy—either cuts in spending, increases in taxes, or, most likely, some combination of the two.

Demographic change is relatively easy to forecast, and economists have been studying and debating the budgetary pressures associated with aging for a long time now. But, in addition to the expected consequences of demographic change, it is possible that some other changes that we have been experiencing in the economy may also be linked to aging—in particular, low interest rates and lower productivity growth. These too have important consequences for our long-term fiscal outlook.

This paper is organized as follows. In Section I, I discuss the effects that aging has on federal spending on entitlement programs and the implications for the overall debt burden. In Section II, I review the evidence on the effects of aging on interest rates and productivity, and show how

these factors affect the long-term budget picture. Finally, in Section III, I discuss some potential policy responses to aging. In particular, I examine the role that increasing labor force participation may play, and discuss the considerations policymakers need to consider when choosing the composition and timing of changes in spending and revenue. Section IV concludes.

I. Direct effects of aging on the federal budget

Figure 1 presents the most recent Congressional Budget Office projections of revenues and spending that show how spending and taxes will evolve assuming that current laws remain unchanged, with a few exceptions that I will discuss later. [1] As the figure shows, federal spending is projected to increase from just under 21 percent of GDP today, to almost 30 percent of GDP in three decades; tax revenues are projected to creep up slowly over time. The resulting continued imbalances between spending and revenues give rise to an unsustainable fiscal future, as shown in Figure 2. Federal debt, already historically high today at 75 percent of GDP, is projected to increase rapidly over time, reaching 150 percent of GDP by 2047.

These rapid increases in deficits and debt are driven by two primary factors: aging and health care costs that grow much faster than the economy. In addition, years of primary deficits (deficits not including interest on the debt) lead to rapid increases in interest on the debt as well, providing a third reason for escalating debt levels.

Understanding aging.

Population aging is the product of two important forces: a decline in fertility and an increase in life expectancy. From 1926 to 1965, fertility averaged 2¾ children per woman; since 1965, fertility has hovered around 2 children per woman. This large change, which at first

[1] All of the data in this paper are based on CBO's March 2017 Long-Term Budget Outlook (CBO, 2017).

increased the ratio of working–age adults to children, is now translating into a decrease in the ratio of working age adults to the ratio of elderly.

There also have been substantial gains in longevity. In the 1960s, average U.S. life expectancy was 67 years for males and 73 years for females. In 2015, the averages were 76 and 81 respectively. Although longer life generally improves well-being, it also increases the number of Americans who are aged 65 and older, and extends the time period during which certain program benefits must be paid. Of these two factors—lower fertility and increased life expectancy—lower fertility is by far more important, accounting for about 2/3 of the increase in the ratio of elderly to working age Americans expected over the next three decades.[2]

Aging imposes significant challenges on our old-age entitlement system—Social Security, which provides cash pensions, and Medicare, which provides health insurance. Because spending programs depend on the number of dependents and on real wages, and tax revenues depend on the number of workers and real wages, the ratio of dependents to workers is a key parameter in determining the sustainability of a pay-as-you-go entitlement system.

Social Security. Social Security is an entitlement program that provides annual payments to beneficiaries 62 years or older. Initial benefits per beneficiary are tied to average wage growth in the economy, so Social Security would remain constant as a share of GDP if there were no demographic changes, policy changes, or other major structural changes in the economy. Instead, over the next 30 years, CBO projects that Social Security outlays will increase almost 30 percent,

[2] Calculation based on numbers in Goss (2014).

from 4.9 percent of GDP in 2017 to 6.3 percent in 2047.[3] Virtually all of this rise is driven by population aging.[4]

Medicare. Medicare is a public health insurance program that provides health insurance primarily to Americans 65 and older, although some non-elderly disabled are eligible as well. Medicare expenditure growth is driven by two forces: population aging, which increases the share of Medicare beneficiaries in the population, and growth in health spending per beneficiary. These two factors reinforce each other—aging without per beneficiary spending growth would be easier to finance, as would per-beneficiary spending growth without aging. Together, these two factors are projected to lead to a doubling of Medicare spending as a share of GDP over the next 30 years—from 3.1 percent of GDP to 6.1 percent of GDP.

How much would Medicare spending increase without aging? Assuming that age-adjusted health spending per beneficiary continues to increase at its expected pace[5], Medicare spending would still increase by a substantial 40% or so, far lower than the doubling of spending projected by CBO.

[3] One policy change that is included in these projections is the gradual increase in the normal retirement age, from its current 66 to 67 over the next decade. While workers are still allowed to begin drawing benefits at age 62, increase in the normal retirement age lower the benefits they receive. See "Raise the Full Retirement Age for Social Security" (CBO 2016).

[4] Indeed, several structural factors in the economy would likely lower the ratio of Social Security spending to GDP in the absence of aging, including a reduction in the share of GDP going to labor, and continued increases in health spending and increased wage inequality, all of which lower taxable social security wages hence lead to lower future benefits.

[5] When health spending per beneficiary increases faster than GDP per capita—as it has over the past 5 decades—health spending increases as a share of GDP even in the absence of aging. The difference between health spending growth—adjusted for the age distribution of beneficiaries—and per capita potential GDP is called excess cost growth. In addition, the age of the Medicare population also has an impact on Medicare spending. In the next decade, as the baby boomers retire, the average age of a Medicare beneficiary will decline, leading to lower Medicare spending, but over time, as the baby boomers get old and as life expectancy continues to increase, the average age of a Medicare beneficiary will increase, boosting spending. The effect of the change in the age distribution of the population on per beneficiary spending is properly called an effect of aging, not of rapid health spending growth.

Taken together, population aging is projected to increase entitlement spending over the next 30 years by 4.3 percent of GDP. Figures 3 and 4 show what the fiscal outlook would be without aging. As shown in Figure 3, even without aging, the United States would still face significant deficits (the difference between spending and revenues), but they would increase only slowly over time—from about 3 percent of GDP today to 4 percent in 30 years—rather than widening substantially as in the baseline. Furthermore, assuming that interest rates and productivity growth are invariant to demographic change (a point to which I return later), these deficits are close to being sustainable, in the sense that debt does not explode, as shown in Figure 4.

How can that be, given the very significant increase in health costs that increase spending on Medicare, as well as other non-age related health programs? To see what is happening, look to Figure 5, which shows the projected debt to GDP ratios under the assumption that (1) there is no aging and (2) health spending per person grows in line with GDP per person. In this scenario, shown as the red line, the debt to GDP ratio actually declines, reaching just above 50 percent by 2047.

Do CBO projections understate the fiscal challenges faced by the US? As noted above, CBO's projections are intended to represent spending and revenues under the assumption that Congress does nothing to change laws. They are not meant to forecast what Congress will actually do or what will actually happen, but as an exercise that provides a baseline to Congress that shows the magnitude of the policy changes that will be necessary. But there are two difficulties with this approach.

Projecting discretionary spending. First, it is hard to know what a current law approach means when it comes to discretionary spending, annually appropriated spending that funds many

of the basic functions of government, including national defense, transportation, education, and tax collection. Unlike entitlement spending such as Social Security and Medicare, discretionary spending is not dictated by benefit and eligibility formulas. Instead, Congress decides annually how much to appropriate. In recent years, such appropriations have often been governed by legislation that set limits on total discretionary spending. For example, the Budget Control Act of 2011 set caps on discretionary spending through 2021. But, for 2022 and forward, CBO projections don't reflect current law (because they can't) and, instead, reflect budget conventions that assume that discretionary spending rises with inflation from 2022 to 2027, and with GDP thereafter.[6] The net result of the recent declines in discretionary spending and the tight caps over the next few years is that discretionary spending in the CBO projection is expected to decline by 1 percent of GDP over the next 10 years, reaching a level lower than seen over the past 50 years, and to remain at that level throughout the remainder of the projection. (See Figure 6.) If instead, discretionary spending were to return to something closer to a historical average, spending and projected deficits would be higher in each year of the long-term forecast.

Projecting revenues. The second area where the CBO projections might be understating the budgetary challenges is in term of revenues. The US income tax system is indexed for inflation, but not for real GDP growth. Because the tax system is progressive, as average incomes rise over time, more and more taxpayers are pushed into higher tax brackets—a phenomenon known as "real bracket creep." This means that, without changes in law, tax revenues automatically rise over time. In practice, tax laws are changed frequently—often in response to the perception that taxes are "too high", and there has been no upward trend in revenues as a share of the economy over time. (See Figure 7.)

[6] There are different conventions that apply during the first 10-years, the so-called budget window, and in the long run, from year 10 to year 30.

