FEDERAL BUDGET POLICY WITH AN AGING POPULATION AND PERSISTENTLY LOW INTEREST RATES

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SUMMARY

Relative to the size of the economy, U.S. federal debt is larger now than at any time since the end of World War II. Under current policies, the debt is expected to climb from around 75% of the Gross Domestic Product today to over 140% by 2046 and keep growing after that. Debt is rising in part because of a major demographic shift as the baby boom generation retires. It is projected to occur even though interest rates on Treasury borrowing likely will be persistently lower than historic norms.

We analyze how these and other developments should affect the optimal debt path going forward and conclude that tax increases or spending cuts will be essential eventually because federal debt relative to GDP cannot increase indefinitely. We argue that restraining the debt is necessary to give the government room to maneuver if a crisis of any sort occurs. In addition, we observe that the aging of the U.S. population, which lowers the fraction of the population that is working, means that the country should save more now than otherwise, which can be achieved by reducing federal debt.

How much and how quickly should the federal government tighten its belt? We note that, while debt should eventually decrease relative to GDP, the fact that U.S. government borrowing rates are at historical lows and likely to stay low for some time implies spending cuts and tax increases should be delayed and smaller in size than widely believed. Low long-term interest rates mean that the U.S. should borrow to make additional public investments. They also reduce the payoff from near-term debt reduction.

After considering other factors—including the role that fiscal policy can play during economic downturns when short-term interest rates are already so low that the Federal Reserve has little room to cut them—we argue for measured, gradual debt reduction with a higher debt-to-GDP ratio than has historically been the case.

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INTRODUCTION

Federal debt has surged in the past several years, and debt is now larger relative to gross domestic product (GDP) than at any time in U.S. history except for the period around the end of World War II. Moreover, debt would rise substantially further relative to GDP if current laws were not changed, increasing from roughly 75 percent today to about 140 percent 30 years from now and even more in later years (CBO, 2016b). By comparison, federal debt averaged 39 percent of GDP during the past 50 years. The projected further increase in debt stems in large part from the sharp demographic transition now underway in this country.

Some observers have argued that such high and rising debt poses a grave threat to the country's economic future. They worry that debt was too large compared with GDP even before the recent surge, and they have urged significant changes in tax or spending policies to sharply reduce federal borrowing. In stark contrast, other observers have noted that interest rates on long-term Treasury debt are extremely low, despite the run-up in debt and continuing economic expansion, and they have argued that such persistently low interest rates justify additional federal borrowing and more federal investment.

This paper addresses the implications for federal budget policy of the recent steep run-up in federal debt, the aging of the population, and persistently low Treasury interest rates. Although we cannot definitively state the optimal ratio of debt to GDP, we are hopeful that by framing the issues in a systematic way, our analysis helps to clarify the different presumptions of those who argue that "fixing the debt" should be a main policy priority and those who argue that undue concern over the debt has been a costly macroeconomic error. We conclude:

- The federal budget is not on a sustainable path. Projections under current law show federal debt increasing indefinitely relative to GDP, so substantial reductions in federal spending, increases in federal taxes, or both will ultimately be needed.
- If federal debt remained at its current high level relative to GDP, national savings would ultimately be lower than otherwise. In addition, the federal government would have less fiscal space to respond to unexpected developments, which would be especially risky because large adjustments in fiscal policy are best made slowly. Therefore, apart from the implications of population aging and low interest rates, debt should be reduced as a percentage of GDP.
- The aging of the U.S. population will reduce the share of the population in the labor force, reducing feasible consumption relative to what it would be in the absence of aging. A social planner (essentially a benevolent dictator) would respond to that aging—in a world where many other countries are also aging rapidly—by lowering consumption and increasing national saving over the next decade by about 1 percent of GDP, with further declines in consumption in subsequent years. Ultimately, consumption would be almost 16 percent below what it would be without population aging, although it would be well above today's levels because of continued productivity growth.
- Changes in saving of that magnitude amount to more than $2 trillion over the next 10 years and more in subsequent years. However, the changes in federal spending and taxes relative to current law that are needed to achieve that increase in saving are unclear for two reasons—first, because

it is not clear how closely the path of the federal budget under current law corresponds to desired saving in the absence of population aging, and second, because changes in the federal budget balance generally induce changes in private saving and thus do not lead to dollar-for-dollar changes in national saving.

- The widening of the U.S. budget deficit in CBO's extended baseline projections is not a good measure of the federal budgetary costs of population aging, as that widening is also affected by the projected growth rates of federal health care spending per person, revenues, and spending for programs not directly affected by population aging. We find that projected changes in federal health care spending (apart from the effects of aging), revenues, and other spending as a percentage of GDP offset, on net, almost one-half of the budgetary costs of aging over the next 25 years. However, those changes largely reflect the legislated methodology of baseline projections rather than explicit societal choices, so the projected long-run fiscal imbalance probably understates the magnitude of the policy changes that ultimately will need to be agreed upon.
- Interest rates on federal debt will probably increase in the next several years but remain persistently well below the average levels of the past few decades—although there is considerable uncertainty about that expectation. There is a wide range of alternative explanations for why rates might remain much lower than historic norms. Most of those explanations imply that federal debt should be substantially larger than it would be otherwise. Moreover, persistently low interest rates reduce the ability of the Federal Reserve to reduce rates in recessions, which increases the importance of countercyclical budget policy.
- Most of the alternative explanations for why interest rates on federal debt will probably remain low imply that federal investment should be higher than it would be if interest rates were at historic norms. Spending more on investments with significant economic returns can improve the country's ability to address the challenge of population aging and spending more on investments during economic downturns can enhance macroeconomic stability.

Where does that set of considerations leave us? Eventually, the federal government will need to reduce spending or increase taxes relative to what would occur under current law to rein in projected increases in federal debt relative to GDP. However, the appropriate magnitude and timing of those changes remains unclear: The aging of the population and the desirability of regaining fiscal space imply that faster and larger policy changes would be better, as is widely understood by both analysts and policymakers. However, persistently low interest rates imply that policy changes should be deferred and reduced in size and that federal investment should be increased, points that have received far less attention from analysts and are not well understood by policymakers.

Unfortunately, the logic and evidence examined in this paper do not allow us to quantify all of those factors. Moreover, the paper addresses the optimal amount of federal debt relative to what it would be in the absence of population aging and low interest rates, and it is not clear that historical levels of the debt-to-GDP ratio were optimal. Therefore, we are not able to identify an optimal debt-to-GDP ratio. Our analysis suggests however, that the response to the high level of debt and to population aging should be quite gradual.

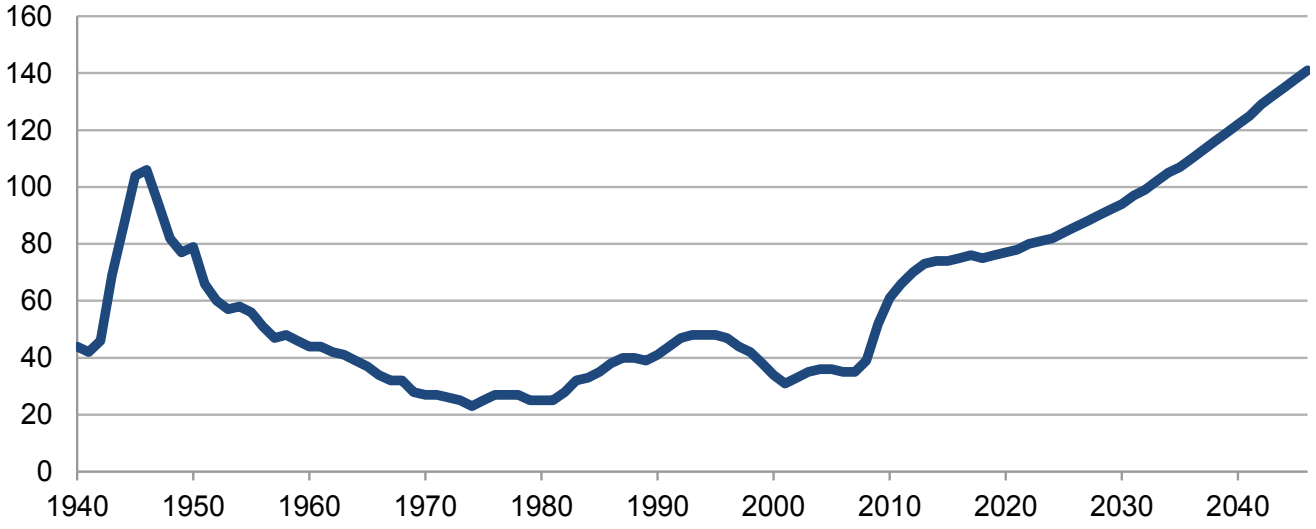
I. IMPLICATIONS OF THE PROJECTED FURTHER INCREASE IN FEDERAL DEBT UNDER CURRENT LAW

CBO projects that, under current law, federal debt will remain close to its current percentage of GDP for the next several years and increase indefinitely thereafter. Such a continual increase in debt relative to the size of the economy is unsustainable.

I.A. Federal debt—Past, present, and projected

Federal debt held by the public jumped during World War II, reaching 106 percent of GDP in 1946 (see Figure 1). Debt then declined gradually relative to GDP over the following three decades, hitting a postwar low of 23 percent in 1974. Debt rose again as a percentage of GDP in the 1980s and peaked at 48 percent in 1993, the highest mark in 35 years. Debt fell in the late 1990s and was roughly stable in the early 2000s, equaling 35 percent of GDP in 2007. Following 2007, however, the combination of the financial crisis, severe recession, and resulting policy actions generated exceptionally large deficits and a sharp rise in debt—to 75 percent of GDP in 2016 (CBO, 2016b).

Figure 1: Federal Debt Held by the Public (Extended Baseline)



Source: CBO 2016 Long-Term Budget Outlook.

Federal debt held by the public represents securities issued by the Treasury Department and owned by private investors in this country and abroad, and domestic and foreign governments other than the U.S. federal government and the Federal Reserve System. Such debt is roughly equal to the cumulative amount of past federal budget deficits. Gross federal debt and debt subject to limit (which are very similar to each other) also include Treasury securities held by accounts of the federal government, such as the Social Security trust fund. Because debt held by federal accounts represents both a liability and an asset of the federal government, we and most other analysts do not address it.

In addition, the federal government owns considerable assets. Debt held by the public less the federal government's holdings of financial assets—what we call "net debt" in this paper—is less than debt held by the public but generally follows a similar path. Specifically, CBO (2016a) estimates that debt held by the public less financial assets was 66 percent of GDP in 2015 and will rise to 78 percent of GDP in 2026, compared with 74 percent and 86 percent for debt held by the public. Nearly all of those financial assets were accumulated as part of a federal program with other purposes, rather than with the objective of increasing the government's financial leverage.

One might also consider even broader measures of the federal government's financial position (see CBO, 2010). For example, one might integrate the assets and liabilities of the Federal Reserve System (for which the federal government receives any surplus earnings) or Fannie Mae and Freddie Mac (which are effectively owned by the federal government now). However, those broader measures tend to follow roughly the same contours as debt held by the public, because the assets and liabilities of those institutions are usually fairly similar in amount. One might also include physical assets owned by the government, but we discuss federal nonfinancial investment separately.

CBO projects federal deficits and debt in future years under so-called "baseline" assumptions about tax and spending policies; the assumed policies generally adhere to current law.[1] In CBO's latest baseline projections, debt rises from 75 percent of GDP in 2016 to 86 percent by 2026. Baseline deficits rise notably thereafter, and debt is projected to pass 122 percent of GDP by 2040 and be on an upward trajectory.

The principal drivers of the growing imbalance between federal spending and revenues are rising payments relative to GDP for Social Security, Medicare, Medicaid, and interest on the debt. Payments for Social Security and the major health care programs are projected to increase mainly because of the aging of the population and because health care spending per person rises faster than overall output per person (albeit with a narrower projected gap between those growth rates than has been the case in some past periods). Interest payments are projected to increase during the next decade primarily because of a projected rise in Treasury interest rates and to increase beyond the next decade primarily because of rising debt. Interest payments were 1.3 percent of GDP in 2015 and are projected to be 3.0 percent in 2026 and 4.8 percent in 2040.

The federal government engages in substantial nondefense investment.[2] The Office of Management and Budget classifies three types of federal spending as investment—infrastructure, education and training, and research and development (OMB, 2015). Such investment has been trendless as a share of GDP for the past several decades (Figure 2). However, under the current statutory limits on annual appropriations, such investment will soon fall to the smallest share of GDP in a half-century. In addition, certain federal benefits, especially for lower-income families, have been shown to increase children's future earnings; this makes such benefits economic investments as well.[3] Under current law, some of those benefits will increase relative to GDP over time, and others will decline.

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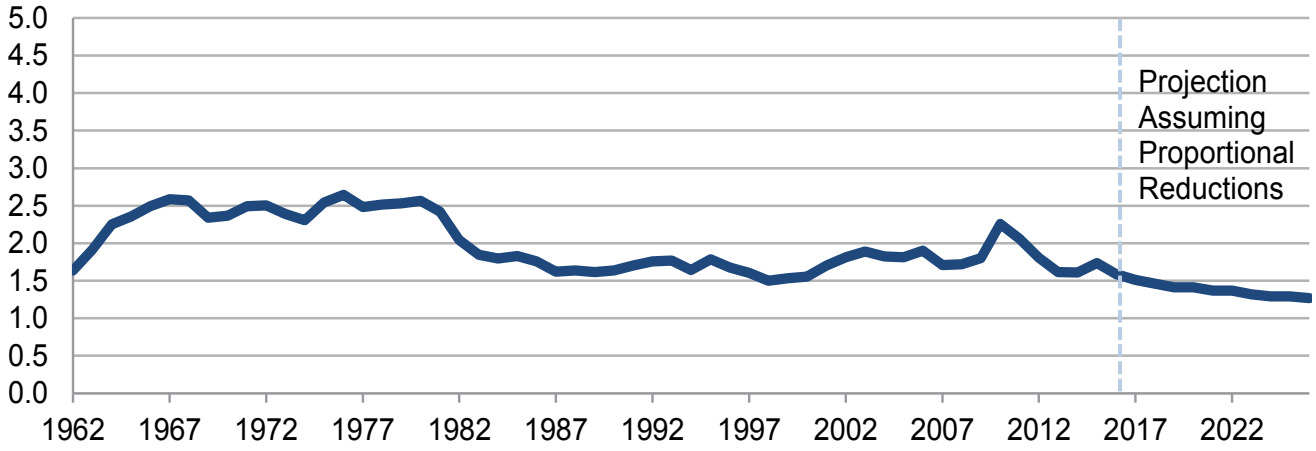
1 CBO (2015a, pages 19-21) describes the policy assumptions underlying the baseline projections.

2 The federal government also undertakes considerable defense investment, but that investment has little direct effect on future economic output, and we do not discuss it in this paper.

3 For example, as noted by Furman (2015), recent evidence suggests that programs like the earned income tax credit, Medicaid, and Supplemental Nutrition Assistance Program (SNAP) have lifetime benefits for children, leading to better health, greater educational attainment, and higher earnings.

Figure 2: Federal Nondefense Investment



Source: OMB Historical Tables; CBO 10-Year Budget Projections; authors' calculations.
Note: Based on CBO's "Federal Investment," December 2013, Exhibit 5. 2016 onward projected assuming average 2000-2015 ratio of nondefense investment to total discretionary, using CBO's 2016 Long-Term Budget Outlook projections of total discretionary.

Of course, those federal budget projections are highly uncertain. CBO (2015a) presents alternative projections based on different rates of improvement in mortality, rates of productivity growth, interest rates on Treasury securities, and growth rates of health care spending. When CBO varies all of those factors at once, using ranges based on historical variation in the factors, projected debt in 2040 ranges from 88 percent to 160 percent of GDP, compared with 122 percent in the baseline. Moreover, CBO explains that "[a]n economic depression, unexpectedly large losses on federal financial obligations, [or] a large-scale military conflict … [could generate budget outcomes] that are substantially better or worse" than the reported range (page 92). We return to the implications of that uncertainty later.

I.B. Federal debt cannot increase relative to GDP

In a later section, we examine the optimal response to the recent run-up in debt. Here we address only the projection that, under current law, debt will increase faster than GDP indefinitely.

A continual increase in federal debt relative to GDP is unsustainable. As debt and the burden of servicing the debt grow relative to the potential tax base, people will eventually become more concerned that the government will be unable or unwilling to honor its obligations, and interest rates will rise. Therefore, if current projections are even roughly accurate, changes in the laws governing taxes and spending eventually will be needed.

II. IMPLICATIONS OF POPULATION AGING

In this section, we consider how fiscal policy should respond to the challenge of population aging, starting with a closed economy and then following with an open economy.

II.A. Macroeconomics of population aging in a closed economy

We begin by considering how aging affects the overall economy and then turn to the implications for the federal budget. The analysis we present follows that in Cutler, Poterba, Sheiner, and Summers (1990) ("CPSS") and Elmendorf and Sheiner (2000) ("ES"). Both those papers argued that—contrary to conventional wisdom—the optimal response to population aging 25 and 15 years ago was to reduce saving and increase consumption. But now that we are in the beginning stages of the demographic transition, we analyze whether that conclusion still holds. We find that it does not. The optimal response to aging in a macroeconomic model is now to lower consumption and increase saving, which implies running smaller budget deficits or budget surpluses.

II.A.1. The effects of aging on sustainable consumption in a closed economy

Population aging in the United States today is attributable to two distinct factors: the drop in fertility following the baby boom and continued increases in longevity. Aging affects the macroeconomy in two ways. First, it lowers the ratio of workers to population. Holding constant labor productivity and labor force participation, a decline in the ratio of workers to population implies a decline in per capita GDP, because GDP is equal to output per worker (productivity) multiplied by the number of workers. Second, population aging that stems from lower fertility (but not increased longevity) lowers the required saving rate for any given level of capital per worker—because lower fertility implies a slower growth rate of the labor force which, in turn, requires less saving to equip new workers with any given level of capital. Together, these two effects change the level of sustainable per capita consumption at any given capital-labor ratio.[4]

Following CPSS (1990), we define the support ratio, α, as the ratio of workers to population.[5] Then, the steady state sustainable consumption per capita (c) for a given steady-state capital labor ratio (k) can be written as:

$$c = \alpha(f(k) - (n + \delta)k) \qquad (1)$$

where n is the steady-state growth rate of the labor force and δ is the rate at which capital depreciates. In equilibrium, consumption per worker (consumption per capita divided by workers per capita (c/α)) is equal to the difference between output $f(k)$ and the saving necessary to keep the capital-labor ratio constant: $(n+\delta)k$.

Including labor-augmenting technical progress, which boosts the "effective" labor force by g percent per year, and redefining k as capital per effective worker, the equation becomes:

$$c = \alpha(f(k) - (n + g + \delta)k) \qquad (2)$$

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4 By 2015, however, the transition to a slowly growing labor force was mostly complete. The growth rate of the population ages 20 to 64 declined from 1.3 percent per year in 2000 to 0.9 percent per year in 2010 to 0.6 percent per year by 2015; according to Social Security projections, it will remain close to ½ percent per year going forward.

5 In calculating the support ratio below, we weight children, non-elderly adults, and adults according to their "consumption needs," recognizing that children need less than adults to achieve a particular level of utility but that the elderly need more. The consumption needs are based on actual total consumption per capita (private and public) from the National Transfer Accounts (Lee and Mason, 2011).

As shown by CPSS and ES, the net effect of these two factors in the United States is to lower the sustainable level of consumption at any given capital per worker, which we show in Figure 3 for a closed economy. The figure shows the consumption possibilities frontiers—that is, the sustainable equilibrium consumption amounts for given capital-labor ratios—using the demographics (α and n) of 2015 and 2050; the frontier shifts down a bit each year as the baby boomers enter into retirement.[6] The graph is normalized so that the initial steady-state consumption is 100 and the initial capital per worker is 1000. The frontiers show how much population aging lowers consumption possibilities relative to an alternative baseline in which demographics are constant; the frontiers do not show absolute levels of consumption. Despite the effects of aging, ongoing productivity growth implies that actual consumption possibilities in 2050 are much larger than in 2015.

A social planner can respond to this shift in the consumption frontiers in any number of ways. One choice would be to cut consumption (by cutting spending or raising taxes) by a proportional amount in every year, so that each generation bears the same cost of aging, in terms of percentage reduction in consumption relative to a baseline with no aging. As shown by the black line in Figure 4, this response to aging would involve cutting consumption now to point B. Because consumption at point B is below the current consumption possibilities frontier, savings would increase and the capital stock would begin to increase as well. Over time, the capital stock would increase from point B to point B', which would then be the new steady state.

This response to aging is parallel to one in which, in order to ensure Social Security solvency, the government cut benefits or raised taxes, starting today, so that the system was sustainable in the long run. Such a policy would increase the size of the Social Security trust fund, and interest from the trust fund assets would be used in the long run to supplement taxes so as to be able to finance projected benefits. This response to aging is also similar to immediately closing a "fiscal gap" of the sort that is sometimes calculated for the federal budget as a whole, which measures what permanent change in policy, if begun today, would be sufficient to put the budget on a sustainable path.[7] In a closed economy, such a policy comes with a cost: As the capital stock increases, the marginal benefit of that additional capital declines.[8]

At the other extreme, the social planner could act myopically and simply adjust consumption each year to the level that would maintain the current capital-labor ratio—shown by the gray line in Figure 4. That is, the social planner could choose not to save more in anticipation of greater need for consumption later. This would be akin to cutting Social Security benefits or raising payroll taxes each year by just enough to eliminate that year's imbalance. The social planner would allow consumption to fall gradually each year until it reached the new steady state with the same capital-labor ratio as currently but much lower consumption, at point C.

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6 We use data from the World Bank so as to compare population aging in the United States with that in the rest of the world, and these projections extend only to 2050. The demographic transition is essentially complete by then, and after that, support ratios drift down only slowly as life expectancy continues to increase.

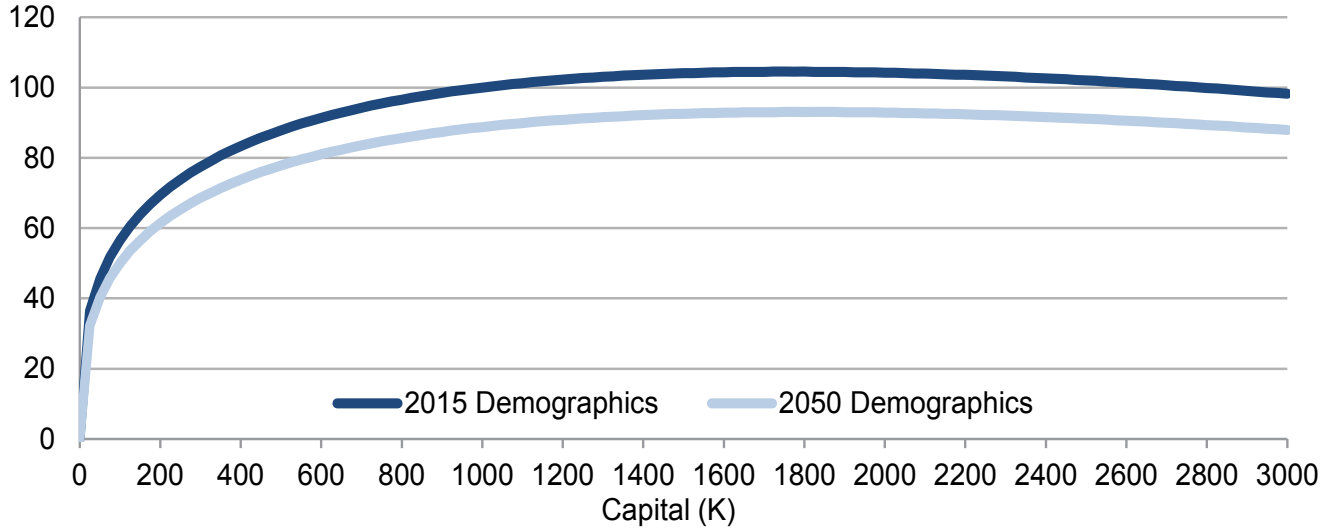
7 The "fiscal gaps" calculated by CBO in its Long-Term Budget Outlooks (for example, CBO, 2015a) do not require the budget to be sustainable over an infinite horizon, as in this example, but rather calculate the changes required for the debt-to-GDP ratio to hit some target by some year—for example, to not exceed today's level by 2040.

8 This declining marginal product of capital is what gives the consumption frontier its curved shape. In a small open economy with exogenous interest rates, consumption frontiers are linear.

An optimizing social planner would want to take into account both the benefits of consumption smoothing (so would not follow the gray line) and the declining benefits of saving as the capital stock increases (so would not follow the black line), and so would choose a path somewhere between those two extremes.

Figure 3: Sustainable Consumption Frontiers

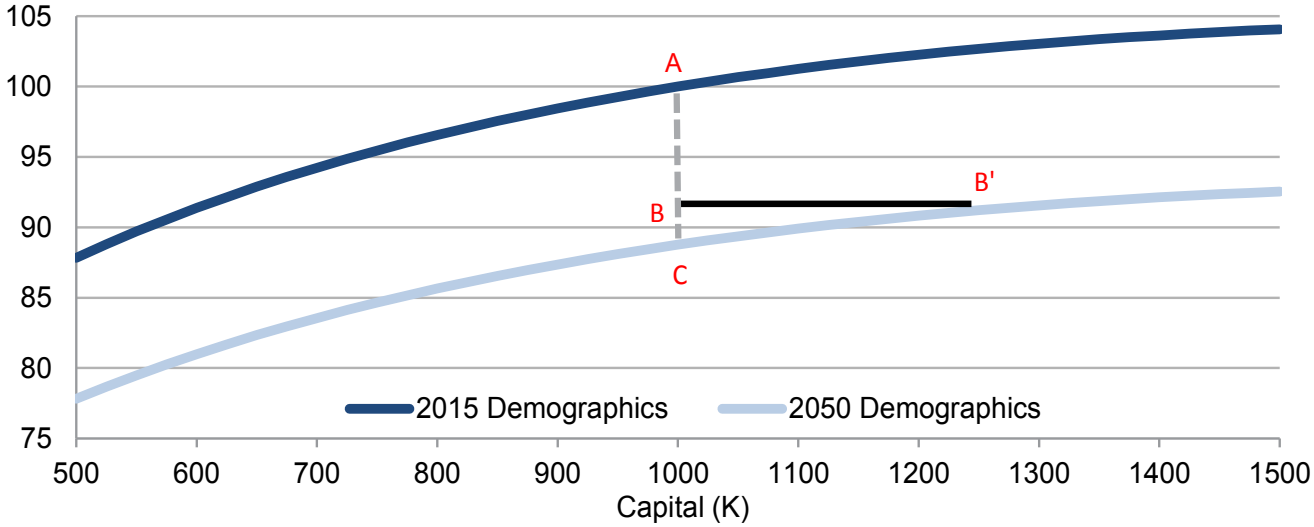
Consumption index (C = 100 where K = 1000)



Source: World Bank (demographic inputs); National Transfer Accounts and Census (consumption weights for support ratios); authors' calculations.

Figure 4: Sustainable Consumption Frontiers

Consumption index (C = 100 where K = 1000)



Source: World Bank (demographic inputs); National Transfer Accounts and Census (consumption weights for support ratios); authors' calculations.

II.A.2. The effects of aging on optimal fiscal policy in a closed economy

In thinking about optimal fiscal policy, it is helpful to think about the government's objective function. Here, we follow CPSS and ES by assuming that the government maximizes a social welfare function equal to the present discounted value of utility:

$$SWF_0 = \int_o^{\infty} N_t e^{\rho t} U(c_t) \partial t \qquad (3)$$

where N_t is the population at time t, ρ is the rate of time preference, and c_t is consumption per capita.[9] Although this model of the economy seems highly stylized—the government chooses the level of consumption each period—it can be viewed as a model in which the government's fiscal policy takes into account private decisions about consumption and investment in order to maximize the social welfare function.[10] That is, the government chooses its policies so that, given these policies, the private sector choices will equal the social optimum.

For simplicity, we assume that both the utility function and the production are Cobb-Douglas.

This social welfare function yields the standard Euler equation:[11]

$$\frac{\dot{c}}{c} = (f'(k) - \rho - \delta) \qquad (4)$$

where $\frac{\dot{c}}{c}$ is the growth rate of consumption person and f'(k) is the marginal product of capital. In steady state, per capita consumption rises at the rate of productivity growth, g, giving us the steady state condition:

$$f'(k) = \rho + \delta + g \qquad (5)$$

Note that, in steady state, the marginal product of capital is determined only by the rate of time preference, depreciation, and productivity growth. Assuming (as we do) that these are not affected by population aging, the economy's steady state capital labor ratio does not change; however, as we show below, the capital-labor ratio does change during the transition—first increasing, and then declining.

Using these equations, we simulate how a social planner would respond to demographic change. In particular, we assume that the economy is initially in a long-run steady state consistent with the demographic variables prevailing at the start of the simulation (labeled 2015 in Figure 5). We then allow the social planner to "learn" about the trajectory of the demographic variables over the next 50 years and adjust consumption accordingly. In practical terms, our solution involves finding the unique initial consumption level, given the new demographic trajectory, that will eventually bring the economy to the new steady state (2080) if consumption growth follows the Euler equation in (4).

Figure 5 shows the optimal response to population aging if the simulation is started in 2015. We normalize per capita consumption in 2015 at 100. Unlike the findings in both CPSS and ES, the optimal response to

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9 As in Cutler, Poterba, Sheiner, and Summers (1990) and Elmendorf and Sheiner (2003), we choose a utility function that weights future generations by their total population. Without this assumption, the social planner chooses higher average consumption levels for smaller generations, because it is relatively cheap to do so. Utility functions that do not include this weighting scheme imply that a slower rate of population growth raises the average capital labor ratio.

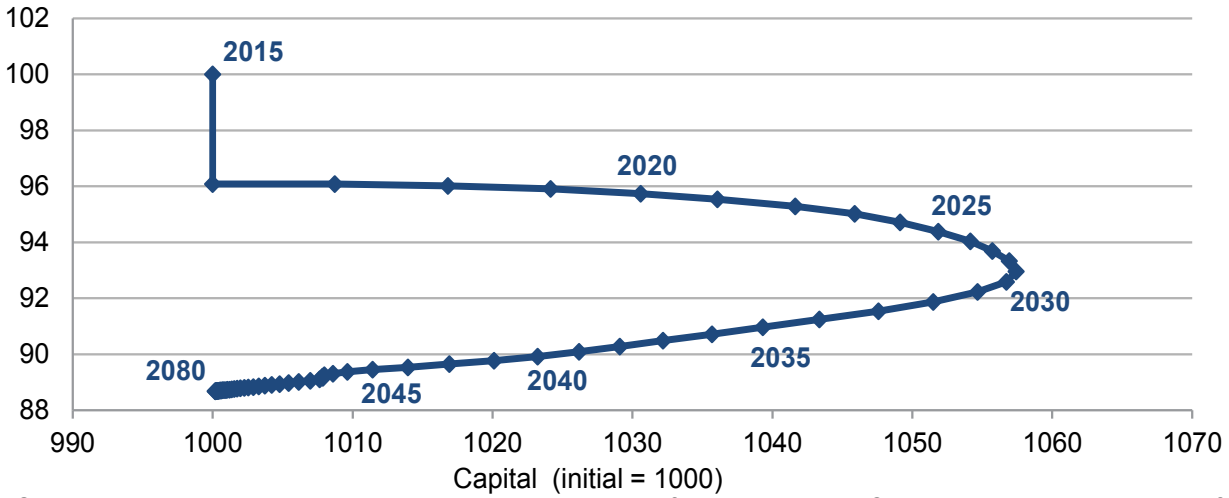
10 The model does ignore the costs of such fiscal policy, however, like deadweight loss from taxation.

11 For a more general utility function, the conditions would be: $\frac{\dot{c}}{c} = \sigma(f'(k) - \rho - \delta) = g$, so $f'(k) = \rho + \delta + g/\sigma$, where σ is the elasticity of substitution in consumption (which is 1 with a Cobb-Douglas utility function).

population aging is to now decrease consumption—that is, upon hearing the "news" of the demographic transition, the social planner would immediately lower consumption and increase saving. With demographic change already started, the social planner uses the next decade to build up the capital stock. That is, between 2015 and 2030, consumption continues to drift down while the capital-labor ratio increases; from 2030 to 2080, the capital-labor ratio decreases; by 2080 the economy is close to the next steady state.

As expected, the optimal consumption response lies between the two extremes shown above: The initial fall in consumption is 4 percent, greater than that needed to maintain the current capital labor ratio—so the capital labor ratio increases—but much less than the ultimate fall in consumption, which ends up 11½ percent below what it would have been in the absence of demographic change (but still significantly greater than today because of productivity growth). The buffering of the ultimate decline in consumption is fairly small relative to the size of the demographic shift and the (rhetorical) attention given to the notion of saving in advance of the shift: Consumption is initially reduced by 35 percent of its ultimate decline, and the maximum increase in the capital stock is only 5½ percent.

Figure 5: 2015 Optimal Consumption Path



Source: World Bank (demographic inputs); National Transfer Accounts and Census (consumption weights for support ratios); authors' calculations.

In Figure 6, we compare the trajectories of optimal consumption assuming the transition began in 2000. As in ES, the optimal response in 2000 would have been to increase consumption, rather than increase saving. However, even if we had reacted to aging in 2000 by increasing consumption, by 2015, optimal consumption would have begun its gradual decline towards its ultimate level. That is, regardless of when we begin the simulation—that is, regardless of whether the social planner is only now responding to population or responded long ago, consumption per effective person should be falling now, and national saving should be rising.[12]

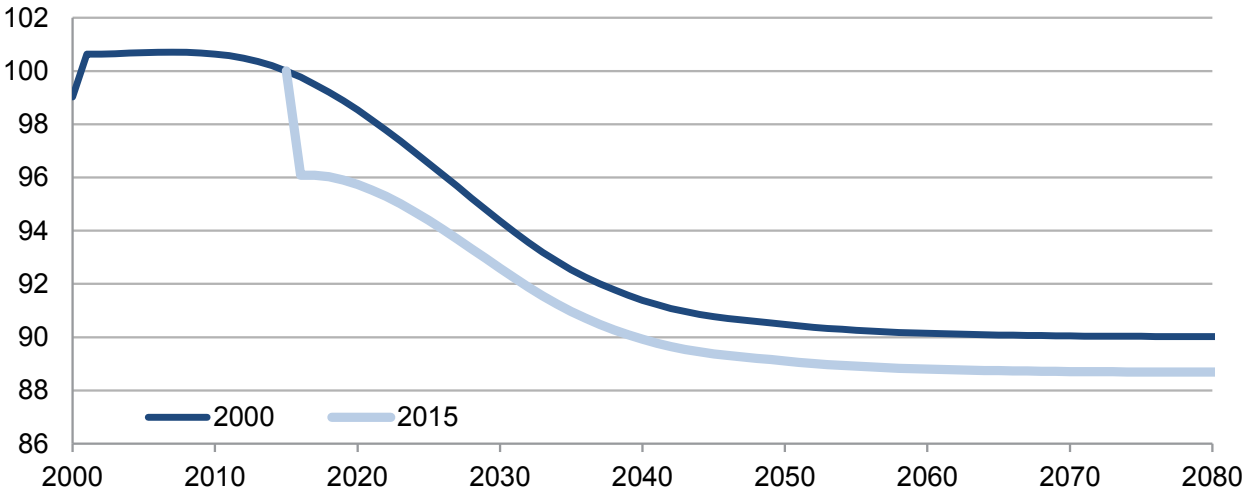
Figure 7 compares the path of consumption from this optimization to the two extreme paths described above—a one-time drop in consumption that is sufficient to reach the new steady state (the "fiscal gap" path), and a path that does no consumption smoothing at all (the "no smoothing" path).[13] As expected, the

12 When consumption per "effective" person is declining, per capita consumption may still be rising, but at less than the rate of productivity growth.