Thus, the assumptions about future taxes and discretionary spending in CBO's long-run projection may not reflect the most likely or plausible path. Indeed, there is pressure in Congress right now to raise spending—particularly defense spending—above the levels dictated by the legislated caps, and the Administration and Congress are putting together a tax reform plan that will likely include some significant cuts in tax rates. If legislation is enacted in a way that is not deficit neutral, then the long-run projections could show much larger deficits and debt.

For example, imagine that, instead of falling over the next ten years as a share of GDP, discretionary spending were to remain at today's level, which is still low by historical standards. And imagine that, instead of allowing real bracket creep to push revenues up over time, revenues instead remained constant as a share of GDP at 2017 levels. The green line in Figure 5 shows what the trajectory of the debt would look like in this scenario. Without the fiscal benefits of lower discretionary spending and higher revenues, the fiscal picture looks much more daunting, rising to 210 percent of GDP in 2047. If an actual tax cut were assumed, the picture would look even worse.

Of course, it is possible that Congress will allow spending to drift down and revenues to drift up, given the long-run fiscal picture. In that case, the important lesson from these projections is that they already assume increases in taxes on future taxpayers—revenues in 2047 are about 10% higher than in 2017—and already assume that future taxpayers are living with much lower discretionary spending than the historical norms.

II. Indirect macroeconomic effects

Aging and interest rates. The very low real rates of interest that have been observed here and abroad since the Great Recession has led researchers to think more carefully about the determinants of interest rates. Figure 8 shows the government's borrowing costs over time, adjusted for inflation. As noted by Carvalho et al (2016), the fact that these low interest rates have been trending down for more than two decades suggests that forces other than accommodative monetary policy must be at play.

Several studies have argued that demographic trends, specifically aging, may have played a significant role in the decline in interest rates (Elmendorf and Sheiner, 2017, Gagnon et al. 2016; Ikeda and Saito 2012; Carvalho et al. 2016). The reasoning is as follows: As the growth rate of the labor force slows, capital per worker increases, leading to a reduction in the marginal product of capital and the real interest rate. If, at the same time, workers are also trying to increase their saving to accommodate their longer life expectancy and increased years of retirement, this can put further downward pressure on interest rates.

Fujita and Fujiwara (2016) estimate that demographic change in Japan can account for about 40% of the 2.3 percentage point decline in real rates between 1996 and 2013. Looking at a sample of OECD countries, Carvalho et al.(2016) find that changing demographics led to a reduction of the equilibrium interest rate by at least 1½ percentage points between 1990-2014, about one third to one half of the overall decline in real interest rate. Gagnon et al. (2016) conclude that demographic shifts alone can account for a 1¼ percentage point decline in the U.S. equilibrium real interest rate since 1980, which, by their estimates, is nearly all of the permanent decline in real interest rates over that time period. Their model also suggests that interest rate are likely to remain low over the foreseeable future.

The impact of low interest rates on the fiscal outlook. The federal government is a net borrower. With federal debt already equal to 75 percent of GDP, reductions in borrowing costs have sizable effects on interest payments and deficits. In their projections of the federal government's borrowing costs, shown in Figure 8, CBO assumes that interest rates remain low for a few years, but then very gradually rise to their historical average. If Gagnon et al are correct, then interest rates are likely to remain low over the foreseeable future, rather than increasing. On the other hand, if these low interest rates are really the result of the Great Recession and other temporary factors, interest rates might increase much more rapidly than expected by CBO and other forecasters.

Figure 9 shows the impact on the debt to GDP ratio of these different assumptions. If interest rates remain low (I assume that the real interest rate is a constant ½ percent for this simulation), then the debt to GDP ratio rises much more gradually, but still hits 120 percent of GDP by 2047. If, on the other hand, interest rates rise immediately to their historical average (2½ percent), then the fiscal situation is more challenging—with the debt to GDP ratio rising to 180 percent in 30 years.

Effect of aging on productivity and productivity growth. Productivity growth has also been slow both in the U.S. and abroad since the financial crisis. But, as Fernald (2014) notes, the slowdown appears to have begun a few years before the financial crisis and productivity remains low even now, suggesting that something structural, rather than cyclical, is at work.

One hypothesis is that population aging is behind the slowdown in productivity growth. There are a number of channels through which aging may affect productivity growth. First, the average age of the labor force could have an effect on productivity. On the one hand, older workers are more experienced, and so potentially more productive. On the other hand, older

workers may not have the skills to keep up with new technologies, and so might be less productive. Furthermore, declining physical health and cognitive abilities associated with aging may result in lower productivity. If the mechanisms through which aging affects productivity growth is through changes in the average age of the labor force (that is, if the average age of the workforce affects the *level* of worker productivity), then the effect should be tailing off, because, as shown in Figure 10, most of the aging of the labor force is behind us.[7] For example, the median age of the workforce started declining as the large baby boom cohort began entering the labor force in around 1960, and bottomed out at around 35 in the early 1980s. It has been rising sharply since then, reaching 42.2 in 2016; although the average age of the workforce is expected to continue increasing, that increase is expected to be quite slow, with the average increasing from 42.4 in 2017 to 43.3 in 2047.

But the age of the workforce might also have an effect on the growth rate of productivity. Research suggests that the prime age for producing scientific inventions, patents, publications, and other creative material peaks between ages 30 and 40, and declines through later years (National Academy, 2012). As a smaller share of the labor force is in these peak creative years, the rate of technological progress may slow.

Another channel through which aging might permanently affect the rate of productivity growth is through the effect of a reduction in labor force growth on investment. As shown in Figure 11, the rate of labor force growth has slowed sharply over the past 3 decades, a product of both the reduction in fertility and the plateauing of women's labor force participation (discussed below). Looking forward, the rate of labor force growth is expected to remain low. As described

[7] The table plots the median age of the workforce from the Fullerton and Tschetter (1983), and Toosi (2015) and my (rough) calculations of the average age of the workforce in the CBO projections. Because CBO only reports labor force participation rates by age group, as opposed to single years of age, I needed to make assumptions about the average age within each group to calculate the overall average.

in Elmendorf and Sheiner (2017), one possible response to this slowdown is an increase in the capital labor ratio, as firms substitute machines for increasingly scarce labor.[8] This increase in the capital labor ratio will raise the level of labor productivity.

But the slowdown in labor force growth means that investment growth will also slow (even if doesn't initially slow as much as labor while firms increase the capital intensity of their operations.) As noted by Cutler et al (1990), this slowdown in investment could restrain growth in total factor productivity—the productivity growth that comes from technological change rather than from changes in the capital intensity of work. Because innovation may consist largely of fixed costs—the fixed costs of R&D, for example—slowing investment means that fixed costs are spread over a smaller pool of capital, making it less profitable. Thus, the rate of technological progress might slow when labor force growths slows.

Thus, the theoretical implications of aging on productivity growth are ambiguous. Empirical research also reaches conflicting conclusions. Using panel data on OECD and low-income countries, Feyrer (2002, 2008) concludes that productivity growth decreases when the proportion of workers who are over 49 years old rises. However, a report by the National Research Council (2012) notes that Feyrer's effects are sensitive to specification, so his results should be taken with caution. Upon re-estimating Freyer's model, the National Research Council concludes that there will be a negligible effect of an aging labor force on aggregate U.S. productivity growth over the next two decades—between a -0.1 and +0.1 percentage point each year.

[8] In the model in Elmendorf and Sheiner (2017), that increase in the capital labor ratio is eventually reversed, but the process is slow: the capital labor ratio increases over the next 15 years, and then slowly drifts back to its initial level. The reversal is not complete for 60 years or so.

More recent papers (Liu & Westelius 2016; Aiyar et al. 2016) find that aging in Europe and Japan reduced annual total factor productivity (TFP) In Japan, Liu and Westelius estimate that the aging workforce reduced Japan's annual TFP growth by as much as 0.7–0.9 percentage points between 1990 and 2005. Aiyar et al. find that, for 28 countries in Europe, the growing number of workers aged 55 and older decreased annual TFP growth by an average of 0.1 percentage point over the past two decades. Similarly, Maestas et al. find that a 10% increase in the fraction of the population older than 60 years leads to a 3.7% decrease in productivity growth. However, Cutler et al (1990), find that a 1 percentage point decrease in the annual labor force growth rate actually raises productivity growth by 0.62 percentage point a year.

More recently, Acemoglu and Restrepo (2017) find no evidence of a negative relationship between population aging and slower GDP per capita growth across countries. On the contrary, the relationship is positive and significant, whether aging is measured by the change in the average age of the adult population or the change in the ratio of old to young workers. They argue that countries with aging populations might be more likely to adopt of automation technologies, thereby increasing worker productivity.

Effect of productivity on the federal budget. While the link between demographic change and productivity growth is much more uncertain than that between demographic change and interest rates---both in direction and magnitude—it is worth at least exploring what the implications of such a link might be for our fiscal future.

Productivity growth can affect the federal budget through many different channels. (See Sheiner, forthcoming 2018) First, slower productivity growth will lower revenues as a share of GDP, because there will be less "real bracket creep", a concept explained above. Second, slower productivity growth—if distributed broadly--will lead to increases in poverty, which will boost

spending for federal anti-poverty programs like Medicaid and food stamps. Third, slower productivity growth will raise the GDP share of spending programs that are not fully indexed to wages (including Social Security, because only initial benefits are indexed to wages, and subsequent benefit are indexed to inflation an food stamps, which are indexed to the price of food.) Finally, slower productivity growth may also lead to lower interest rates, which would partially offset the negative effects of slower productivity growth on the fiscal outlook. (See, Hamilton, Hatzius, Harris, and West (2015) for a discussion of the effects of productivity growth on interest rates.)

In a 2016 report, CBO calculated the effects of slower productivity growth on the federal debt. They found that a permanent ½ percentage point decrease in productivity growth would raise the ratio of debt to GDP in 30 years from 141 percent (their baseline last year) to 173 percent of GDP.

III. Policy responses to aging

The fundamental challenge of population aging is that it increases the ratio of non-workers to workers. Thus, one potential pathway to addressing aging is to raise the size of the labor force. This can be accomplished through increased immigration or increases in labor force participation.

Increasing Immigration. About 3/4 of immigrants are adults between the ages of 20 and 54 (Migration Policy Institute, 2017). Thus, increasing immigration can lower the age of the workforce and increase the ratio of workers to retirees. CBO assumes the rate of immigration (the number of immigrants in a year as a share of the US population) will average .32 percent

over the next 30 years; Social Security assumes a slightly higher number, about .37.[9] Although CBO does not provide information about the sensitivity of its long run outlook to immigration assumptions, it has produced cost estimates of legislation that would increase immigration. In particular, CBO (2013) found that the "Border Security, Economic Opportunity, and Immigration Modernization Act" (S. 744) would increase the labor force by about 5 percent by 2033, and lower the deficit from 2023-2024 by 0.2 percent of GDP (with a smaller impact in the first ten years.) The Social Security Administration (The Trustees, 2017) does provide sensitivity analyses about the effects of immigration.[10] They show that a 25% increase in immigration rates from their baseline would lower the 75-year imbalance (the difference between average Social Security outlays and average Social Security income over 75 years) by about 10 percent—from 2.8% of payroll in its baseline to 2.6% in its high-immigration alternative. Thus, both CBO and the Social Security Trustees find increased immigration to have beneficial, but small, effects on the budget outlook.

Increasing Labor Force Participation. Another way to increase the number of workers is to increase labor force participation—either of those over 65 or under 65. Increased labor force participation will likely lead to some small increases in Social Security benefits—because benefits are tied to earnings histories—but would have no effect on Medicare benefits, which don't rise with earnings.[11] Increased labor force participation is also a useful response to aging from a household perspective. Increasing work effort—by working more during the normal work years or by delaying retirement—can help adjust to longer life expectancy, to lower returns on

[9] Author's calculations based on the single year tables associated with the Trustees report.
[10] Social Security assumes declining rates of immigration over time, whereas CBO assumes constant rates, so the sensitivity of the CBO projections to changes in assumptions could be somewhat different.
[11] Reznik, Weaver, and Biggs (2009) estimate that, on average, the present value of increased social security benefits offset about ½ of the **payroll** taxes paid when a worker ages 62 to 65 delays retirement. Increased income taxes are not offset at all.

saving arising from population aging, and to any benefit cuts enacted in response to the fiscal challenges of aging.

Table 1 presents some simple calculations of the magnitude of the changes in labor force participation required in order to completely offset population aging. Of course, in reality assessing the effects of policies to change labor force participation on the budget is much more complicated than what is shown here. Such an analysis would require knowing the wages of those whose participation changes, the effects of their increased participation on Medicare and Social Security outlays, and any offsetting effects from changes in take-up of other programs, like Medicaid and health subsidies in the Affordable Care Act. But the simple exercise helps gauge order of magnitudes.

The table uses CBO's projections of population and labor force participation (CBO, 2017.) The first row of the table shows the data for 2017: with 171 million workers and roughly 46 million retirees (which I define as those 62 or older who are not in the labor force), the worker to retiree ratio is 3.7. By 2047, CBO projects that the worker to retiree ratio will decline to just 2.6.

Two different types of adjustments can raise that ratio back to 3.7. The first increases the size of the labor force—the numerator in the worker to retiree ratio—whether through delayed retirement or increased labor force participation of younger Americans, but makes no adjustment to benefits, so that people get the same Social Security and Medicare benefits despite working longer. This leaves the denominator in the worker to retiree ratio unchanged. This assumption is largely in keeping with current law.[12] The second type of adjustment assumes people delay

[12] Under current law, when people below the normal retirement age (66 now, but rising to 67) work and claim benefits, social security applies an earnings test that automatically delays benefits. Workers older than the normal

retirement but lose the benefits they would have received. This means they no longer count as beneficiaries, putting them in the numerator and taking them out of the denominator in the worker/retiree ratio calculation. Such a change should be viewed as a benefit cut and would require legislation.

The bottom two panels of Table 1 shows the implications of these adjustments. When benefits are unchanged, overall labor force participation (defined as the share of the population 16 and over who are in the labor force) would have to increase dramatically—from 59% to 85%—in order to fully offset the effects of aging. In the second scenario—when all of the increase in labor force comes from delayed retirement and that delayed retirement also reduces benefits, overall labor force participation increases much less, but the participation of Americans 62 or older increases much more, from 25% to 43%. At the same time, the number of beneficiaries falls about 25%, from 73 million to 56 million.

These are very large changes, and most likely impossible to achieve. Figure 12 shows CBO's projections of labor force participation rates by age and sex. They anticipate only minor changes in participation over time – with some small reductions among prime-age men, a continuation of a trend that has been ongoing for some time (Executive Office of the President, 2016) and some continued increases in participation at older ages, particularly for women. The labor force participation of women, which plateaued in the late 1990s (Lee, 2014) is expected to remain well below that of men.

---

retirement age don't face an earnings test—so can work and still receive benefits—but can delay claiming if they choose. When benefits are delayed, they are adjusted upward in an actuarially fair manner, on average, so that the present value of benefits is unchanged. Medicare doesn't apply an earnings test—everyone who reaches 65 is eligible—but it does require that Medicare be the secondary payer for beneficiaries who have employer-provided health insurance. Thus, under current law, Medicare could save money when workers delay retirement past 64.

To get a sense of what types of increases might be achievable, I consider three scenarios. First, I consider what would happen if years of work increased with life expectancy. As shown in Table 2, the CBO projections assume that life expectancy at 62 increases by 2.4 years for men and 2.2 years for women between now and 2047, but expected years of work increase only 0.4 years for men and 2 years for women.[13] Imagine instead that, in response to this increased longevity and presumably better health, people delay retirement by adopting the labor force participation of those 2 years younger (so that, a 70 year old has the same participation as what CBO projects a 68 year old will have.)[14] Under this assumption, as shown in column 3 of table 2, the expected time in the workforce at age 16 increases by1.6 years for men and 3.1 years for women between now and 2047; expected time in the labor force at 62 (assuming survival until age 62) increases by 1.8 years and 2 years for men and women, respectively.[15]

As a second scenario, suppose that women's labor force participation climbed over the next 30 years to equal that of men. As shown in column 4 of Table 2, this would boost the change in women's expected years of work by 6.6 years at age 16 and by 2.5 years at age 62. Finally, as a third scenario, assume both of these changes occur simultaneously. Figure 13 shows what participation rates would be under scenarios 2 and 3.