13 ES show that these paths are chosen when the intertemporal substitution in consumption is 0 and infinite, respectively. When consumption is not substitutable over time, the social planner wants all generations to suffer equal losses in consumption. When consumption is perfectly substitutable, the social planner gets no benefit from consumption smoothing.

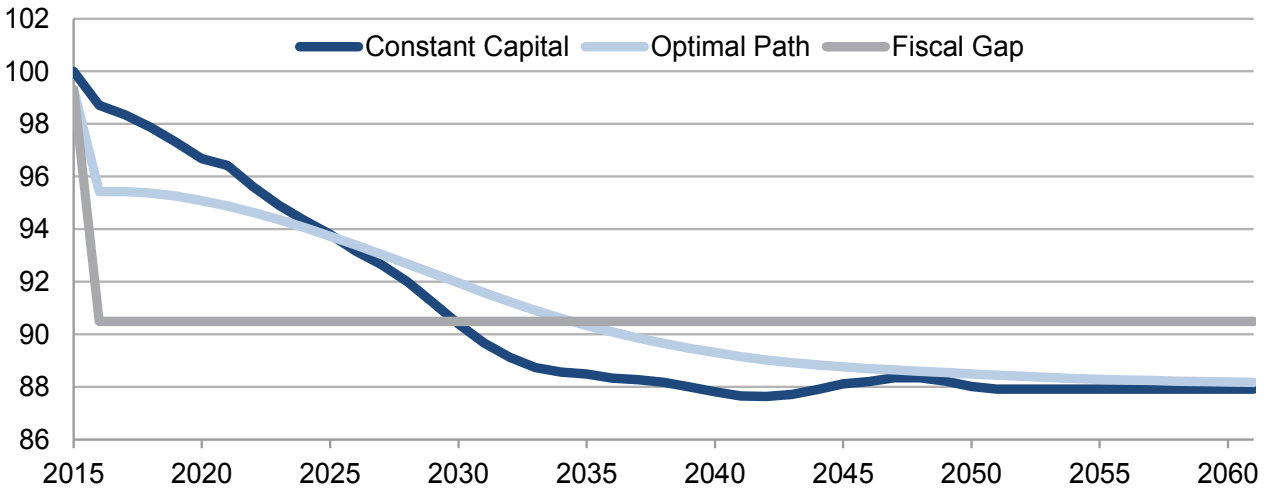
optimal path falls somewhere between the two extremes, although closer to the “no smoothing” path. The optimal response to population aging is to do some consumption smoothing—optimal consumption is lower than in no-smoothing consumption over the next decade, but higher over the following 25 years. By 2050, with the demographic transition largely complete and the capital labor ratio close to its long-run equilibrium, the two paths are very similar. In contrast, the “fiscal gap” path does considerably more smoothing—consumption is much lower, on average, over the next 20 years, allowing the capital labor ratio to build up, which enables a significantly higher consumption level from about 2040 onward. The key point is that the “fiscal gap” path takes no account of the decline in the return to capital stemming from rising capital labor ratio, while the optimal path incorporates that consideration.

Figure 6: Optimal Consumption Paths for 2000 and 2015



Source: World Bank (demographic inputs); National Transfer Accounts and Census (consumption weights for support ratios); authors' calculations.

Figure 7: Closed-Economy Sustainable Consumption Paths



Source: World Bank (demographic inputs); National Transfer Accounts and Census (consumption weights for support ratios); authors' calculations.

II.B. Macroeconomics of population aging in an open economy

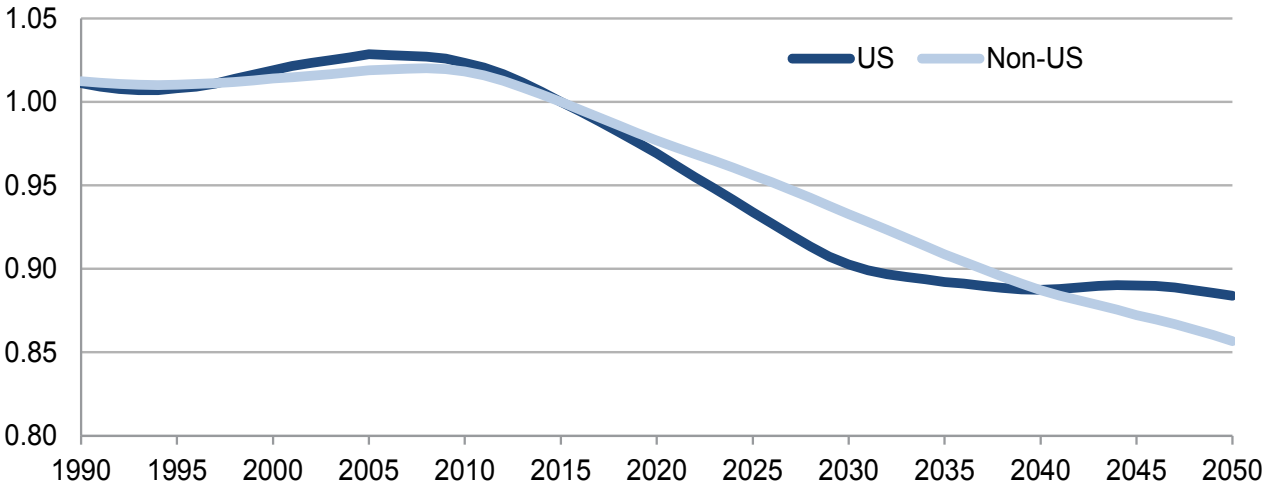
One criticism of these results is that the United States is not a closed economy. If the United States was a small open economy, it would take the path of interest rates as given. As discussed in ES, if world interest rates were constant—not just exogenous, but unchanging over time—then the social planner would choose an option where consumption fell now to its sustainable level, like the "Fiscal Gap" line in Figure 7.[14,15] However, the world population is aging, so it makes little sense to assume that world interest rates are fixed. Instead, we examine the optimal response to aging in a two-country model, with the United States as one country and the rest of the world modeled as another.[16]

II.B.1. Population aging in the United States and the rest of the world

Figures 8 and 9 compare population aging in the United States and in the rest of the world.[17] To calculate the "rest-of-the-world" demographics, we weight each country's labor force by its level of GDP per capita, and we assume that the consumption weights of old and young are the same as in the United States. Figure 8 compares support ratios, while Figure 9 compares rates of labor force growth. Using 2015 as the starting point, we see that the decline in the support ratio is a little more rapid in the United States than in the rest of the world, although it ultimately does not fall as much here. The bottom panel compares labor force growth rates: Part of the reason the United States does not experience as large a decline in the support ratio is that our labor force growth rate does not fall as much.

Figure 8: US and Non-US Support Ratios

Ratio of those 15-64 to total population, indexed (2015 = 1)



Source: World Bank (demographic inputs); National Transfer Accounts and Census (consumption weights for support ratios); authors' calculations. Note: Non-US support ratios calculated using 2013 GDP-per-worker weights.

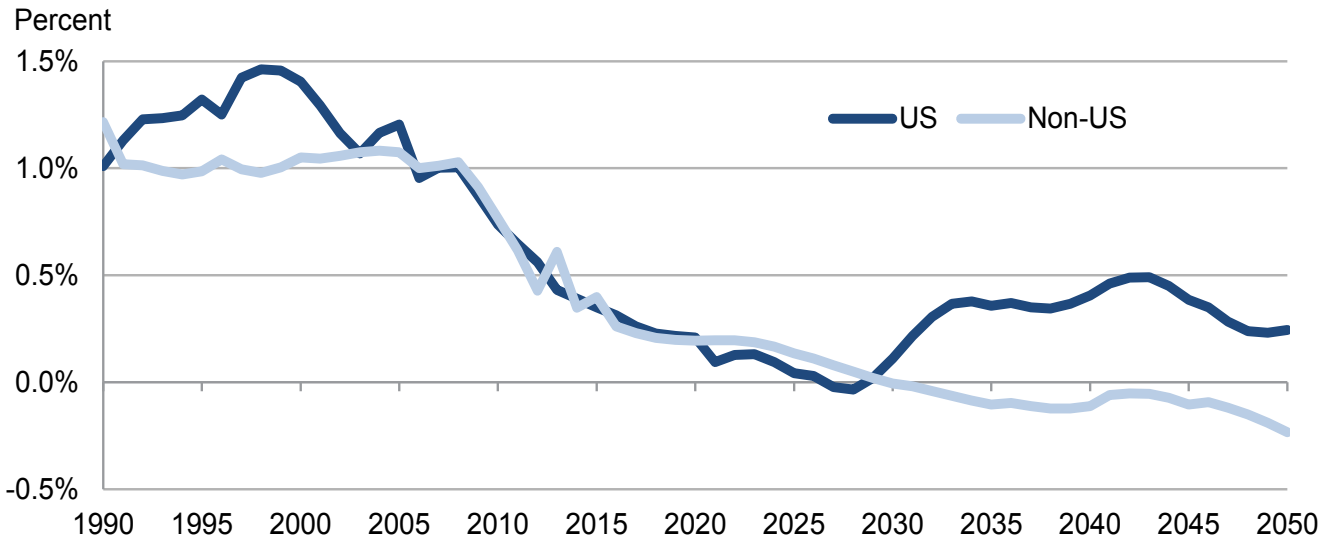
14 This assumes that the world marginal product of capital was equal to $\rho + \delta + g$, which would be the only sustainable equilibrium.

15 ES also shows that, if the elasticity of substitution in consumption is zero, then, even in a closed economy, a social planner would also choose a one-time consumption drop that perfectly smooths the costs of aging across generations, because, with such a utility function, a large increase in consumption now followed by a reduction in consumption later always lowers social welfare.

16 We calculate a weighted support ratio for the rest of the world. We assume that: (1) each country's consumption weights by age are the same as the US; (2) the labor force is measured by the working-age population; (3) each country's weight in the weighted support ratio is equal to its share of the non-U.S. effective labor force, where the effective labor is equal to the actual labor force multiplied by the level of labor productivity. Because receipts of factor income from the rest of the world are roughly equal to payments of factor income to the rest of the world, we also assume that initially, each country's capital is owned by its residents.

17 We use data from the World Bank that go through 2050. To run the simulations, we assume that labor force growth rates ultimately converge to the weighted average of the US and non-US labor force growth rates in 2050.

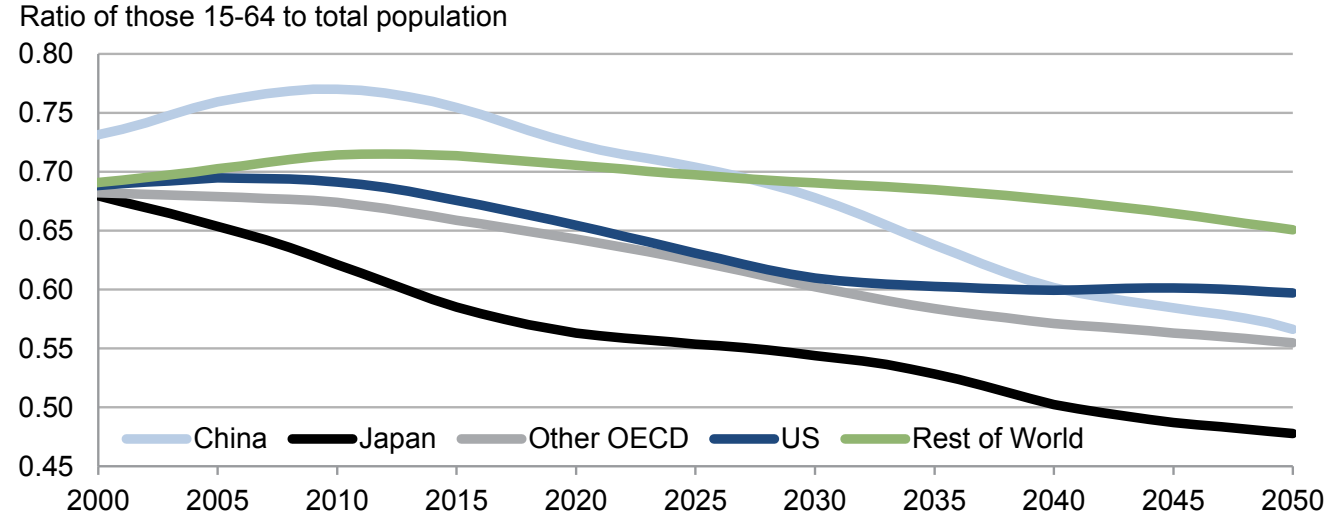
Figure 9: US and Non-US Labor Force Growth Rates



Source: World Bank (demographic inputs); National Transfer Accounts and Census (consumption weights for support ratios); authors' calculations. Note: Non-US labor force growth rates calculated using 2013 GDP-per-worker weights .

Figure 10 shows the evolution of the support ratios in China; Japan; the non-Japan, non-U.S. OECD; the United States; and the rest of the world. The support ratio in Japan, which has already fallen considerably since 2000, is expected to continue to decline further over time, while China is just now entering a period of aging. Even the rest of the world is aging, albeit much less sharply than elsewhere.

Figure 10: World Support Ratios

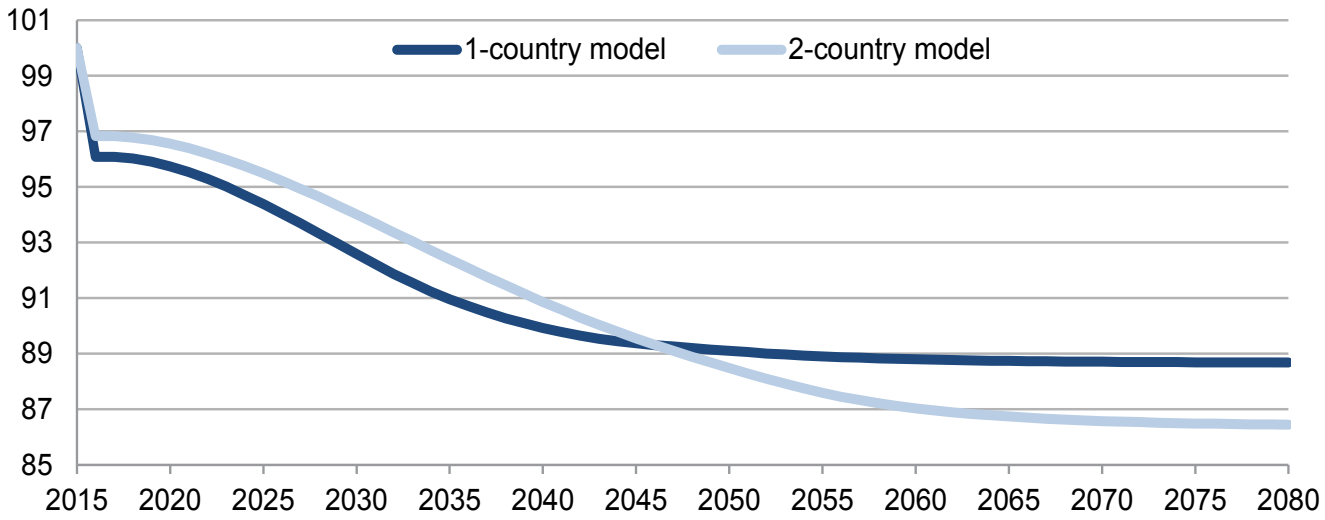


Source: World Bank (demographic inputs); National Transfer Accounts and Census (consumption weights for support ratios); authors' calculations. Note: Support ratios for "Other OECD" and "Rest of World" calculated using 2013 GDP-per-worker weights.

II.B.2. Optimal consumption in an aging world

Figure 11 compares the optimal consumption paths coming from the one-country and two-country models for a simulation beginning in 2015. Given the similarities in the rates of aging, it is not surprising that the results of the two-country model are quite similar to those from the one-country model. In both cases, the U.S. social planner chooses to lower consumption a bit now, and then consumption drifts slowly lower over time. Because the rest of the world is aging, the United States cannot smooth consumption over time with a constant return to capital—the labor force in the rest of the world is growing more slowly, and other countries are increasing their saving, both factors that push down the return to capital.[18] In these simulations, the social planner does less consumption smoothing in the open economy model than in the closed economy model—consumption is higher in the near term and lower in the long term—as other countries' desire to save pushes down the rate of return to capital, causing the U.S. social planner to choose to save less. The U.S. national saving rate in the two-country model increases by about 1 percentage point over the next decade.