The results are shown in the bottom panel of Table 1. Consider, at first, the effects of the increases in the labor force, while keeping benefits the same. Under this assumption, these increases in labor force participation only undo a small part of the decrease in the ratio of workers to beneficiaries. If workers act as if they are 2 years younger, the labor force increases

[13] The larger increase for women represents cohort effects, because women turning 62 in 2047 have higher labor force participation at all ages than women who turn 62 in 2017.
[14] I start this shift at age 45. That is, I don't change participation rates of those younger than 45, but shift participation for those 45 and older to those projected for those 2 years younger.
[15] The expected years of work at a given age are conditional on actually attaining that age. Thus, increasing participation at older ages has a larger effect on work years at 62 than at 16.

by 5 million workers—not enough to significantly change the ratio of workers to beneficiaries. Increasing the labor force participation of women so that is equal to that of males has a bigger effect, increasing the ratio to 2.8. And doing both of these helps a little bit more.

On the other hand, if the generosity of the system is assumed to decrease alongside the labor force changes, the effects are more significant. Even so, cutting benefits, increasing the labor force participation of women, and delaying retirement for all only brings the ratio up to 3.3, still well below today's 3.7 ratio.

Cut spending or raise taxes. Increased labor force participation clearly has a role to play in addressing the challenges of aging, but, on its own, only solves a small part of the problem. It is clear that government spending eventually will have to decline or taxes increase. There are two policy questions that need to be answered: first, when should these changes take place, and second, what should the composition of the tax increases and spending cuts be—which programs, which taxes?

Timing of policy changes. With about 2/3 of the demographic transition still ahead of us, it is still possible to smooth consumption over time by enacting tax increases and spending cuts now that allow for smaller changes in the future. The question is whether we should. As noted by Elmendorf and Sheiner (2017), the optimal response to aging is probably not complete smoothing of consumption, because the rates of return on that saving are not likely to be large enough to be worth it. Indeed, with government borrowing costs extremely low by historical standards, the benefits of higher saving now appear quite small.[16]

[16] Elmendorf and Sheiner (2017) discuss the impact of low interest rates on optimal fiscal policy.

Figure 14 illustrates two scenarios that are based on an extended CBO baseline where I assume that, after 2047, taxes and non-interest spending are constant as a share of GDP. In one scenario, I assume that policymakers take action today to stabilize the debt in perpetuity, and, in the second, I assume that policymakers allow the debt to increase for 20 years as in the CBO baseline, and then take action to stabilize the debt. The top panel of the figure shows what happens to the debt in each case. If policymakers take action today, the debt eventually stabilizes at about 40 percent of GDP; if they wait 20 years, the debt to GDP ratio is much higher, ending up at 105 percent of GDP.

The bottom panel shows the changes in the deficit required under each scenario. What is striking about this figure is how little long-run benefit is derived from taking action today and reducing the debt to GDP ratio. If action is taken today, the deficit needs to be reduced by 3.8 percent of GDP. If no action is taken for 20 years—that is, there are no cutbacks in spending or increases in taxes for 20 years, then, when action is eventually taken, the change in the deficit needs to be 4.1 percent of GDP, or just .3 percentage points more than if we take action today. This very small benefit is a direct result of the very low interest rates that are expected to prevail over the next few decades. With borrowing rates projected to be just ½ percentage point above GDP growth by 2047, debt is not very costly and reducing it not very beneficial.

Analysts often do a different calculation that shows a much larger benefit to acting sooner, shown in Figure 15. They compare the reductions in the deficit (through tax increases or spending cuts) that would be necessary at different points in time if the goal is to ensure a particular debt to GDP ratio at the end of the period. For example, if the goal is for the debt to GDP ratio in 2047 to be 77 percent, the same as today's, the deficit would have to decrease by 2.5% of GDP starting today, 3.6% of GDP starting in 10 years, and 7.6% starting in 20 years.

But these changes are not intended to stabilize the debt to GDP ratio—they just make sure they hit 77 percent in 2047. To stabilize debt at 77 percent of GDP from 2047 on, the deficit cut relative to the current baseline would have to be 4% of GDP. So, in the "act now" case, additional deficit decreasing measures would have to be taken in 2047, whereas in the "act in 20 years case" there could be large spending increases or tax cuts. These comparisons tend to overstate the benefits of acting sooner rather than later because they compare temporary changes, not permanent ones.

Of course, interest rates are extremely hard to predict and the larger the debt to GDP ratio, the more vulnerable the budget is to unexpected interest rate increases. Thus, prudence requires us to aim for a lower debt-GDP ratio than we otherwise would. Furthermore, changes to entitlements are often best made years in advance in order to give people time to adjust their spending and work decisions. Thus, it makes sense to start making small adjustments to spending and taxes and to start thinking about what kinds of changes we will want to make in the future.

Composition of spending cuts and tax increases Of course, decisions about which programs to keep and what taxes to raise will depend on preferences, which belong in the sphere of politics not economics. But economics does have a valuable contribution to make. I highlight two important issues: the difference between spending on investment and spending on consumption, and the implications of the growing disparities in life expectancy by income.

Investment versus consumption: Cutting valuable investments to lower the debt makes little sense from an economic perspective. So long as the risk-adjusted social return on the investments exceeds the government's borrowing costs, future well-being improves when the government borrows to invest. Investments need not "pay for themselves" in the narrow sense that the return is so large that just the tax revenues arising from the investment are sufficient to

pay off the cost of borrowing—this is too high a bar that would preclude the government from making many extremely valuable investments. Instead, the social rate of return needs to be adjusted (downward) for any deadweight loss that arises out of any increases in taxes that might be necessary to pay off the debt.[17]

Deciding what is investment and what is consumption is not straightforward. Unlike state and local governments, the federal government does not have a capital account and an operating account, and, even if it did, it would likely not adequately capture spending that, from an economic perspective, represents investment or has investment-like features. Of course, spending on infrastructure and equipment should be counted as investment, but so too should some social spending—particularly transfers to low-income children, which have been shown to have impacts that last well beyond the childhood years. Butcher (2017) provides a nice summary of the research on the long-run effects of government spending, which suggest that cash transfers, through the EITC or other programs, and in-kind transfers like food stamps, housing assistance, and health insurance, have significant effects on adult outcomes such as educational attainment, earnings, and health. Thus, spending on education, infrastructure, and transfers to low-income families should be viewed as essential to future well-being and should be protected.

Increasing disparities in life expectancy: While life expectancy has increased over time in the United States, recent research shows that the gains have occurred mostly in the top half of the income distribution. For example, according to a recent report from the National Academy of

[17] Imagine, for example, that a $1 investment today will increase wages by 5 cents per year every year, and imagine that the government's borrowing cost is 2% and the average tax rate is 20%. Without changing tax rates, the government will gain an additional 1 cent per year from the additional wages, which is not enough to pay the 2 cent per year interest cost. Assume that there is deadweight loss, so that when the government raises taxes on wages to collect the additional cent, work effort falls so that the increment to wages is now just 4.5 cents per year. This is still a good deal. Tax revenues go up enough to pay the additional interest costs, and workers are left with an additional 1.5 cents per year after tax.

Science (National Academy, 2015), for the cohort born in 1930, life expectancy at age 50 was 76.6 years for men in the bottom quintile of lifetime earnings, and 81.7 for men in the top quintile, a gap of 5.1 years. For the cohort born in 1960, if recent trends continue, they estimate those life expectancies will be 76.1 and 88.8, a gap of 12.7 years.

The policy implications of such rising disparities are profound. Medicare and Social Security are annuities, which means that people get them for as long as they live; as the rich live longer and longer, they get more and more of the benefits of entitlement programs. The National Academy report calculates, for example, that increased life expectancy for those born in 1960 relative to those born in 1930 will boost the present value of lifetime benefits from Social Security and Medicare by almost 50% for those in the top income quintile, whereas those in the bottom income quintile receive no benefit at all. In addition, differential life expectancy is likely associated with differential health, meaning that lower income workers are likely less able to delay retirement. Changes to entitlement programs need to take account of this rising disparity if they are to maintain fairness. Policies that cut benefits more for high earners, or base retirement ages on years of contribution, should be preferred over policies that cut benefits across the board.

Perhaps more importantly, addressing the reasons for this rising disparity, which are still unclear, needs to be an important priority for the federal government.

IV. Conclusion

Population aging will put significant pressure on federal budgets in coming years, and policy changes are inevitable. With a permanently older population, and with health spending continuing to rise faster than GDP, it seems likely that overall government spending will have to be higher. Remembering that some government spending is actually investment, and taking into

consideration the widening disparities in life expectancy, tip the balance a bit more toward higher taxes rather than cuts to spending. But, given the size of the challenge, some combination of spending cuts and tax increases will likely be required.

It is difficult to find policies to lighten the future burden. Increases in labor force participation can help, but without concomitant cuts in benefits, they are not likely to make a large dent. Similarly, policies to lower the debt now have only small effects on the changes required in the future, because the interest savings from such policies are so small. Measures to improve the efficiency of health spending are one exception—such policies could help address fiscal imbalances without requiring much sacrifice. Continuing to experiment with payment reforms should be viewed as an important priority for the government, one that has the potential to have very large returns.

Of course, all of these projections are subject to a great deal of uncertainty, and prudence requires that we consider the downside risks, which include more rapid increases in interest rates than expected and further declines in productivity growth. Acting to slow the increase in the debt to GDP ratio a bit more than we otherwise would makes sense given these risks. Furthermore, changes to entitlements are often best made years in advance in order to give people time to adjust their spending and work decisions. Thus, a reasonable policy is to begin to make small adjustments to spending and taxes and to start planning the kinds of changes we will want to make in the future.

References

Acemoglu, Daron and Pascual Restrepo. 2017. "Secular Stagnation? The Effect of Aging on Economic Growth in the Age of Automation." Working Paper No. w23077. National Bureau of Economic Research.

Aiyar, Shekhar, Christian Ebeke, and Xiaobo Shao. 2016. "The Impact of Workforce Aging on European Productivity." Working Papers 16/238, International Monetary Fund.

Butcher, Kristin, 2017. "Assessing the long-run benefits of transfers to low-income families." Hutchins Center Working Paper #26

Carvalho, Carlos, Andrea Ferrero, and Fernanda Nechio. 2016. "Demographics and Real Interest Rates: Inspecting the Mechanism." Working Paper 2016-05. Federal Reserve Bank of San Francisco. http://www.frbsf.org/economicresearch/publications/workingpapers/wp2016-05.pdf

Congressional Budget Office. 2013. Cost estimate of "S. 744, Border Security, Economic Opportunity, and Immigration Modernization Act. July 3. https://www.cbo.gov/system/files/113th-congress-2013-2014/costestimate/s744aspassed.pdf

Congressional Budget Office. 2016. "Raise the Full Retirement Age for Social Security". Retrieved September 14, 2017, from https://www.cbo.gov/budget-options/2016/52186

Congressional Budget Office, 2017. The 2017 Long-Term Budget Outlook, Long-Term Budget Projections https://www.cbo.gov/sites/default/files/recurringdata/51119-2017-03-ltbo_1.xlsx

Congressional Budget Office, 2017. The 2017 Long-Term Budget Outlook, Projections Underlying Social Security Estimates, https://www.cbo.gov/system/files/115th-congress-2017-2018/reports/52480-2017projectionsunderlyingsocialsecurityestimates.xlsx

Cutler, David, James Poterba, Louise Sheiner, and Lawrence Summers. 1990. "An Aging Society: Opportunity or Challenge?" NBER Working Paper No. 1559. National Bureau of Economic Research.

Elmendorf, Douglas and Louise Sheiner, 2017. "Federal Budget Policy with an Aging Population and Persistently Low Interest Rates." *Journal of Economic Perspectives*, vol. 31, no. 3. Summer.

Executive Office of the President of the United States, Council of Economic Advisers. 2014. *The labor force participation rate since 2007: causes and policy implications*. July.

Fernald, John. 2014. "Productivity and Potential Output Before, During, and After the Great Recession." *NBER Macroeconomics Annual*. Volume 29, Number 1.

Feyrer, James. 2002. "Demographics and Productivity." Working Paper No. 02-10. Dartmouth College. Available at SSRN: http://dx.doi.org/10.2139/ssrn.325365

Feyrer, J. (2008). "Aggregate Evidence on the Link between Age Structure and Productivity." *Population and Development Review, 34*, 78-99. Retrieved from http://www.jstor.org/stable/25434760

Fujita, S., & I. Fujiwara. 2016. "Declining Trends in The Real Interest Rate And Inflation: The Role Of Aging." Working Paper 2016 16-29, Federal Reserve Bank of Philadelphia.

Fullerton, Howard and John Tschetter. 1983. "The 1995 labor force: a second look." Monthly Labor Review November. https://stats.bls.gov/opub/mlr/1983/11/art1full.pdf

Gagnon, Etienne, Benjamin K. Johannsen, and David Lopez-Salido. 2016. "Understanding the New Normal: The Role of Demographics," Finance and Economics Discussion Series 2016-080. Washington: Board of Governors of the Federal Reserve System, http://dx.doi.org/10.17016/FEDS.2016.080.

Goss, Stephen. 2014. Strengthening Social Security to Meet the Needs of Tomorrow's Retirees. *Testimony Before Subcommittee on Social Security, Pensions, and Family Policy of the Senate Committee on Finance*. May 21. https://www.ssa.gov/oact/testimony/SenateFinance_20140521.pdf

Hamilton, James D., Ethan S. Harris, Jan Hatzius, and Kenneth D. West. 2015. "The equilibrium real funds rate: past present, and future." Working Paper #16. Hutchins Center on Fiscal & Monetary Policy at Brookings. October.

Ikeda, Daisuke and Masashi Saito. 2012. "The effects of demographic changes on the real interest rate in Japan." Working Paper No. 12-E-3, Bank of Japan. https://www.boj.or.jp/en/research/wps_rev/wps_2012/data/wp12e03.pdf

Jones, B.F. 2010. "Age and great invention." *Review of Economics and Statistics*, 92(1), 1-14

Lee, Jin Young. 2014. "The Plateau in U.S. Women's Labor Force Participation: A Cohort Analysis." *Industrial Relations* Vol. 53, No. 1

Liu, Yihan, and Niklas Westelius. 2016. "The Impact of Demographics on Productivity and Inflation in Japan." Working Papers 16/237, International Monetary Fund.

Maestas, Nicole, Kathleen Mullen, and David Powell. 2016. "The Effect of Population Aging on Economic Growth, the Labor Force and Productivity." Working Paper No. 22452, National Bureau of Economic Research.

Migration Policy Institute. 2017. "Age-Sex Pyramics of Top Immigrant Origin Groups in U.S. 2015." http://www.migrationpolicy.org/programs/data-hub/charts/age-sex-pyramids-top-immigrant-origin-groups. Retrieved September 17, 2017.

Mislinski, Jill. 2017. "Demographic Trends for the 50-and Older Work Force." *Advisor Perspectives*. September 6.

https://www.advisorperspectives.com/dshort/updates/2017/09/06/demographic-trends-for-the-50-and-older-work-force

National Research Council of the National Academies. 2012.*Aging and the Macroeconomy: Long-Term Implications of an Older Population*. Washington, D.C.: The National Academies Press.

National Academy of Sciences. 2015. *The Growing gap of Life Expectancy by Income, Implications for federal programs and policy responses.* Washington, D.C.: The National Academies Press.

Reznik, Gayle L., David A. Weaver, and Andrew G. Biggs. 2009. "Social Security and Marginal Returns to Work near Retirement." Issue Paper no 2009-02. Social Security Office of Retirement and Disability Policy. April. https://www.ssa.gov/policy/docs/issuepapers/ip2009-02.html

Sheiner, Louise, forthcoming 2018. "The effects of productivity growth on government budgets." Peterson Institute for International Economics.

The Board of Trustees, Federal Old-Age and Survivors Insurance and Federal Disability Insurance Trust Funds. 2017. "*The 2017 Annual Report of the Board of Trustees of the Federal Old-Age and Survivors Insurance and Federal Disability Insurance Trust Funds*." Washington.

Toossi, Mitra. 2015. "Labor force projections to 2024: the labor force is growing, but slowly," *Monthly Labor Review*, U.S. Bureau of Labor Statistics, December. https://doi.org/10.21916/mlr.2015.48.