Figure 11: US Optimal Consumption Paths



Source: World Bank (demographic inputs); National Transfer Accounts and Census (consumption weights for support ratios); authors' calculations.

II.C. Other considerations

The calculations presented here are stylized and do not include a number of potentially important considerations.

First, we assume no change in labor force participation as the population ages. Many analysts have noted the feasibility, and argued the desirability, of increasing labor force participation (for example, National Research Council, 2012) as an important response to population change. Sheiner (2014) calculates that a

18 To check that our intuition is correct, we ran the two-country model under the assumption that the rest of the world was not aging. We found that, in this case, the US social planner would do a lot more consumption smoothing—that is, consumption would fall more in the near term and less in the long run.

gradual increase in labor force participation over 30 years cumulating to 11 percent would be sufficient to undo the effects of aging and eliminate the need for (non-leisure) consumption to fall. Although an increase of this magnitude seems unlikely, it is likely that participation will increase somewhat as life expectancy increases, moderating the necessary adjustments in consumption.

Second, we do not consider the benefits of tax smoothing. The deadweight loss caused by a tax depends roughly on the square of the tax rate, so the distortion-minimizing way to finance a given stream of government spending is to maintain a smooth tax rate over time. As noted above, the aging of the population and rising spending for health care relative to GDP will cause federal spending as a percentage of GDP to rise over time, absent changes in federal benefit rules. Unless all of the adjustment to those underlying trends takes the form of reductions in benefits, revenues will need to be increased.[19] In that case, the logic of tax smoothing implies that taxes should be increased now, which means reducing the debt for some number

of years and then allowing it to increase later. This consideration is not included in the analysis in this section because we assume the government moves resources around costlessly. Furthermore, this consideration does not appear to be quantitatively important.[20]

An additional reason one might want to smooth both tax changes and spending cuts is to avoid disruptions to the macroeconomy. Although our model assumes full employment at all times—that is, there are no recessions—in reality large changes in government taxes or spending might have effects on employment and output. Avoiding the risk of an austerity-induced recession is another reason to smooth consumption changes.

II.D. Optimal budget policy in an aging society

In the example above, we considered the question of how a social planner would respond to population aging, making no explicit assumptions about how people themselves respond. For example, even if private behavior is best described by an overlapping-generations model of life-cycle consumers, we implicitly assumed that the government would be able to use its levers to bring aggregate consumption to the level that maximized the social welfare function (essentially "undoing" any private choices that led to different outcomes than optimal).

Another way to think about aging from the government's perspective is to ask how it should respond to the budgetary challenges associated with population aging. As ES noted, one can think about some of the challenges of aging as being borne by the public sector (higher Medicare and Social Security costs) and some being borne by the private sector (an increased need for saving or lower consumption in retirement as life expectancy increases and rates of return decrease). Assuming that people optimally respond to the

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19 In addition, there may be an equivalent deadweight loss calculation associated with changes in benefits, although that has not been established in the literature.

20 We calculated the deadweight loss that would result from the optimal consumption path and the "fiscal gap" path shown in Figure 7, assuming that the change in consumption was accomplished by levying a tax on labor income. As expected, the optimal consumption path entailed higher increases in the tax rate in steady state—16 percent versus 12.8 percent for the "fiscal gap" measure. But the present values of deadweight losses arising from the two paths are very similar. Similarly, CPSS calculated the benefits of tax smoothing as a response to aging using fixed interest rates, and found that the difference in deadweight loss from tax smoothing was miniscule.

private challenges of aging, how should the government adjust its programs so that the aggregate response is optimal?[21]

Although it is tempting to think about the long-run fiscal outlook of the United States as measuring the fiscal challenges of population aging, this is not appropriate because the long-run fiscal outlook is affected by other factors as well. In particular, the long-run fiscal outlook is driven primarily by three forces: (1) population aging, which drives up Social Security and Medicare expenditures relative to GDP; (2) rapid growth in per beneficiary health spending, which drives up federal health spending relative to GDP; and (3) assumptions about the growth of revenues and other spending.

Thus, the long-term budget outlook does not represent the impact of aging alone, and it is not directly analogous to the consumption frontiers described above. To isolate the impact of aging on the federal budget, we use the Congressional Budget Office's (CBO) long-term budget projections to construct an alternate aging-only federal budget projection that holds all revenues and all non-age-related spending constant as a share of GDP. Then we consider the implications for budget policy and compare our analysis to CBO's projections.

II.D.1. Impact on the budget of population aging

One issue in constructing this baseline is how to deal with excess cost growth, the growth in health spending per beneficiary greater than the growth in per capita GDP.[22] If excess cost growth in health spending represents rising costs for the same basket of goods, then it would properly be viewed as a cost of aging: Since the elderly use more health care, rising health care costs would increase the challenges of population aging. On the other hand, if excess cost growth in health care represents faster growth of the quantity or quality of health care relative to other categories of spending, then it seems preferable to view it as a choice about the composition, rather than the level, of consumption. We take that approach here, and calculate the expected growth in Medicare spending that is attributable simply to aging, holding excess cost growth at zero.[23, 24]

Figure 12 shows the primary deficit (that is, the deficit excluding interest payments) under the assumption that all revenues and spending other than Social Security and Medicare remain constant as a share of GDP at their 2015 levels. The Social Security projection matches that in CBO's extended baseline, and the Medicare projection is what CBO's projection would be if excess cost growth were zero in every year. Further population aging relative to the demographic composition in 2016 boosts federal spending by 2½ percent of GDP by 2040, with Social Security accounting for a little over half and Medicare a little under half of the increase. Adding in the existing primary deficit of about 1½ percent of GDP in 2016 brings the total primary deficit to 4 percent of GDP by 2040.

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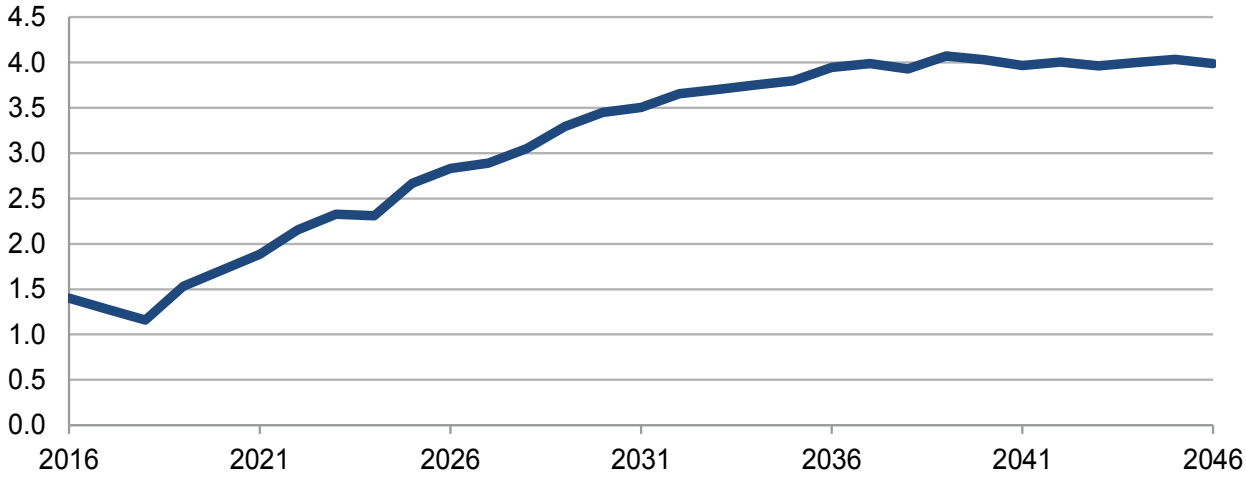
21 Note we are assuming that consumers are not Ricardian—that is, we assume that they will not adjust their saving to offset government actions.

22 Technically, it is the difference between the growth rates of age-adjusted health spending per beneficiary and potential GDP per capita.

23 In any case, it would be hard to argue that the excess cost growth in Medicare underlying CBO's long-run budget projections reflect the choices a social planner would make. In compiling its long run budget projections, CBO assumes that, after the first ten years, Medicare excess cost growth is higher than the excess cost growth in the private sector or Medicaid, reflecting the lower degree of flexibility in the Medicare program under a "current law" framework. That is, CBO assumes that changes will be made to Medicaid and private health insurance that will limit the growth of spending per beneficiary, but that such changes would not be possible for Medicare without legislation. A social planner would make those changes, however.

24 The combination of the text of the Long-Term Budget Outlook report and the accompanying tables provides enough information to back out the rates of excess cost growth actually used by CBO in constructing its projections.

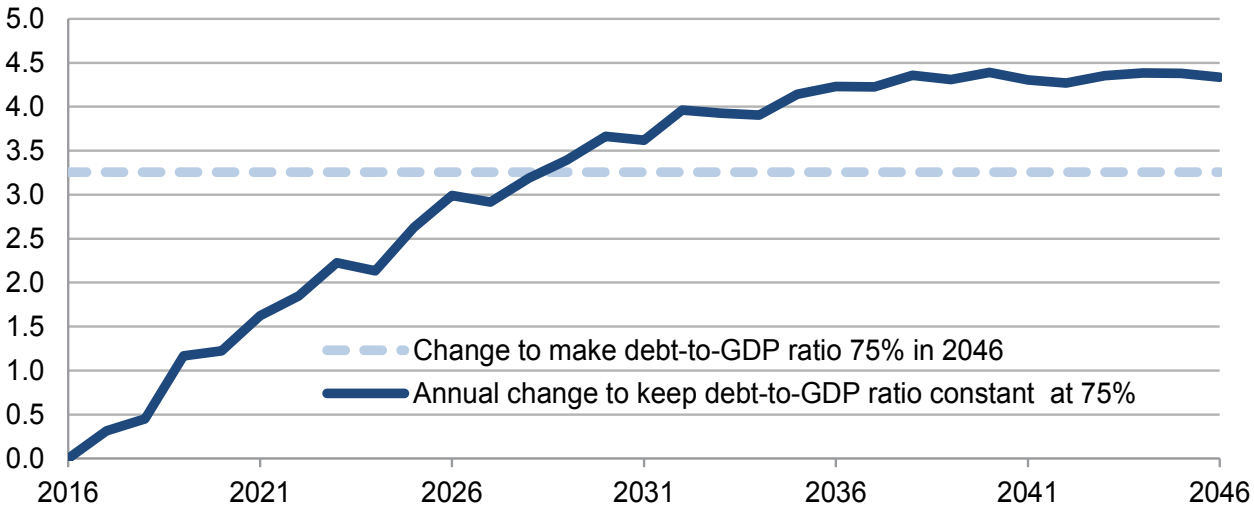
Figure 12: Aging-Only Projection of Primary Deficits



Source: CBO 2016 Long-Term Budget Outlook; authors' calculations. Note: Assumes all revenues and spending (other than Social Security and Medicare) remain constant at 2016 levels as shares of GDP.

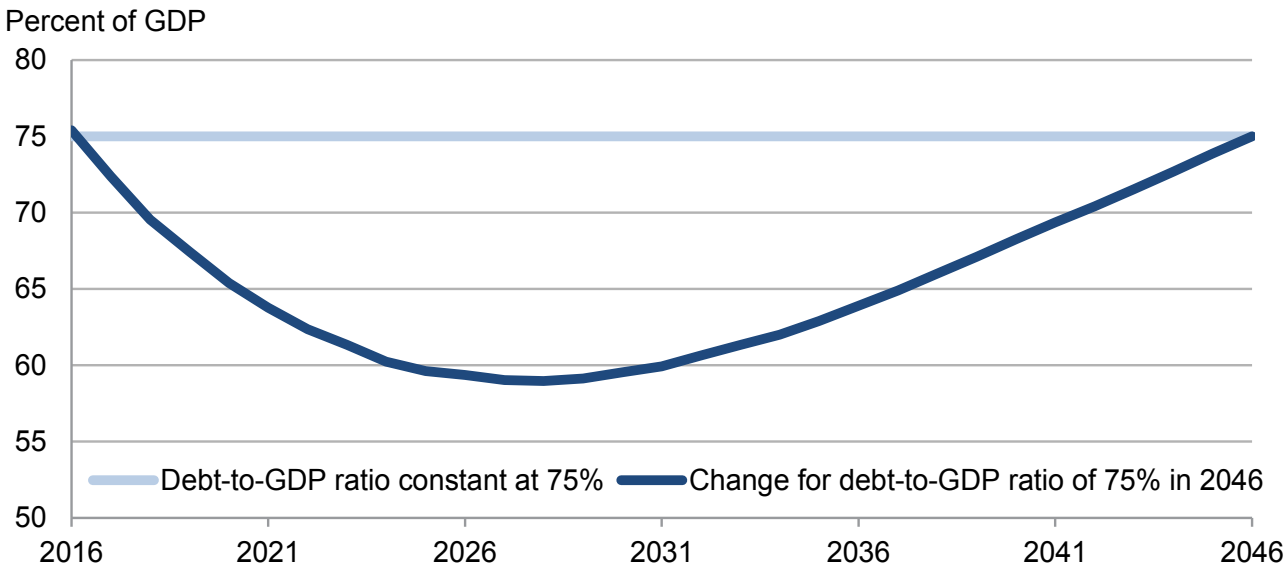
Using this aging-only projection of the federal budget, Figure 13 shows what the adjustment in taxes and/or spending would have to be under two possible responses to aging—one in which taxes are increased or spending reduced immediately and permanently so as to keep the debt-to-GDP ratio at 75 percent by 2046, and another in which taxes are increased or spending reduced each year so as to maintain the debt-to-GDP ratio in each year at its starting value of 75 percent of GDP (Figure 14). In these calculations, we focus only on the implications of population aging and set aside for now the question of whether we should also be trying to reduce the historically high debt-to-GDP ratio.

Figure 13: Required Change in GDP Share of Taxes/Spending



Source: CBO; authors' calculations.

Figure 14: Debt to GDP



Source: CBO; authors' calculations.

The dashed line in the Figure 13 shows that, relative to our aging-only projection of the federal budget, an immediate increase in revenues or reduction in spending equal to 3.3 percent of GDP—roughly $600 billion this year and growing with GDP in future years—would be sufficient to ensure that the debt-to-GDP ratio in 2046 equals today's value of 75 percent (allowing only for the effects of aging and not for other factors, as discussed above). As shown in Figure 14 such a change would cause the debt-to-GDP ratio to drift down temporarily, hitting 59 percent of GDP in 2027, before starting to turn up again thereafter. After 2046, other adjustments would be needed.

Another alternative—the "no consumption smoothing" alternative—is to adjust revenues and spending annually, so as to prevent the debt-to-GDP ratio from rising above 75 percent in our aging-only projection. As shown by the solid line in Figure 13, such an approach would allow the deficit to inch up over the next few years (the solid line goes below zero) but would lead to increasingly large deficit reductions thereafter. By 2036, the required adjustment would be over 4 percent of GDP.

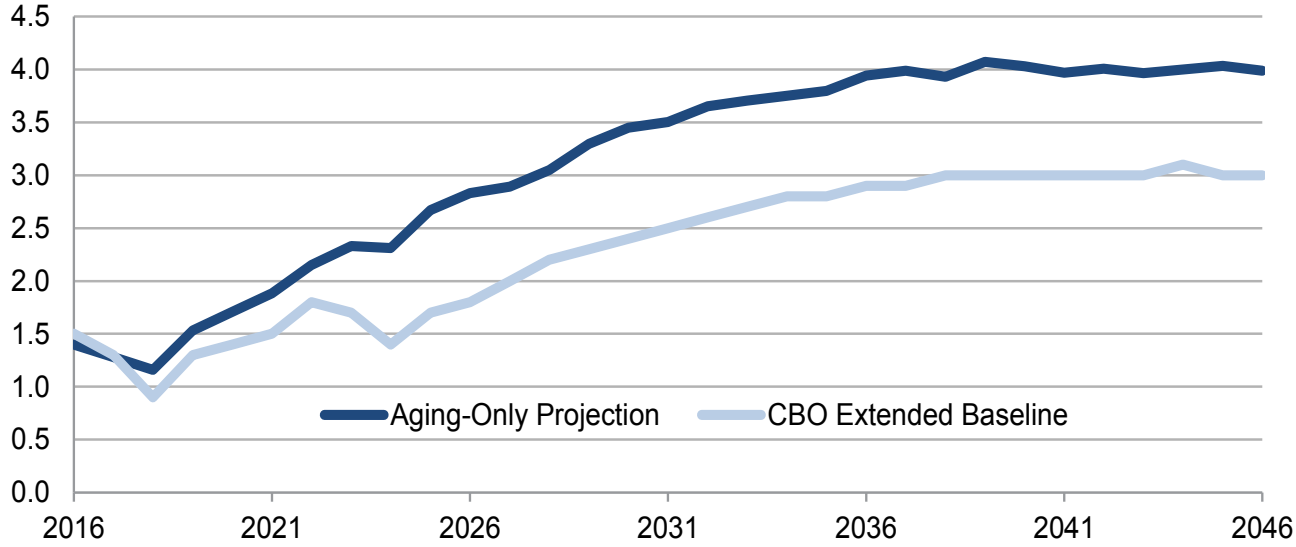
Using the results of the Ramsey model as a guide, it seems likely that a social planner would choose a path something in between these two—the planner would do a bit of consumption smoothing, but, particularly with these low interest rates, not nearly so much as with an immediate and permanent adjustment.