Figure 1
Federal Spending and Revenues

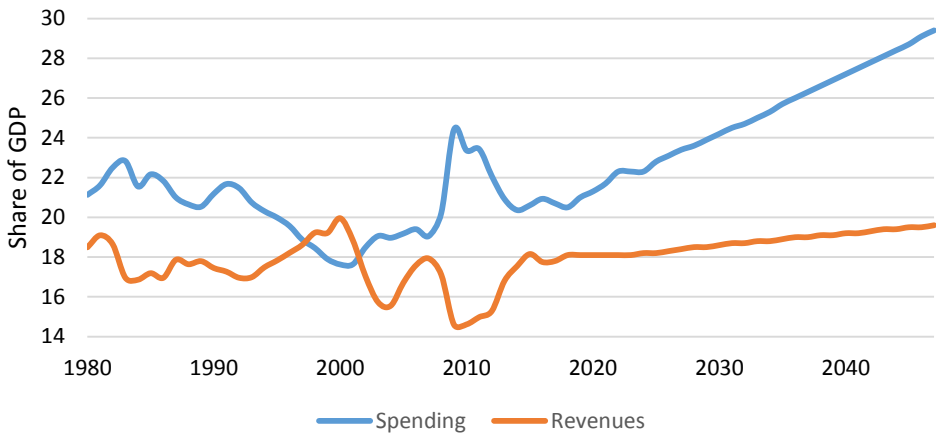


Figure 2
Federal Debt

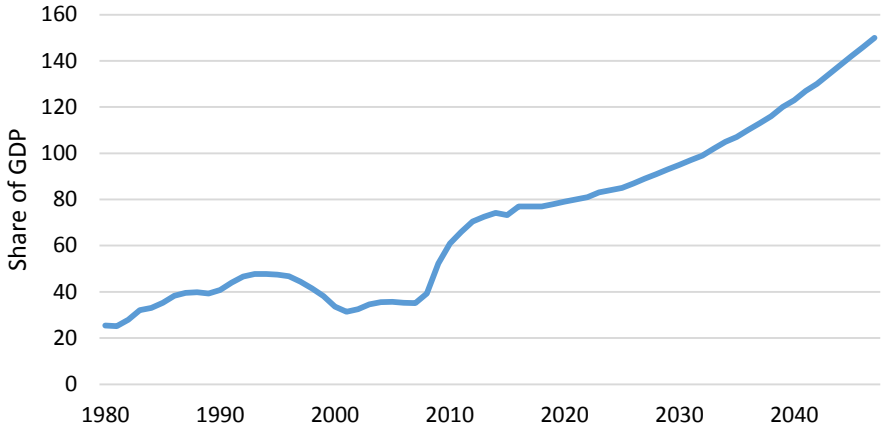


Figure 3
Effects of Aging on Federal Outlays

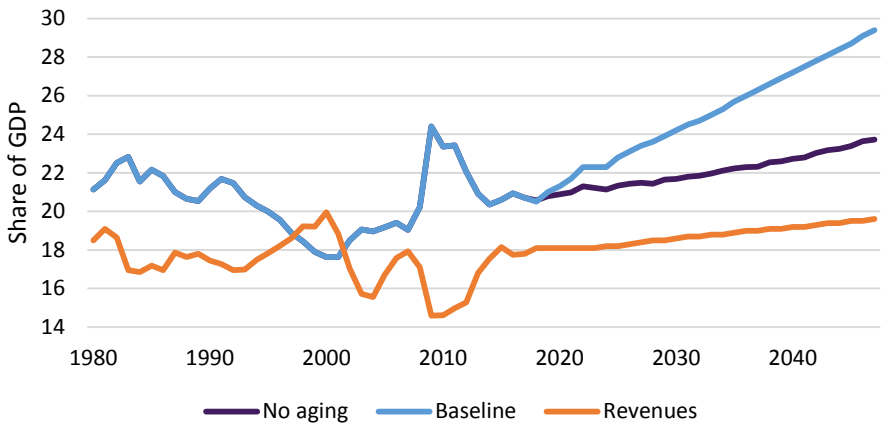


Figure 4
Effect of Aging on Debt

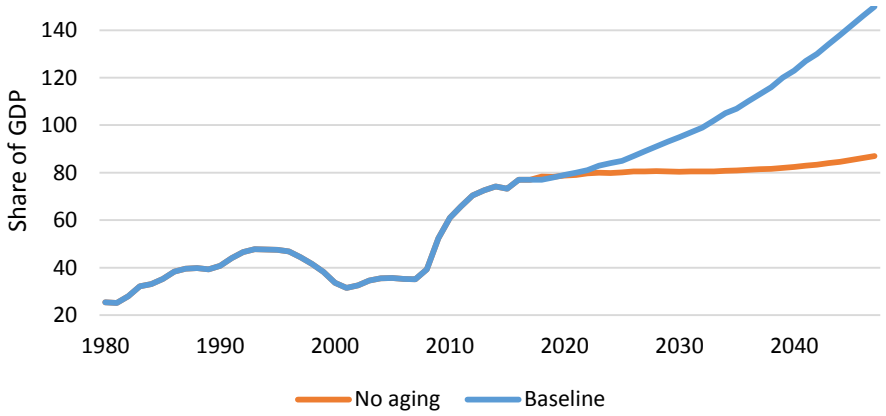


Figure 5
Debt Trajectories under various assumptions

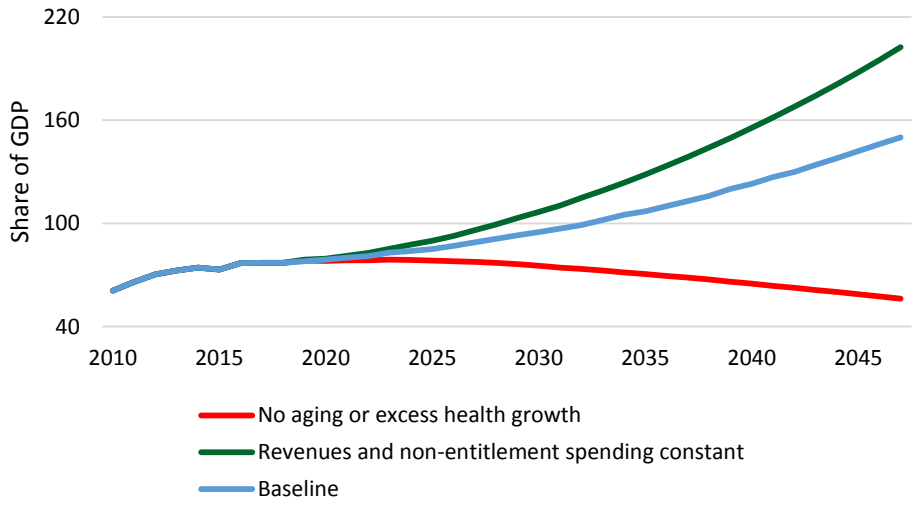


Figure 6
Discretionary Spending

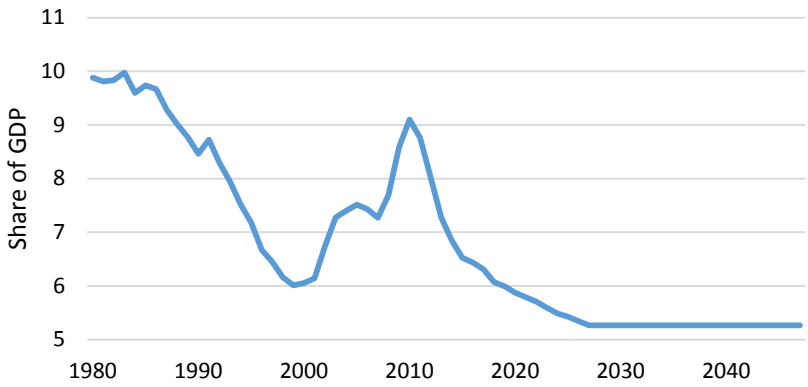


Figure 7
Revenues

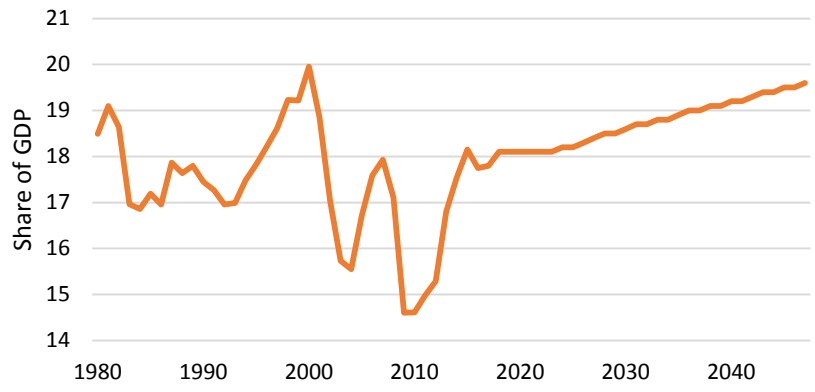


Figure 8
Real Interest Rates on Federal Debt

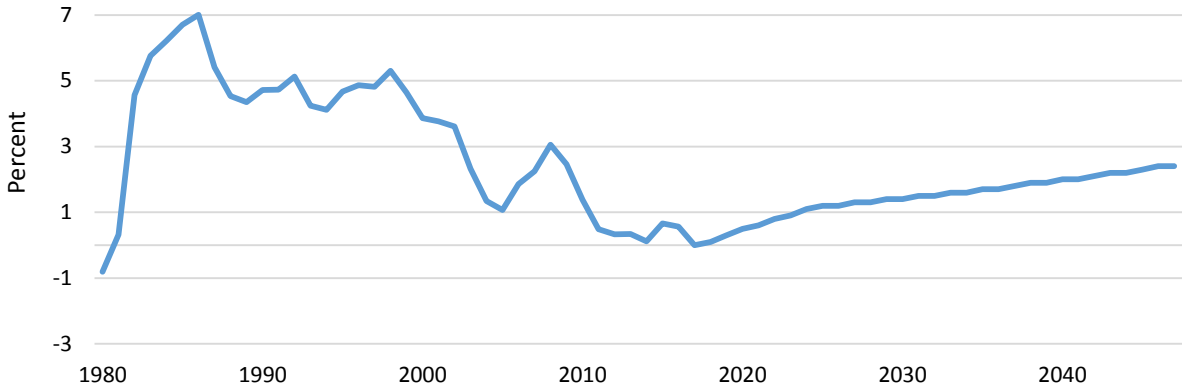


Figure 9
Debt under Different Interest Rate Assumptions

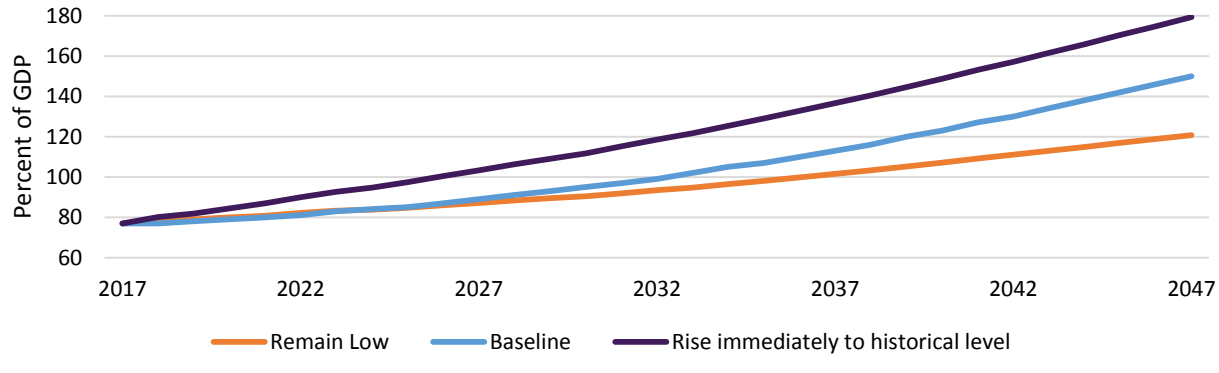


Figure 10
Average/Median age of workforce

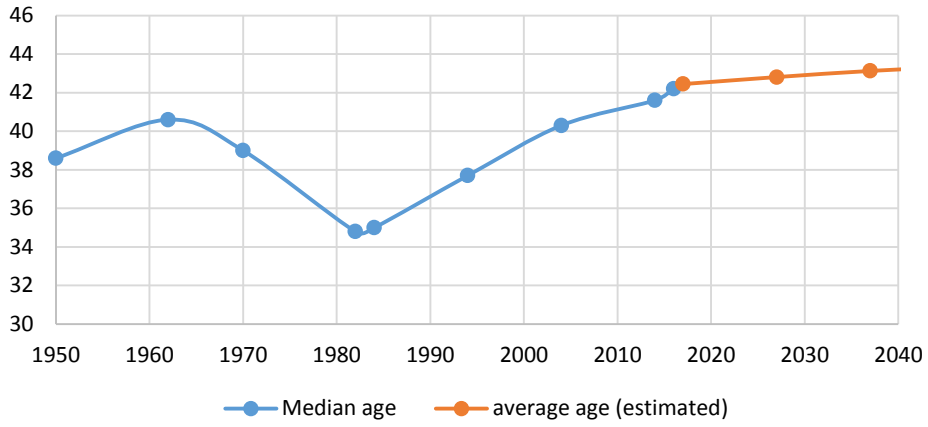
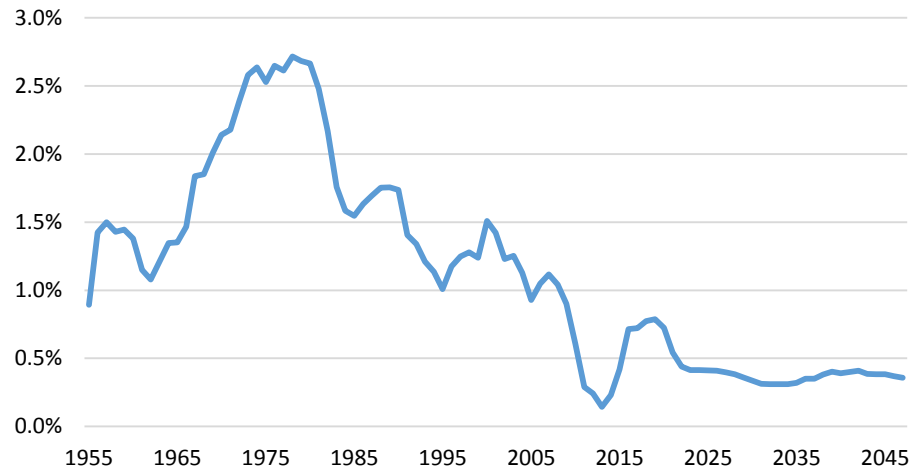


Figure 11
Labor Force Growth



5-year moving average; BLS and CBO.

Table 1
Labor Force Adjustments to Undo Aging

Baseline	Workers (millions)	Beneficiaries 62+ (millions)	Ratio Workers to Beneficiaries	Share of 62+ in Labor Force	Overall Participation Rate
2017	171	46	3.7	25%	63%
2047	188	73	2.6	25%	59%
Changes in 2047 to get ratio to 2017 level					
Increased labor force participation, Unchanged Benefits	270	73	3.7	25%	85%
Delayed retirement with benefit cuts	205	56	3.7	43%	65%
Effects of 3 "plausible" scenarios					
Assume benefits don't change					
Delay retirement	193	73	2.6	29%	61%
Increase women's LFP	202	73	2.8	30%	64%
Do both	209	73	2.9	35%	66%
Assume increased work effort is offset by lower benefits					
Delay retirement	193	69	2.8	29%	61%
Increase women's LFP	202	68	3.0	30%	64%
Do both	209	63	3.3	35%	66%

Table 2
Changes in Life Expectancy and Years of Work, 2017-2047

	Change 2017-2047, CBO Baseline		Change in Work 2017-2047 under alternate LFP scenarios		
	Life Expectancy	Years of Work	Shift LFP schedule 2 years for 45+	Women LFP increases to Men's	Shift Younger and Change Women's LFP
At Age 16					
Men	3.6	0.4	1.6	0.4	1.6
Women	3.0	2.0	3.1	6.6	7.9
At Age 62					
Men	2.4	0.9	1.8	0.9	1.8
Women	2.2	1.1	2.0	2.5	3.5