II.D.2. Comparison to CBO's projections

Figure 15 compares the primary deficits in our aging-only projection to CBO's extended baseline. In general, CBO's extended baseline shows a substantially smaller increase in the primary deficit than does our aging-only projection, stemming from a number of factors. First, CBO's extended baseline assumes continued (albeit declining) excess cost growth in health care; this assumption boosts CBO's projected deficits relative to those in the aging-only projection. Second, CBO's extended baseline includes reductions relative to GDP

in discretionary spending and in mandatory spending apart from Social Security and the major health care programs to smaller shares of GDP than at any point in at least 50 years. In particular, in keeping with caps on discretionary spending in the Budget Control Act of 2011 (as modified by subsequent legislation), CBO assumes that discretionary spending over the next decade declines sharply as a share of GDP, from 6.5 percent in 2016 to 5.2 percent in 2026, and remains a constant share of GDP thereafter.[25] CBO projects that other mandatory spending—which includes spending for federal civilian and military employees, certain veterans' programs, the Supplemental Nutrition Assistance Program (SNAP), unemployment compensation, and refundable tax credits—will decline gradually over time relative to GDP because that is what would occur under current law, even though this category of spending has been roughly constant as a share of GDP over the past several decades.[26] Finally, CBO projects that revenues will increase gradually over time relative to GDP because, under current law, real growth in incomes will push more taxpayers into higher tax brackets ("real bracket creep"); as a result, revenue relative to GDP is projected to rise notably above its average of the past 50 years.

Figure 15: Primary Deficits



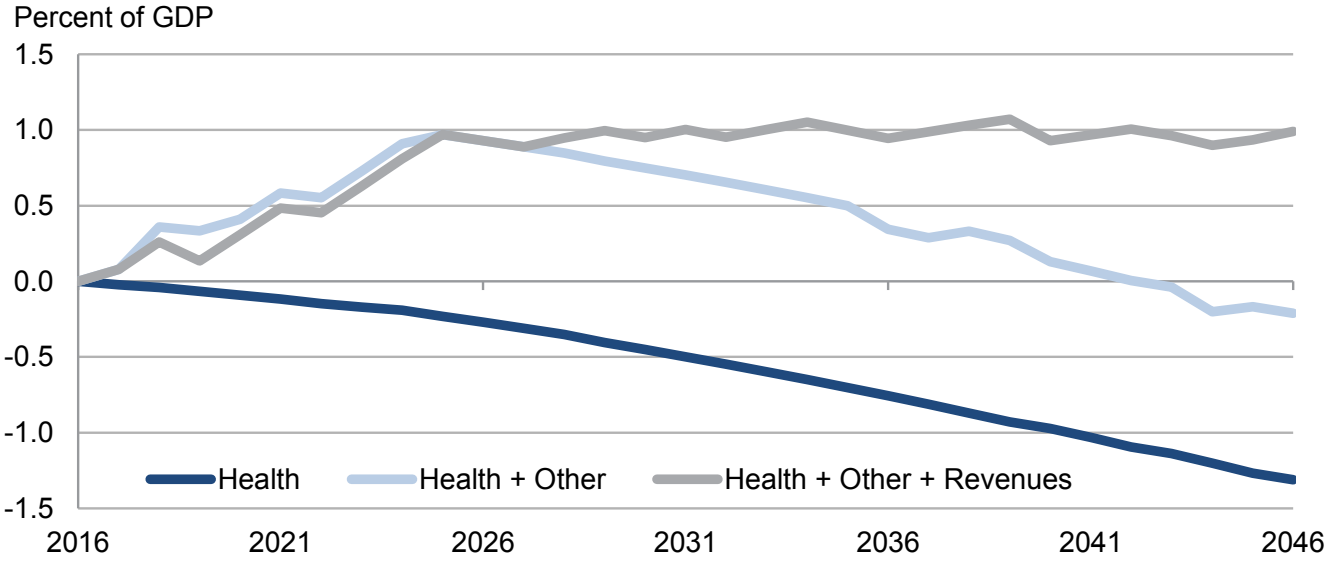
Source: CBO 2016 Long-Term Budget Outlook; authors' calculations.

Figure 16 shows how these factors contribute to the difference between our aging-only projection and CBO's extended baseline. Taken together, on average over the next 30 years, those factors offset nearly half of the effects of aging, as can be seen in Table 1.

25 The Budget Control Act of 2011 imposed caps on discretionary appropriations through 2021; from 2021 through 2025, CBO assumes that discretionary spending rises with inflation (and hence continues to fall as a share of GDP), as assumption required by the Balanced Budget and Emergency Deficit Control Act of 1985.

26 For example, both the eligibility requirements for SNAP and the cost of the SNAP benefit rise with inflation, and not per capita GDP growth, meaning that the costs of the benefit as a share of GDP declines over time as does the share of the population likely to be eligible.

Figure 16: Why Aging-Only Deficit is Larger than CBO Baseline



Source: CBO 2016 Long-Term Budget Outlook; authors' calculations.

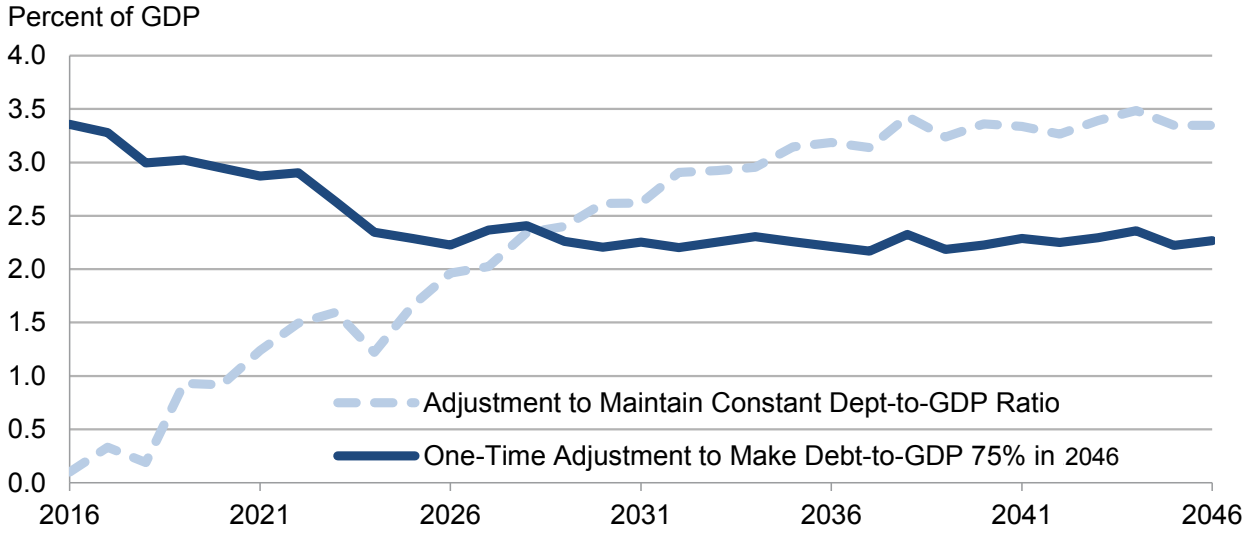
Table 1: Difference Between Aging-Only Projection and CBO's Extended Baseline

Increase in Primary Deficit Relative to 2016	**2026**	**2036**	**2046**
Aging-Only	1.4	2.5	2.6
CBO LTBO	0.5	1.6	1.6
Difference	0.9	0.9	1.0
Difference Owing to Assumptions About:			
Excess Cost	-0.3	-0.8	-1.3
Discretionary and Other Mandatory Spending	1.2	1.1	1.1
Revenues	0.0	0.6	1.2
Shares			
Excess Cost	-29%	-80%	-133%
Discretionary and Other Mandatory Spending	129%	117%	111%
Revenues	0%	64%	121%

It is unclear whether the three factors that offset part of the effects of population aging represent societal preferences or simply forecasting conventions. But, if we take the CBO extended baseline as a reasonable projection of future policy, it is helpful to ask: given these changes, what further changes would be required to make the budget sustainable?

In particular, we ask: What annual changes in the primary deficit would be needed, on top of those already assumed in the CBO baseline, if the desired policy were (1) making a permanent reduction in the deficit, starting today, that would leave the debt to GDP ratio at 75 percent in 2046; or (2) ensuring that the debt-to-GDP ratio remained a constant 75 percent? The estimates are shown in Figure 17.

Figure 17: Reductions in Primary Deficit Needed in Addition to Those Assumed by CBO



Source: CBO; authors' calculations.

If the optimal response to population aging is a one-time permanent reduction in consumption, then the deficit needs to be cut more in the near-term than in the long-term, because CBO's extended baseline already assumes significant cuts in later years. If, on the other hand, we wanted to simply adjust annually to population aging, keeping the debt-to-GDP ratio at a constant 75 percent, then we would make only small policy changes over the next few years and larger changes later.

III. IMPLICATIONS OF THE RECENT RUN-UP IN DEBT

Given the surge in federal debt since 2007, an important question is whether the level of debt should be reduced and, if so, how quickly? The answers to these questions depend on a number of factors, including the likely path of interest rates and the uncertainty regarding interest rates and desired revenues and noninterest spending. In particular, the uncertainty of budget projections enhances the importance of reducing the debt-to-GDP ratio from its current high level to give policymakers greater flexibility to respond to unexpected developments.

III.A. Responding to the recent run-up in debt with fixed interest rates and no other budget uncertainty

To start, suppose that U.S. federal debt were small enough in the context of the global economy that federal debt did not affect interest rates, that interest rates stayed at today's level, and that interest rates were equal to the social planner's discount rate. Under those circumstances, the optimal response to the elevated level of debt would be to raise the primary surplus as a share of GDP each year by an amount equal to the difference between the nominal interest rate and the nominal growth rate of the economy (i-g) times the increase in the debt-to-GDP ratio. That is, a social planner would spread out the costs of the high debt equally over generations, with each generation experiencing the same percentage drop in consumption.[27]

The social planner would not take steps to lower the debt-to-GDP ratio, because that would involve temporarily lowering current consumption by more in order to maintain a higher level of future consumption. There would be no reason to shift consumption intertemporally in that way because, without changes in the relative price of consumption over time, a social planner would rather smooth consumption.

Does this approach suggest that the nation's debt will be on a permanently increasing trajectory? In other words, if all shocks that raise the debt level are treated as "bygones," would debt tend to keep rising? No, because just as the social planner does not lower consumption by enough to reverse the debt increase following a negative shock, the social planner would not increase consumption to reverse the debt decline following a positive shock.

III.B. Responding to the run-up in debt in a closed economy

In a closed economy, where interest rates respond to the level of government debt, a surge in debt is associated with a reduction in the capital stock: As the government borrows more, private investment is crowded out. Because the equilibrium steady-state capital stock is pinned down by preferences in a closed economy, as in equation (5), the optimal response to a higher-than-desired debt level is to gradually bring it back down in order to build the capital stock back up.

III.C. Responding to the recent run-up in debt with uncertainty about interest rates and other aspects of the budget

Two arguments related to uncertainty imply that federal debt should now be reduced relative to the size of the economy.

The first involves uncertainty about future interest rates and economic growth rates. Although many analysts now expect interest rates to remain significantly lower in the next few decades than in the past few, that expectation could turn out to be wrong. Indeed, the fact that actual and expected long-term interest rates have declined so suddenly over the past several years should remind us that corresponding increases are entirely possible. Similarly, economic growth rates could turn out to be much less than now expected. During

27 Again, this statement assumes there is an equilibrium, which requires the fixed interest rate to equal time preference plus productivity growth ($\rho + g$).

the last few years, many economic forecasters have significantly reduced their projections of future output, and productivity growth remains quite weak. If interest rates rise significantly or growth rates fall significantly, then the budgetary and economic consequences of high debt would be much more detrimental than they may appear today.

That risk is especially noteworthy because significant adjustments in federal taxes and spending should generally be made only with considerable advance notice. Only with advance notice can households, businesses, and state and local governments adjust behavior gradually, with households adjusting to losses in benefits, state and local governments adjusting to losses in grants, and businesses adjusting to changes in tax rates. Without that notice, the required adjustments would generally be much more damaging. Following that logic, for example, most proposals to cut benefits for older Americans do not impose major cuts on people already receiving benefits or on the cusp of receiving benefits. Indeed, the largest reduction ever enacted in Social Security benefits is the increase in the full retirement age from 65 to 67, which was enacted in 1983 but will not be complete for new beneficiaries until 2022—a span of nearly 40 years. Moreover, the level of benefits paid to some beneficiaries who retire early in 2021 will remain higher for decades than they would be if this increase in the eligibility age for full benefits had been implemented immediately. Thus, because fiscal policy is hard to change and long lead times are desirable for most significant policy changes, we should allow for a range of possible outcomes for interest rates.

The second argument involves “fiscal space,” which was defined by Heller (2005) as “the room in a government’s budget that allows it to provide resources for a desired purpose without jeopardizing the sustainability of its financial position or the stability of the economy.” Recent discussions of fiscal policy, in the United States and elsewhere, often include comments about the desirability of creating more fiscal space by returning the amount of government debt relative to the size of the economy toward historical norms. The goal is to protect the United States from a situation in which the large amount of debt restricts “policymakers’ ability to use tax and spending policies to respond to unexpected future challenges, such as economic downturns or financial crises” (CBO, 2015a, page 4).

The surge in federal debt from 35 percent of GDP in 2007 to 75 percent of GDP in 2016—and the fact that many observers think fiscal policy should have remained substantially more expansionary for longer than it did during those years—illustrates why fiscal space would be desirable. If we hit a similar financial crisis and severe recession with debt at 75 percent of GDP instead of 35 percent, we might want to increase debt to more than 120 percent of GDP, and that level of debt could raise serious concerns among potential purchasers of the debt.

Specifically, the view that a large amount of federal debt would restrict policymakers’ ability to increase spending or reduce taxes is founded in the concern that raising debt from a level that is already unusually high would increase the chance that interest rates would rise sharply. That is, at some debt-to-GDP ratio, it is possible that investors would demand a premium to continue lending to the government to protect themselves against the risk of default, whether explicit or through a higher rate of inflation that lowers the real return.

This question of "fiscal space" is somewhat controversial. Some analysts—for example, Krugman (2014) argue that fiscal space is not an important concern for the United States. In particular, if interest rates would not rise with additional federal borrowing, then the effect of raising debt by a certain percentage of GDP when needed would be no different if the initial debt was high or low. Other analysts—for example, Summers (2016)—express greater concern about fiscal space at some level of debt-to-GDP, although not necessarily at the current level. Indeed, some warnings about the risk of running out of fiscal space—for example, CBO (2010)—emphasize the uncertainty about how fast interest rates might rise and at what debt-to-GDP level. While it is possible that fiscal space is not an important concern, the risk that it might be important implies that the possible advantages of regaining fiscal space should be a consideration in setting budget policy today.

Auerbach (2014) formally addressed the issue of optimal fiscal policy in the face of broad uncertainty. He argued that the appropriate response to uncertainty about the fiscal outlook and the ability to sustain a given level of debt is to do more, rather than less, about the projected long-term increase in debt. In particular, he noted that risk-averse taxpayers would be willing to forego some consumption now in order to protect themselves against the need for greater reductions in consumption later, should the fiscal outlook turn out to be worse than expected. Under this view, the greater the uncertainty of the long-term outlook, the lower the optimal debt level.

IV. IMPLICATIONS OF PERSISTENTLY LOW INTEREST RATES ON TREASURY SECURITIES

A downtrend in interest rates on Treasury securities (as well as rates on other long-term sovereign debt around the world) in the decades preceding the financial crisis, analyses of the fundamental factors affecting those rates, and current long-term rates all imply that Treasury rates in coming decades will be significantly below the averages of previous decades. What are the implications for federal budget policy?

For any given target of debt relative to GDP, persistently low Treasury rates allow for a larger gap between federal revenues and noninterest spending. Such low rates also have implications regarding the amount of debt for which a social planner would aim, which is the principal subject of this section. The implications of low rates depend partly on the reasons why rates are low, and we examine the implications of a number of possible reasons. Most of the possible explanations for why Treasury interest rates are unusually low imply that crowding out of private capital investment by the issuance of additional federal debt would be less costly than if rates were higher, which means that the optimal amounts of federal debt and investment likely would be higher than otherwise; however, in some cases, the low rates also mean that future generations will be worse off than otherwise, in which case the effect on the optimal federal debt is ambiguous. But, in addition to affecting optimal debt in a full-employment economy, the low level of equilibrium interest rates also will limit the scope for stimulative monetary policy during economic downturns, so issuing additional federal debt would have benefits for macroeconomic stabilization that it would not otherwise have—although there may be better ways to enhance stabilization.

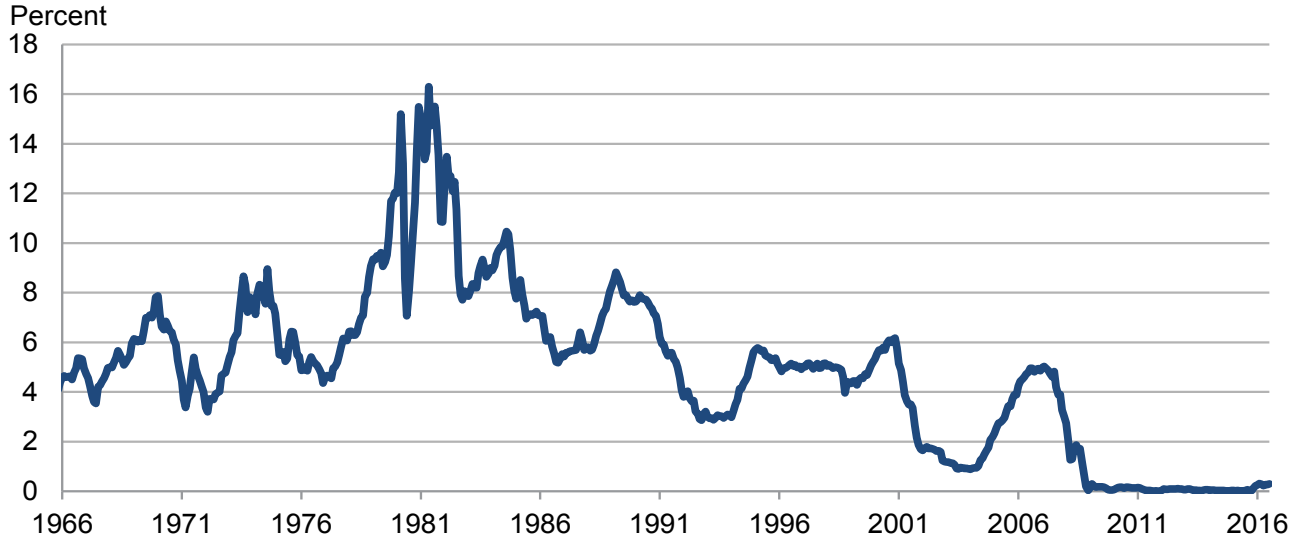
The outlook for interest rates is highly uncertain, though. The past downtrend is not dispositive about the future pattern; projecting the factors that affect interest rates and quantifying their influence on rates is difficult; and financial markets may have overreacted to the experience since the financial crisis. Federal budget policy should allow for the possibility that rates rise substantially above current projections, which would limit the increase in the target debt-to-GDP ratio. Still, with future Treasury interest rates likely to be well below their historical average, federal debt should be well above the amount that would have been appropriate in the past.

IV.A. The downtrend in Treasury rates in recent decades and projections for coming decades

Interest rates on short-term and long-term Treasury debt are now very low by historical standards, despite the continuing economic expansion, the onset of tightening in monetary policy by the Federal Reserve, and the surge in Treasury debt since 2007. The yield on 10-year Treasury notes remains well below its level in the early 2000s—which itself was lower than the yield had been at any time since the mid-1960s. Most projections show rates rising in coming years but remaining low by historical standards.

The yield on 3-month Treasury bills rose dramatically between the mid-1960s and early 1980s, and then it reversed course equally dramatically (see Figure 18). The yield on 10-year Treasury notes followed a similar pattern (see Figure 19). The sharp increase and then decrease in inflation and inflation expectations during those years make assessing movements in inflation-adjusted rates difficult. For the period between 1990 and 2007—which did not see the sharp swings in inflation of the 1970s and 1980s, and also did not include a significant financial crisis or deep recession—the 10-year yield trended down for the first dozen years and then roughly leveled out at about 4½ percent.

Figure 18: Yield on 3-Month Treasury Bills



Source: Federal Reserve.

Figure 19: Yield on 10-Year Treasury Notes

Source: Federal Reserve.

In the financial crisis and severe recession, the 3-month and 10-year yields fell notably further, as the Federal Reserve cut short-term interest rates and investors sought a safe haven in turbulent markets. The Federal Reserve's target for the federal funds was zero to a quarter-percentage point from the end of 2008 until December 2015, so the 3-month yield was quite close to zero as well. The 10-year yield averaged about 3 percent in 2009 and 2010, and then fell to about 2 percent in 2011, 2012, and the first half of 2013 while the Federal Reserve was sharply expanding its purchases of long-term Treasury securities and mortgage-backed securities as part of quantitative easing. The 10-year yield rose back to nearly 3 percent in the second half of 2013 as the Fed discussed ending quantitative easing and appeared to be moving toward raising the federal funds interest rate, its chief target. At that point, the increase in the 10-year yield could have been viewed as the beginning of a return to the level that prevailed during the half-decade before the crisis.

However, the yield fell back again in 2014 and has stayed below 2½ percent over the past year, and below 2 percent over the past six months. Although the funds rate has been close to zero for so long, inflation has stayed well below the Fed's target, which suggests that the natural short-term interest rate—the rate at which the economy would expand in line with the growth of potential output—is not very far above zero at this point. [28]After seven years of economic expansion—with substantial improvements in household balance sheets (which should increase consumption), housing vacancy rates (which should increase housing investment), capacity utilization (which should increase business investment), and financial stability (which should reduce the demand for safer assets)—having such a low natural interest rate is striking.

There appears to be a widespread consensus that interest rates on both short-term and long-term Treasury debt will probably increase over the next several years but remain significantly below their average levels of the past few decades. Indeed, many forecasters have reduced their projections of interest rates during the past few years.

28 See Hamilton et al. (2015) and Laubach and Williams (2015) for recent estimates of the natural rate.

The average prediction by members of the Federal Open Market Committee is that the federal funds rate will reach a little under 3 percent "in the longer run," down from a projection of 4¼ percent several years earlier (Federal Reserve Board, 2016). Roughly consistent with the FOMC projection, CBO (2016a) projects that the 3-month Treasury rate, which tends to run a little under the funds rate, will be about 2¾ percent in 2020 through 2025, down from a projection of 4 percent several years earlier.[29] For long-term rates, CBO projects that the 10-year yield will be just above 3½ percent in 2020 through 2025, down from a projection of 5¼ percent several years earlier.[30] CBO's latest projection for the inflation-adjusted 10-year yield is about 1¾ percentage point below the average between 1990 and 2007.[31]

However, participants in financial markets appear to expect that interest rates will be notably below the projections of the Federal Reserve and CBO. Federal funds futures imply that the funds rate in 2018 will be about two percentage points below CBO's projection and the average projection of FOMC members. The yield curve implied that market participants also expect the 10-year rate to be well below CBO's projection in 2020 and later years.[32]

IV.B. Factors affecting Treasury interest rates

Several researchers and policy organizations have attempted to quantify the impact on future interest rates of a number of key factors. Examples of such efforts include CBO (2014a), CEA (2015), the staff work described in Federal Reserve Board (2015a) and IMF (2014), Hamilton, Harris, Hatzius, and West (2015), Thwaites (2015), and Rachel and Smith (2015). In addition, Summers (2013, 2014, 2015a, 2015b), Bernanke (2015a, 2015b, 2015c, 2015d), Krugman (2015), and others have addressed various significant factors affecting interest rates. Those analyses have concluded—consistent with the projections described above—that inflation-adjusted interest rates on Treasury securities will probably increase over the next several years but remain significantly below their average levels of the past few decades.

For our purposes, the factors affecting Treasury interest rates can be usefully grouped into four categories: factors that affect the marginal product of private capital, and thus asset returns in general; factors that affect the risk premium on private assets, and thus Treasury rates relative to the marginal product of capital and other asset returns; factors that affect the demand for Treasury securities for institutional reasons; and factors that have increased desired saving with investment being insensitive to the cost of capital. Before turning to each of those sets of factors, though, we describe some factors that are probably holding down Treasury rates in the short term but will diminish over time.

IV.B.1. Short-tern factors affecting Treasury rates

Treasury rates have been held down since the financial crisis by various factors that are now fading, so rates will probably increase during the coming years. First, Treasury interest rates have been especially low because the Federal Reserve has been pursuing expansionary monetary policy to reduce economic slack. However, the Federal Reserve has now begun raising the federal funds rate.

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29 We compare CBO projections from August 2016 (CBO, 2016c) with those of February 2013 (CBO, 2013).

30 CBO's downward revision to the three-month rate is smaller than its downward revision to the 10-year rate because CBO now expects that the term structure will be flatter in the future than it had previously expected.

31 CBO also projects that inflation will be lower in coming years than it was, on average, between 1990 and 2007. With inflation projected to be ½ percentage point lower, and real rates to be 1¾ percent lower, the nominal 10-year yield is projected to be 2¼ percentage points lower than during the 1990-2007 period.

32 Deducing expectations of interest rates from the yield curve relies on estimated term premiums, which are difficult to estimate—especially when the Federal Reserve holds unusually large amounts of long-term securities. Still, it seems clear that market participants expect lower future interest rates than CBO does.

Second, credit conditions have been unusually tight in ways that are separate from interest rates. For example, credit standards for mortgages have been quite high. Credit conditions will probably ease over time as lenders recover from their experiences during the financial crisis and severe recession, and that process will increase equilibrium interest rates.

Third, the overbuilding of housing in the mid-2000s, the financial stresses and risks faced by businesses and households during the financial crisis and recession, and the prolonged period of weak demand and consequent underutilization of resources, have all reduced the willingness of businesses and households to make investments. As the economic expansion continues, businesses' and households' confidence will probably improve, which will increase their desired investment and increase equilibrium interest rates.

Fourth, participants in financial markets may have overreacted to the extended period of extremely low short-term interest rates by extrapolating that experience too much into the future. If so, the tightening of monetary policy would increase Treasury interest rates by more than participants in financial markets now expect.

IV.B.2. Treasury rates may stay low in part because of a lower marginal product of private capital

Analysts have identified a number of reasons why the marginal product of capital in the next few decades probably will be different from what it was in earlier decades. Four of those reasons involve a decrease in the demand for capital, which will tend to reduce its marginal product; four others involve increases or decreases in the supply of capital, pushing in different directions on its marginal product. Several analysts' plausible—but highly uncertain—estimates imply that the net effect will be a substantial decline in the marginal product of capital.[33]

First, there will be slower growth of the labor force stemming from the retirement of the baby boom generation and the leveling off of women's labor force participation after sharp increases in the 1970s through 1990s. That factor will raise the capital-labor ratio for any given rate of investment, pushing down the marginal product of capital, as we discussed above.

Second, total factor productivity may grow more slowly than in the preceding few decades. Productivity growth in the past decade has been unusually slow—perhaps in part because new technology and new processes are embodied in physical capital, and investment in such capital has been low. Slower productivity growth would push down the marginal product of capital. Indeed, CBO has marked down

its estimate of long-run total factor productivity growth over time. However, as shown in Figure 20, the markdown in Treasury interest rates has been larger than the markdown in economic growth, meaning that the wedge between the growth rate of GDP and Treasury interest rates in the CBO projections has declined over time.

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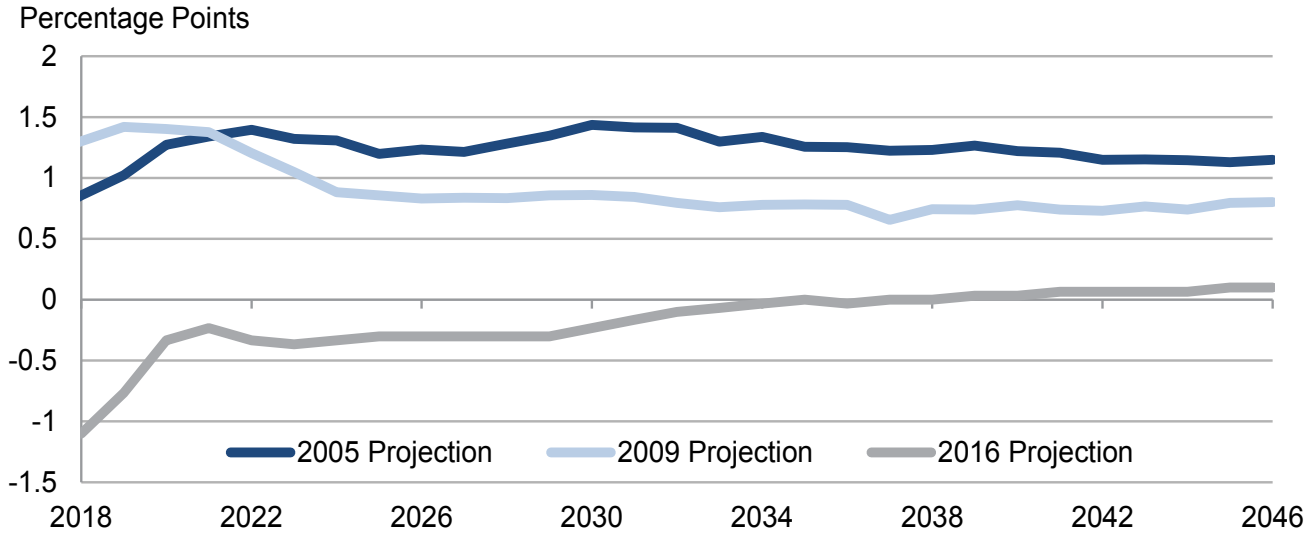
33 The analyses do not necessarily imply that the marginal product will be so low that the capital stock has exceeded the Golden Rule level. For approaches to testing whether capital exceeds that level, see Abel, Mankiw, Summers, and Zeckhauser (1989).

Figure 20: Real Interest Rate and Growth Rate Differentials



Source: CBO Long-Term Budget Projections (Dec. 2005, Jun. 2009, Jul. 2016).
Note: Three-year moving averages of real 10-Year Treasury rates minus real GDP growth rates.

Third, there may be a reduction in the capital intensity of production resulting from the growing importance of economic activities in which production involves little physical capital. For example, Summers (2014, 2015) cites the growth of information technology businesses like WhatsApp. However, the share of total output represented by such businesses is unclear. For example, Furman (2015) notes that "consumers access [Internet services] through the often large investments in wired and wireless networks made by internet service providers." Similarly, a recent study by Mericle and Struven (2015) found that the changing composition of U.S. industry is unlikely to have a noticeable effect on aggregate capital investment.

Fourth, the price of information technology continues to decline, which means that less nominal funds are needed to undertake a given amount of real capital investment.

Fifth, the increase in income inequality is tending to push up private saving because of the greater saving propensity of higher-income people (Dynan, Skinner, and Zeldes, 2004). That effect will reduce the marginal product of capital. However, the personal saving rate has trended down over the past few decades, and the private saving rate has changed little, on balance, so other factors besides rising inequality are evidently affecting saving.

Sixth, the aging of the population will shift more people from their years of peak saving to years of lower saving or dissaving. That shift will reduce the funds available for capital investment and thereby increase the marginal product of capital.

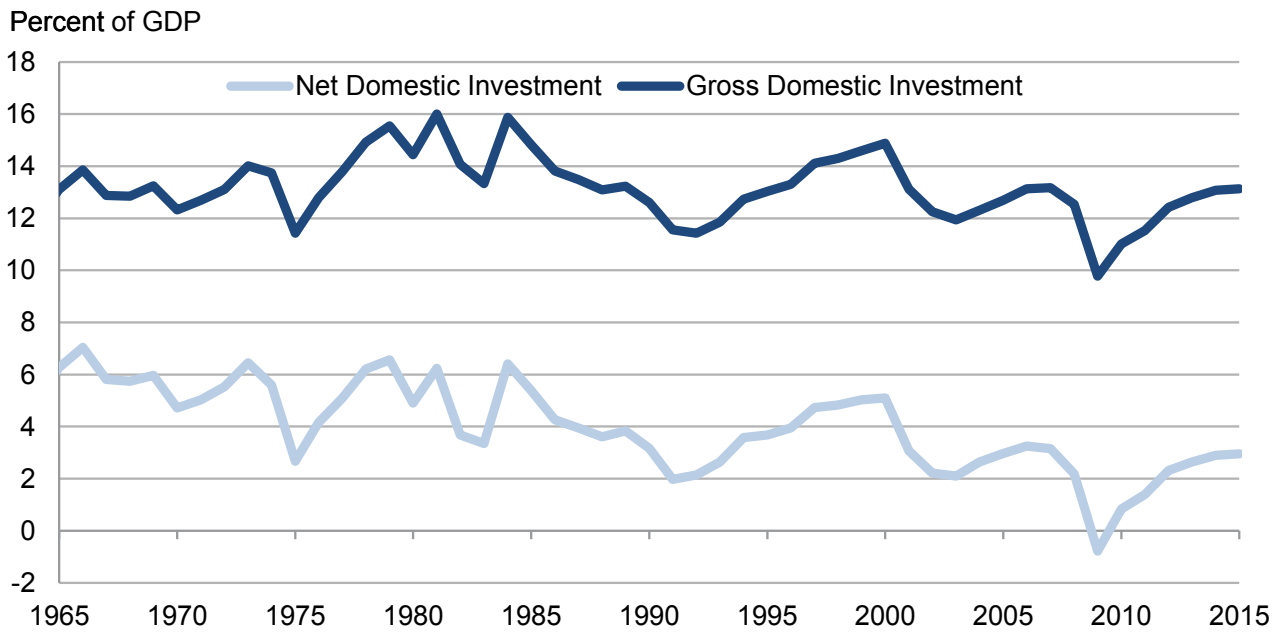
Seventh, federal debt has increased considerably relative to GDP. That will crowd out capital formation under typical economic conditions, thereby increasing the marginal product of capital.

Eighth, capital inflows from other countries will probably be different than in the past, although the direction of change is not clear. CBO (2014a) argued that capital inflows to the United States would probably be smaller than in the past, as emerging market economies invested more of their savings in their own countries in response to an already high level of overseas assets and to demands from their citizens for increases in their standards of living. However, we are now observing slow growth in many economies around the world and a consequent easing of monetary policy and declines in interest rates; those factors are increasing capital inflows to the United States. As a result, foreigners' contribution to the "global savings glut," as dubbed by Ben Bernanke (2005), may continue. Caballero, Farhi, and Gourinchas (2008, 2015) have analyzed this phenomenon carefully.