Figure 12
Labor Force Participation by Age, CBO Projections, 2017 and 2047

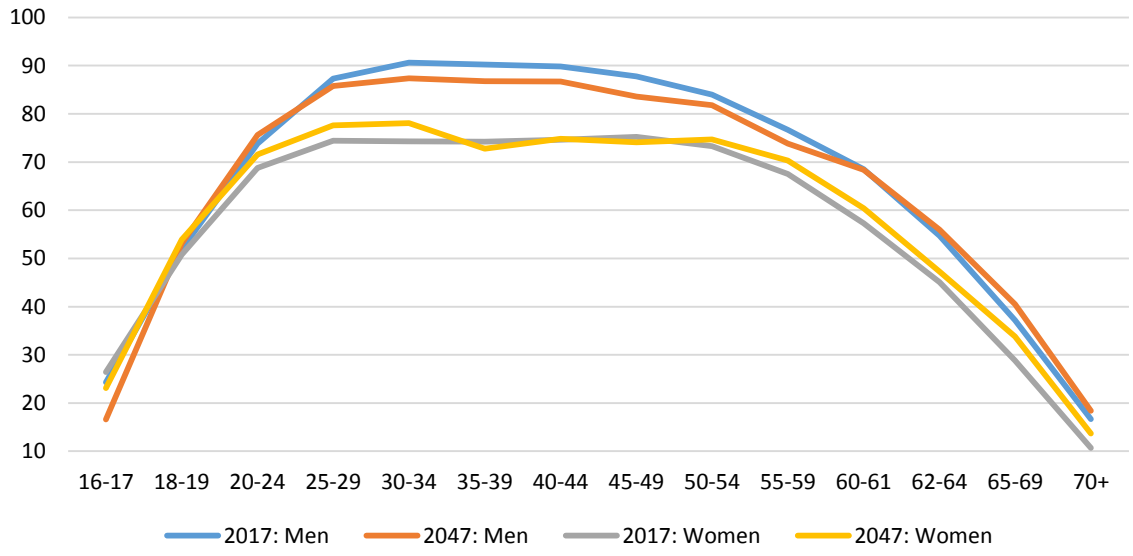


Figure 13
Labor Force Participation Scenarios

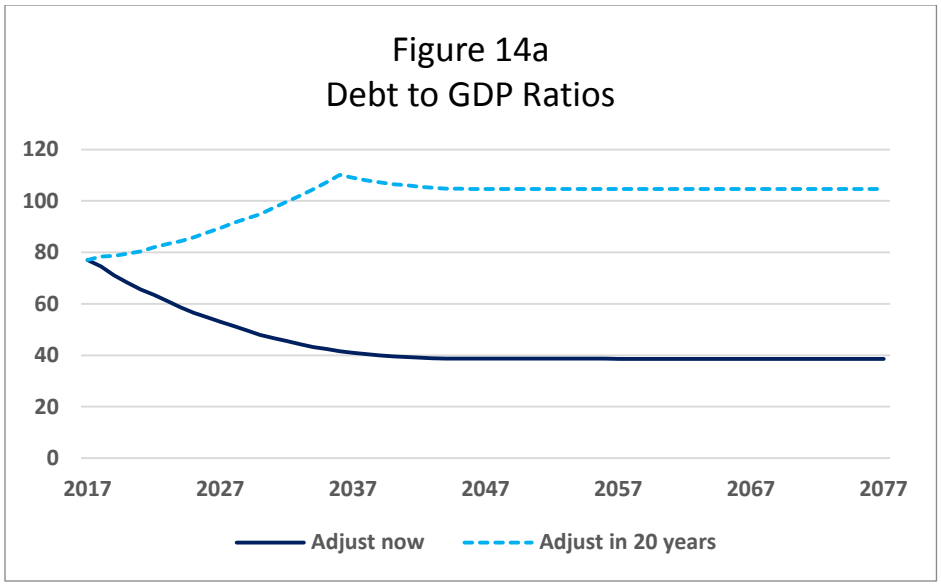


Figure 14a
Debt to GDP Ratios
120
100
80
60
40
20
0
2017
2027
2037
2047
2057
2067
2077
Adjust now
Adjust in 20 years

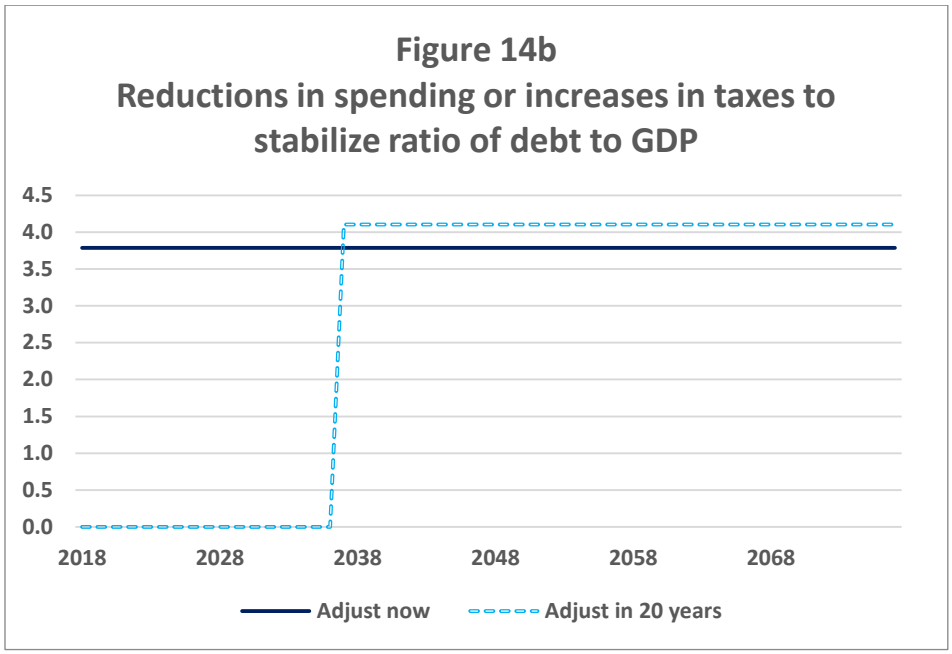


Figure 14b
Reductions in spending or increases in taxes to stabilize ratio of debt to GDP
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
2018
2028
2038
2048
2058
2068
Adjust now
Adjust in 20 years

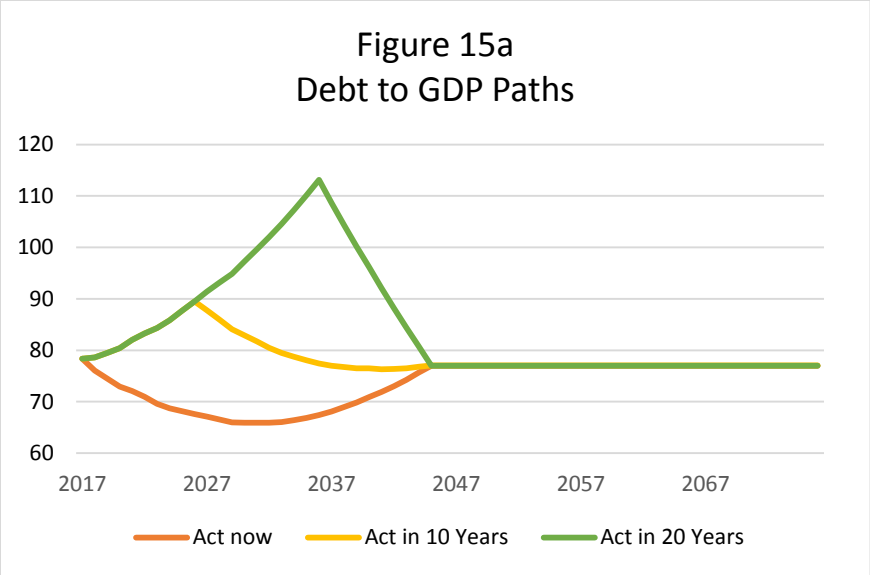


Figure 15a
Debt to GDP Paths
120
110
100
90
80
70
60
2017
2027
2037
2047
2057
2067
Act now
Act in 10 Years
Act in 20 Years

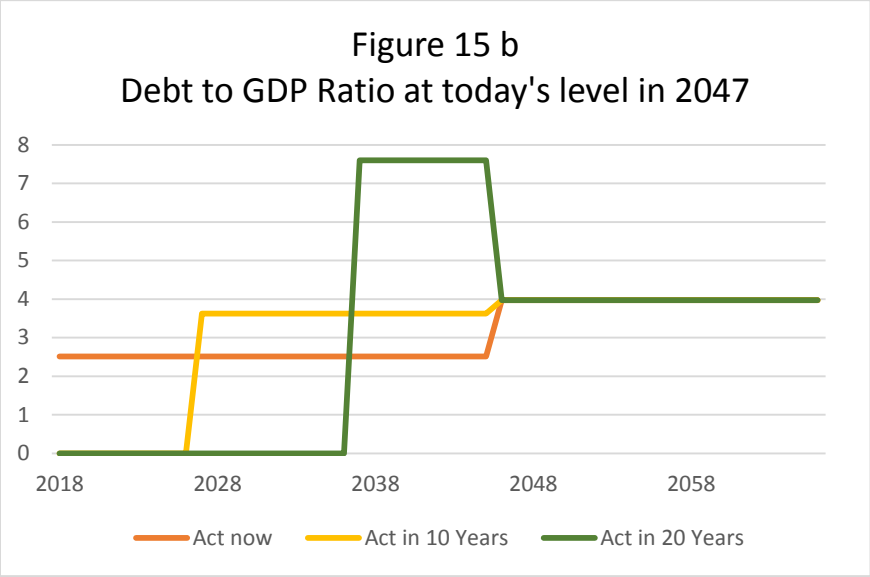


Figure 15 b
Debt to GDP Ratio at today's level in 2047
8
7
6
5
4
3
2
1
0
2018
2028
2038
2048
2058
Act now
Act in 10 Years
Act in 20 Years