As noted above, several attempts to quantify that multitude of factors have concluded that the marginal product of capital in the next few decades will be substantially lower, on balance, than in the preceding few decades. Those estimates are highly uncertain, though. To the extent that the marginal product of capital has already declined, one might hope to find confirmation by examining changes in business investment or capital income. However, conceptual and measurement issues make such confirmation—or disproof—elusive.

Gross business fixed investment is close to its average share of GDP over the past several decades, but net investment has declined (Figure 21). Business investment should be pushed up now by two short-term factors. One is a pent-up need for capital following very weak investment during the recession and its immediate aftermath, at least to acquire new technology even if additional capacity is not needed; the other is the very low cost of funds for businesses stemming from low yields on corporate securities and high price-earnings ratios for equities. On the other hand, lingering concerns about the strength of demand for goods and services and about financial risks may be holding down investment. On balance, the fact that business investment is not currently higher is consistent with a decline in the marginal product of capital but hardly decisive.

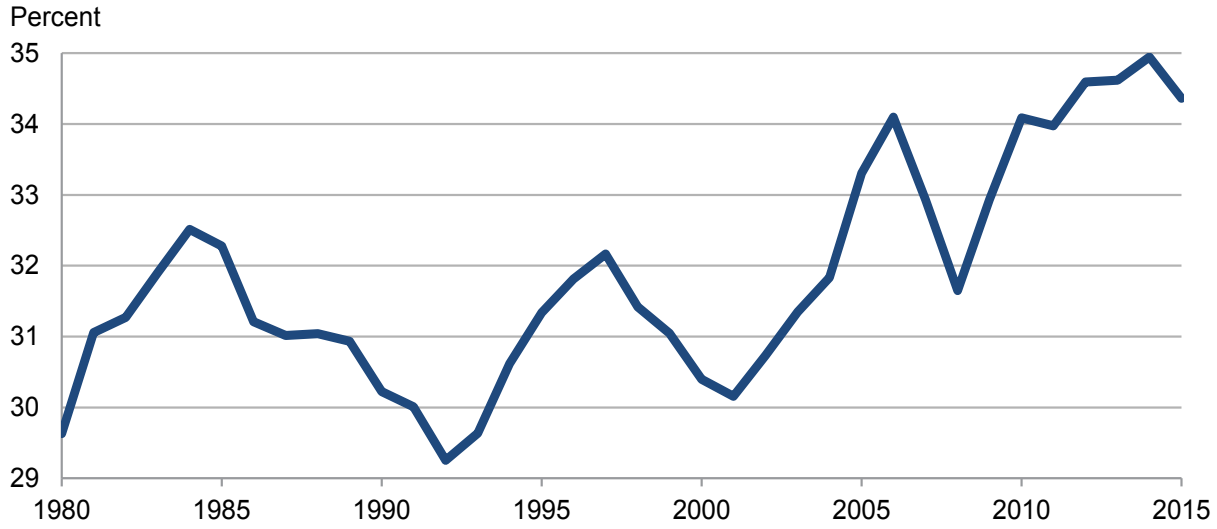
Figure 21: Business Investment as Share of GDP



Source: BEA via Fred.

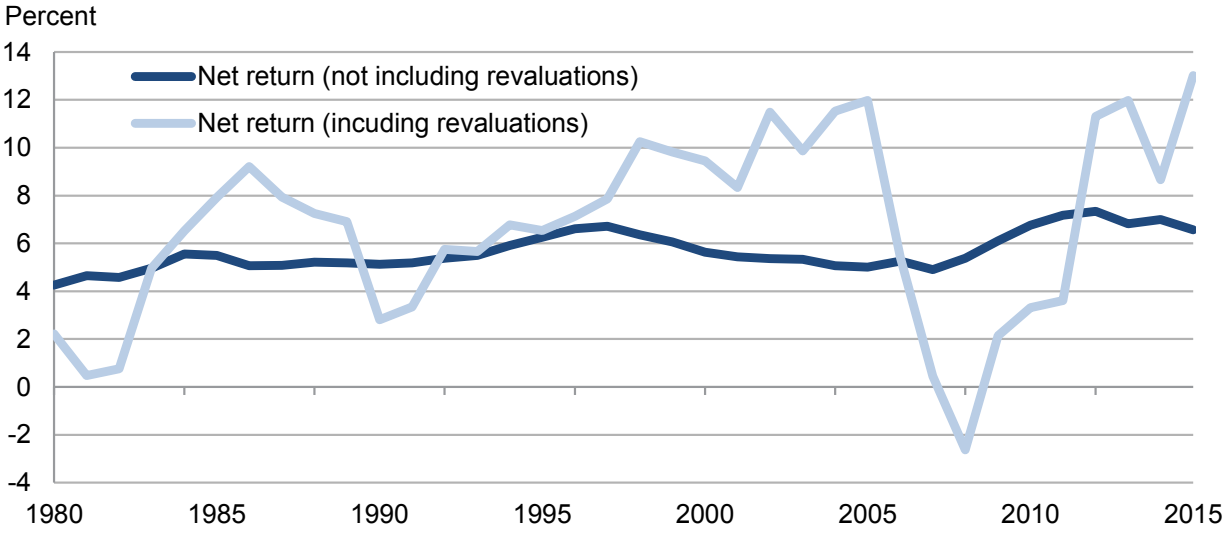
Capital income is now a historically high share of national income, as can be seen in Figure 22.[34] High capital income may seem to imply that the marginal product of capital is high, but that is not necessarily true. In a standard Cobb-Douglas production function, an increase in the quantity of capital reduces its marginal product and has no effect on the capital share because the increase in the quantity of capital and the decrease in return per unit are exactly offsetting; in more flexible production functions, the relationship between the marginal product of capital and the capital share of income varies. However, as shown in Figure 23, the average return to capital does appear to be high by historical standards as well.

Figure 22: Gross Capital Income Share of GDP



Source: Authors' calculations; BEA.

Figure 23: Average Return to Capital



Source: BEA; Flow of Funds; Lincoln Institute

34 We estimated the average return to capital as follows: Using the BEA NIPA accounts, we calculated total capital income as the net operating surplus less the share of proprietors' income that represents labor compensation—which we calculated using the share of compensation in the corporate sector. We divided by total assets, which we defined as total fixed assets plus inventories plus the US net international position, all from the BEA, plus the value of land (which we got from the Federal Reserve Flow of Funds Table, equal to the value of real estate less the replacement cost of structures). To calculate the revaluations of the capital assets, we used the BEA's deflators for fixed assets, the Lincoln Institute of Land Policy's measure of land prices (Morris and Heathcote, 2007), and assumed no change in valuation for inventories and the US international position.

Moreover, the capital share of income may have risen for reasons not captured in a standard production function—and those reasons have varied and unclear implications for the marginal product of capital:

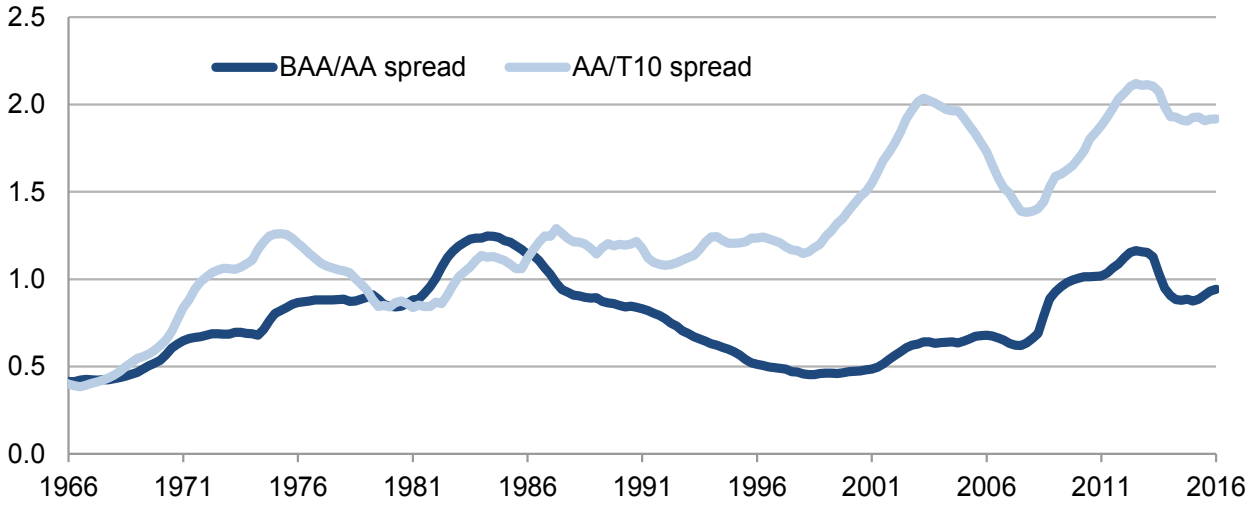
- Capital income may be mismeasured, perhaps because part of what is recorded as the return to physical capital is actually a return to human or intangible capital, and that return has increased over time. Furman and Orszag (2015) show that the biggest gains in profits have been in sectors where intangible assets such as patents or technology standards can be especially important, such as technology and health care. In this case, the marginal product of physical capital may be high or low.
- Capital income may have risen because firms are receiving greater monopoly rents. Such firms might restrain output to benefit from their monopoly positions, which means restraining their demand for capital. In this case, the social marginal product of capital would be higher than the private marginal product.
- Capital income may have risen because globalization or changes in social mores have allowed firms to exert more power over workers and capture some of their marginal product. In this case, the private marginal product of capital would be higher than the social marginal value.
- Risk may have increased, with the average return on capital rising to compensate. Furman and Orszag show that a sharply widening gap between the profits of companies near the top of the profits distribution and further down. However, that risk would seem to be diversifiable, so the average return would not need to rise.

IV.B.3. Treasury rates may stay low in part because of a higher risk premium on private assets

The risk premium on private assets may be higher in the next few decades than in previous decades because of an increase in either perceived risk (perhaps stemming from changes in the economy) or the price of risk (perhaps stemming from changes in people's preferences). Whether this will happen, however, is unclear.

An argument for greater perceived risk would emphasize the highly uncertain macroeconomic conditions in the United States and other countries during the past several years. Between the mid-1980s and mid-2000s, output, employment, and other aspects of economic activity were so stable relative to previous experience as to earn the moniker "the Great Moderation." Although significant disruptions, such as the Asian financial crisis of the late 1990s, occurred periodically, vigorous policy responses and other factors kept most of the global economy fairly stable. But the financial crisis, severe recession, and subsequent slow recovery, as well as ongoing structural and cyclical problems in many large economies, vividly illustrate the considerable macroeconomic risks faced by the United States and the rest of the world. This argument does not explain the downtrend in rates in the few decades before 2007 but might explain low rates looking ahead.

Figure 24: BAA to AA and AA to 10-year spreads (5-year MA)



Source: Bloomberg; Federal Reserve.

One might also build a case for growing risk over time using the Furman and Orszag estimate of growing variation in profits; however, as noted above, that risk would seem to be diversifiable and thus not relevant to the risk premium. In the other direction, more widespread investment in mutual funds and other factors over the past few decades may have enhanced the ability of investors to diversify their investments and thus lowered the risk premium.

Despite those arguments, though, spreads in yields between corporate bonds with different risk ratings have not changed in ways that one would expect if the risk premium had increased. The spread between the yields on 10-year Treasury notes and BAA-rated corporate debt has risen considerably over time—with the five-year average rising from about 1 percent in 1960 to 1¾ percent in 1980 and about 2¾ percent in 2016. However, the increase since 1980 can be attributed entirely to an increase in the spread between the AA and Treasury yields—which rose from about ½ percent in 1960 to a little under 1 percent in 1980 and about 2 percent in 2016—while the spread between the BAA and AA yields was also about ½ percent in 1960 and about 1 percent in 1985 but remained a little under 1 percent in 2016 (Figure 24). Those patterns do not show an increase in the risk premium in the past 35 years but instead suggest that other factors may have contributed to increased demand for Treasuries.

IV.B.4. Treasury rates may stay low in part because demand for Treasuries has increased for institutional reasons

The demand for Treasury securities may have increased for institutional reasons. For example, financial regulations require certain institutions to maintain specified amounts of capital and reach specified degrees of liquidity, and Treasury securities are valuable for those purposes.[35] Moreover, Treasury securities play

35 As an illustration, the *Wall Street Journal* reported on October 20, 2015: "Behind the epic hunger for government debt is a rule change that has … money-fund managers hustling to snap up short-term Treasuries and related debt." The *Journal* explained that the rule change aims to increase the safety of money fund investments and therefore "won't apply to funds that invest only in the debt of the federal government and agencies such as Fannie Mae and Freddie Mac" (pages C1, C4).

distinctive roles for other investors as well. When discussions arose in the late 1990s and early 2000s about the possibility that the federal government might substantially pay off its debt, many observers expressed concern because of the high value of Treasury securities as safe and liquid investments for many investors.

The significance of this phenomenon in explaining the longstanding downtrend in Treasury rates and the current very low levels is unclear. As just noted, the spread between yields on Treasury securities and AA-rated corporate securities has widened notably in the past few decades, while the spread between yields on AA-rated and BAA-rated yields has not. That pattern is consistent with a rising demand for Treasury debt for institutional reasons. However, the supply of Treasury debt has more than doubled in the past eight years, which one might suspect would more than offset changes in rules that have increased the demand for such debt.

IV.B.5. Treasury rates may stay low in part because desired saving is higher and investment demand is insensitive to the cost of capital

Earlier in this section we discussed changes in a number of factors affecting the supply and demand for capital that might result in a reduction in its marginal product. Here we consider the possibility that desired saving has increased, but rather than increasing investment and reducing the marginal product of capital, the effects on investment and the marginal product of capital have been limited and the larger effect has been a decline in the return on financial assets.

Suppose that firms do not adjust their investment much in response to changes in the cost of capital. That view is consistent with the empirical evidence that has failed to find a strong link between investment and

interest rates.[36] And some evidence suggests that firms' choices of hurdle rates for returns on new investments tend to be insensitive to the cost of capital and have not fallen in the past several years despite very low interest rates (Sharpe and Gustavo, 2013). Others suggest that firms limit their investments in response to a lack of qualified management or manpower to oversee them, suggesting that operational constraints are binding rather than financial constraints. (Jagannathan, Matsa, Meier, Tarhan, 2015). Furthermore, state and local government investment appears to be facing political constraints that make them unable to take advantage of the currently low interest rates to increase investment.

If investment is insensitive to the cost of capital, then changes in desired saving manifest themselves primarily in reductions in the return to financial assets without large changes in the amount of saving or investment (Figure 25).[37] The reductions in the returns to bonds and equities would be seen in a decline in interest rates and increase in price-to-earnings ratios, while businesses' interest payments would be low and their profits would be high. Those predictions are consistent with current observations (Figure 26).

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36 As noted by Sharpe and Gustavo, 2013, the empirical literature on the responsiveness of investment to interest rates is mixed: Research that has examined the response to changes in the cost of capital has generally found sizable effects (for example, see Cummins, Hassett, and Hubbard, 1994, and Gilchrist and Zakrajset, 2007), while studies that have examined the response to changes in interest rates specifically have generally found very small and/or insignificant effects (for example, Banerjee, Kearns, and Lombardi, 2015, Kohari, Lewellen, and Warner, 2014, and Pinto and Tevlin, 2014.) Tevlin and Whelan, 2003, suggest that, empirically, investment responds more to some components of the cost of capital—like depreciation—than to others, like interest rates, which is a potential explanation for this discrepancy.

37 Private saving also appears to be fairly insensitive to the rate of return, which would accentuate the change in the return required to equilibrate saving and investment. However, the net inflow of capital from overseas may be more sensitive to the rate of return.

This story is consistent with the "secular stagnation" hypothesis, whereby low interest rates are incapable of stimulating the economy. This means that monetary policy is less effective at getting the economy out of recession and also that the economic growth rate, even at full employment, will be held down by too little investment.

Figure 25: Inelastic Investment, Elastic Savings

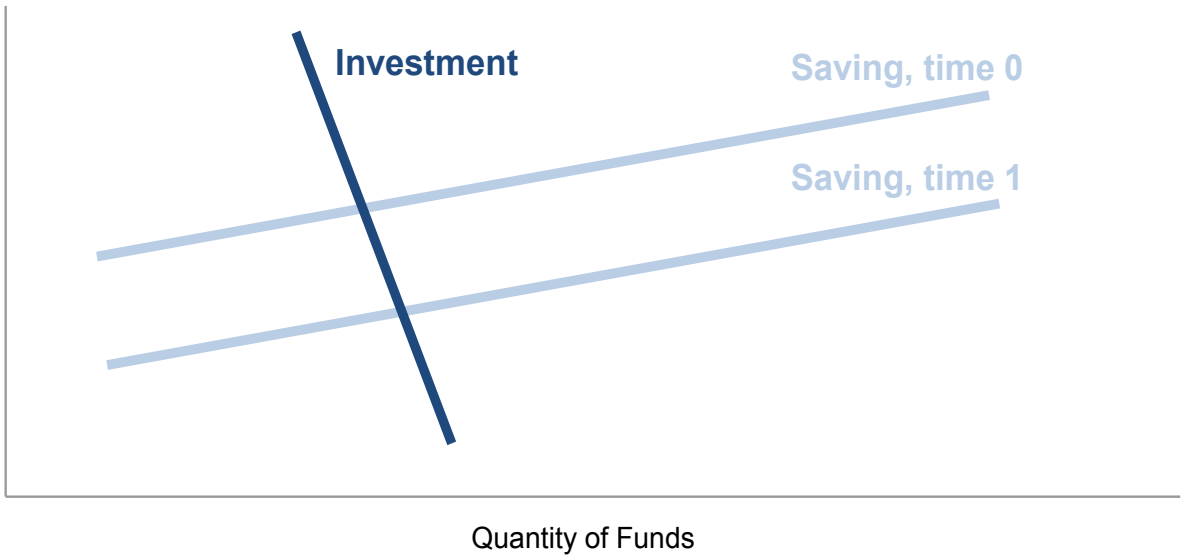


Figure 26: AA Corporate Bond Yields

Source: Bloomberg; Federal Reserve.

V. IMPLICATIONS OF LOWER INTEREST RATES FOR FISCAL POLICY

The most obvious effects of low interest rates on fiscal policy are well known—for any given initial level of debt and projected primary deficits, lower interest rates improve the sustainability of the debt. Less well studied, though, is the question of how policymakers should adjust federal consumption and investment spending in light of low interest rates. In this section, we assess the implications of low interest rates for government tax, spending, asset purchase and investment decisions. Our conclusions are summarized in Table 2 at the end of the paper.

V.A. With lower Treasury interest rates, debt dynamics are more favorable

For any given paths of revenues and noninterest spending, persistently low interest rates reduce future debt. Indeed, the decline in federal debt relative to GDP in the decades following World War II occurred primarily because Treasury interest rates were low relative to economic growth rates, not because the government incurred surpluses. However, even though CBO projects that interest rates will remain well below their average of the past few decades, the agency still projects that debt will rise indefinitely relative to GDP under current law.

CBO currently projects that, in coming decades, the inflation-adjusted rate on 10-year Treasury notes will average roughly 1 percentage point below its average between 1990 and 2007. That projection is about 1 percentage point below CBO's projection from a few years ago—a reduction that has lowered projected debt in 2046 by more than 45 percent of GDP, based on the sensitivity tests in CBO (2016b).

However, debt is still projected to rise over time. With the baby boom generation heading into retirement and the labor force participation rate among working-age women roughly stabilizing after increasing sharply for a few decades, the labor force will grow more slowly in the next few decades than in the past few decades. Therefore, the difference between interest rates and the rate of economic growth has not widened nearly as much as would be predicted by the reduction in projected interest rates alone. Even so, CBO projects that the growth rate of GDP will exceed the average interest rate on federal debt over the next 10 years and fall slightly short in the few decades after that, with growth in GDP exceeding the average interest rate on federal debt for the 25 years as a whole. As a result, if projected federal revenues matched projected federal noninterest spending—that is, if the federal budget was in primary balance—then debt would decline relative to GDP. But federal revenues are projected to fall short of noninterest spending throughout the next 25 years, so debt is projected to rise relative to GDP. Indeed, based on CBO's sensitivity tests, the debt-to-GDP ratio would be projected to rise even if projected interest rates in the long term were 1 percentage point lower than they are now.

Ball, Elmendorf, and Mankiw (1998) showed that Treasury rates were less than the growth rate of the economy for long periods of the past century. They argued that reconciling this relationship with the widespread view that the economy has been dynamically efficient requires consideration of risk: The marginal product of capital has exceeded the growth rate of the economy, on average, but the risk premium has been large enough to push Treasury rates below the growth rate. In that circumstance, according to Ball et al., there is a "deficit gamble" available to society: Letting debt run up for a period and then restoring

primary budget balance would probably be good for current generations and not hurt future generations, because the debt-to-GDP ratio would probably decline again without further policy action. However, that gamble might fail through an increase in interest rates or faltering of growth rates that required policy changes to prevent the debt-to-GDP ratio from rising further. Moreover, those policy changes would tend to be needed when growth was low, which would make the changes especially costly in terms of social welfare. Therefore, Ball et al. concluded, taking the gamble would hurt future generations ex ante, even though it probably would not hurt them ex post.

V.B. Implications of persistently low interest rates stemming from a lower marginal product of capital

The Ramsey model described above can be used to assess the optimal response to shifts in preferences or technology that result in a lower marginal product of capital. As discussed, one of the reasons to expect a decline in the marginal product of capital is aging itself. In our formulation of the Ramsey model, the steady state capital/labor ratio, and hence the steady-state interest rate, is unaffected by population aging, but the capital-labor ratio does increase temporarily along the adjustment path, leading to a decline in the marginal product of capital and the interest rate. As noted, the optimal response to population aging is to increase saving, and it is the increased saving that generates the falling interest rates. In our simulations, however, this effect is fairly small, averaging about ¼ percentage point over the next 25 years.

But population aging is just one of the possible explanations for low interest rates and a low marginal product of capital. Two other potentially important explanations are the global savings glut and the slowdown in current and expected multifactor productivity growth. The Ramsey model can be used to model the optimal response to both of these factors.

V.B.1. Global savings glut

The "Global Savings Glut": We model the global savings glut as a reduction in the rate of time preference. Such a reduction would cause an outward shift in the savings supply schedule. We distinguish between two cases:

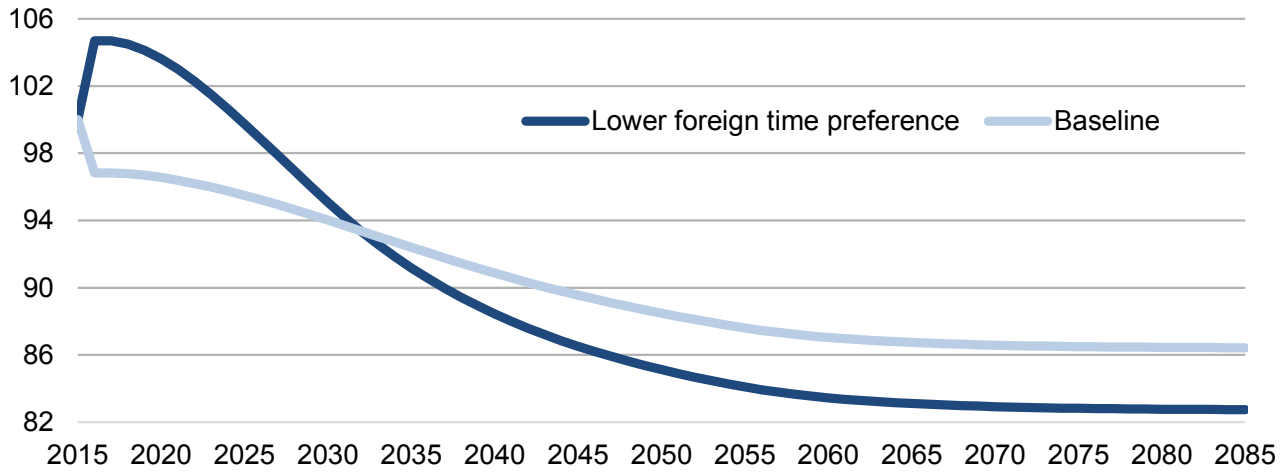
1. A reduction in American and foreign rates of time preference
2. A reduction in foreign rates of time preference, without a change in American preferences

An outward shift in the supply of savings would increase private investment and lower the marginal product of capital. A lower marginal product implies that the return to additional national saving is lower—in other words that the price of future national consumption relative to current consumption is higher. If the marginal product of capital has declined because Americans want to save more, holding all else constant, then the government should not respond to the low borrowing rates by lowering national saving. Instead, it might be appropriate for the federal government to also increase its saving to adjust to changing taxpayer preferences. This conclusion would not hold, however, if the marginal product of capital has decreased so much that it is lower than the growth rate of the economy; in that case, the government should also take steps to lower national saving by increasing its net debt (but see the caveat about the "deficit gamble" discussed above.) Lowering national saving would involve raising current consumption, either through additional government spending or through tax cuts. However, if, as is usually assumed, the savings glut

represents a change in foreign preferences, but not domestic ones, then the optimal reaction is different. In this case, the government should react to the low return to saving by increasing national consumption and reducing saving.

We use the Ramsey model to show this formally. In our initial simulation, we assumed that the economy starts in a steady state and then gets the "news" about population aging.[38] In that situation, the optimal reaction was for consumption to decline. Now, in addition to news about aging, the planner also discovers that the foreign rate of time preference will be temporarily low.[39] The results are shown in Figure 27. With the news of both aging and the decline in the foreign time preference, instead of lowering consumption in response to aging, the social planner increases consumption.

Figure 27: U.S. Consumption with Aging and Low Foreign Time Preference



Source: World Bank (demographic inputs); National Transfer Accounts and Census (consumption weights for support ratios); authors' calculations.

The exact magnitude of the effect depends on the magnitude of the change in the rate of time preference, how long it lasts, and the parameters of the utility and production functions. But the basic point is clear: given that the net foreign asset income of the United States is now roughly zero, a reduction in the rate of return has no effect on US income—the loss to capital owners is exactly offset by the gains to workers, but it does have a substitution effect.[40] When foreigners are willing to lend to the United States at very low rates, current consumption becomes less expensive relative to future consumption, and it makes sense to tilt the balance somewhat toward more consumption now and less consumption later.

When thinking about the issue from the federal government's perspective, the analysis may be somewhat different. Because the federal government is a net debtor, a reduction in borrowing costs has a positive income effect as well as a substitution effect. Thus, when interest rates decline, the federal government

38 The initial steady state assumed zero net foreign ownerships positions, reflecting the fact that U.S. receipts of factor income from the rest of the world are roughly equal to U.S. payments of factor income to the rest of the world.

39 The two-country Ramsey model cannot be solved if time preference in the US is permanently lower than in the rest of the world, because, under that condition, all of the assets would eventually be owned by foreigners. Here, we assume that, for fifteen years, the rate of foreign time preference is 1 percentage point lower for 15 years.

40 U.S. GDP rises, but the increment to GDP accrues to foreigners who have increased their saving and their investment in the U.S.

can raise spending or cut taxes both now and in the future. Although that response is larger than would be appropriate for the economy as a whole, the federal actions might offset the actions of other actors in the United States—such as net savers who experience negative income effects from the decline in rates and therefore would probably lower consumption.

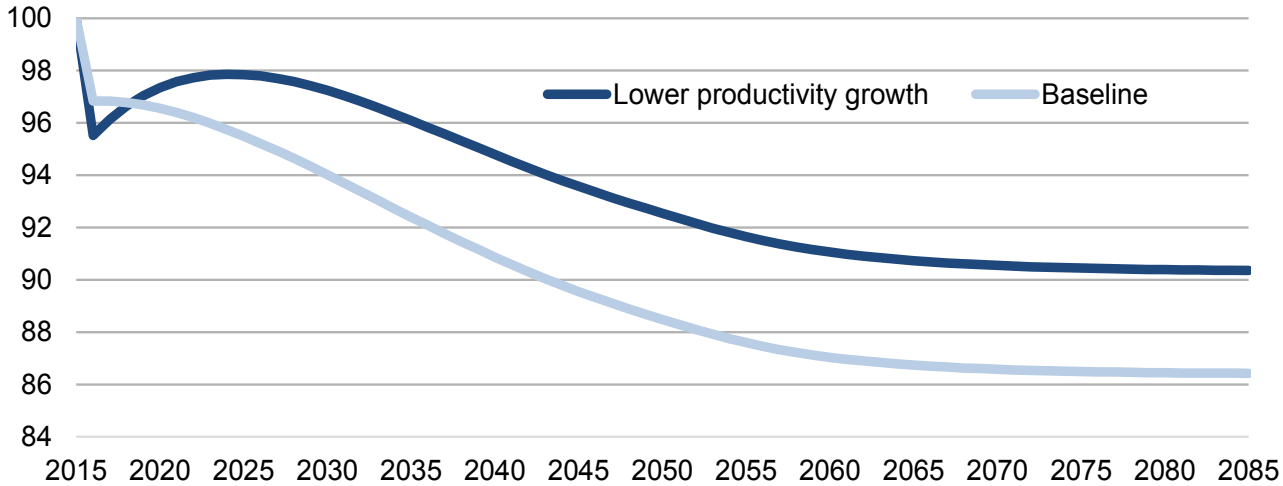
V.B.2. Multifactor productivity

We turn now to the slowdown in current and expected multifactor productivity (MFP) growth.

Lower MFP growth has two effects. First, a decline in MFP means that future generations are not as rich. This factor makes the social planner want to transfer resources to the future by increasing the capital/labor ratio. The way to do this is to forego some current consumption in favor of greater investment. But a lower rate of productivity growth also lowers the return to saving, which makes future consumption more expensive relative to current consumption. Thus, whether the optimal response to a drop in productivity growth is an increase or a decrease in consumption depends on the parameters of the utility and production functions.[41, 42]

In figure 28, we show the result of a scenario where, using our baseline parameters, we impose both population aging and a decline in MFP, from 1.7 percent, the historical average, to 1 percent. The net effect of the change in MFP is to lower consumption by just a bit more than in the case where there is no MFP change.

Figure 28: U.S. Consumption with Aging and Low MFP Growth



Source: World Bank (demographic inputs); National Transfer Accounts and Census (consumption weights for support ratios); authors' calculations.

41 In particular, the steady-state capital labor ratio is determined by g/σ. When σ is large, the drop in utility from future consumption losses is muted, so the social planner is not willing to give up much current consumption; conversely, when σ is small, the utility loss of future generations is large, and the social planner will significantly increase the ratio of capital to effective labor in response to a drop in g.

42 In the context of the Ramsey model above, a decline in g causes the consumption frontier to shift out, because, with slower growth of effective labor, the saving rate need not be as large to maintain any given capital/effective labor ratio.

V.B.3. Public investment

The lower marginal product of private capital implies that the relative return to public capital will be higher than otherwise, unless the return to public capital is lower by as much or more than the return to private capital. Some factors that may be holding down the return to private capital would also hold down the return to public capital. For example, slower growth of the labor force would diminish the marginal value of additional spending for public education, all else equal, just as it diminishes the marginal value of additional private equipment and structures. Yet, other factors that may be holding down the return to private capital have no direct effect on the return to public capital. For example, additional flows of capital from other countries that lead to greater accumulation of private capital than otherwise do not directly change the amount of public capital. In sum, if the return to private capital has fallen, the return to public capital has probably declined but to a lesser degree. With a greater relative return to public capital, federal nonfinancial investment should increase.[43]

V.C. Implications of persistently lower Treasury interest rates stemming from a higher risk premium on private assets

If Treasury interest rates are lower because Americans have become more risk averse or because they perceive that risk has increased, federal fiscal policy should be the same as it would be otherwise.

A higher risk premium does not affect the price of future national consumption relative to current national consumption after adjusting for risk. Therefore, net debt of the federal government should not be changed to generate a change in national saving.[44]

In this scenario, the average return to private financial assets would exceed the cost of federal borrowing by a larger amount than otherwise. However, the cost to the federal government of taking on the risk of private assets would also be larger because the amount of perceived risk or the price of that risk is higher. Therefore, the federal government should not issue additional debt in order to purchase additional financial assets. But that conclusion would not hold if the federal government's ability to bear risk, relative to that of the private sector, has increased as well.

In addition, the risk-adjusted values of federal and private consumption relative to that of private investment are unchanged. Therefore, federal nonfinancial investment and consumption should not be higher, and taxes should not be lower, than they would be otherwise.

V.D. Implications of persistently low Treasury interest rates stemming from a higher demand for Treasuries for institutional reasons

If Treasury interest rates are lower because the demand for Treasury securities is higher for institutional reasons, then federal debt should be higher. If the purchase of financial assets is feasible, the additional debt should be used for that purpose; if not, the additional debt should be used for higher federal nonfinancial investment and consumption and for lower taxes.

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43 That conclusion does not depend on whether public investment "pays for itself." We discuss federal investment at greater length later in the paper.

44 That conclusion would not hold, though, if an increase in government debt would reduce the risk premium on private assets. Such an outcome might occur, for example, if the risk premium has increased because of fears of secular stagnation, which greater federal debt could diminish. We return to this point later.

Domestic and foreign investors each currently hold about half of outstanding federal debt. For domestic investors, the demand for Treasury debt for institutional reasons allows the federal government to borrow funds at lower rates than otherwise. The difference in rates amounts to an implicit tax, and the government should adjust its debt so that the tax relative to other taxes is consistent with equity and efficiency considerations. For foreign investors, the demand for Treasury debt for institutional reasons allows the federal government to extract resources from foreigners. The government should adjust its debt to extract the maximum possible resources, as do other monopoly providers of sought-after items. Because the federal government sells debt to foreign and domestic investors alike in one market, it needs to balance these objectives, and therefore should not benefit as much from low-cost lending by foreign holders, or alleviate the implicit tax on domestic holders, as much as it would if facing only one of those groups. For both groups, though, an increase in demand for Treasury securities for institutional reasons implies that the optimal amount of debt is higher.

Under this scenario, the increase in demand applies only to Treasury securities, so investors are willing to lend funds to the federal government at lower cost than otherwise but are not willing to lend funds to private investors at lower cost. Therefore, there is no change in the price of future national consumption relative to current consumption, and thus no direct reason to change net debt of the federal government in

order to change national saving. Moreover, the value of federal nonfinancial investment relative to private investment is unchanged, as is the value of federal and private consumption relative to that of private investment.

However, increasing the amount of federal debt requires that the funds so raised be used for some purpose. If buying private financial assets is feasible, then the funds should be used for that purpose. That strategy amounts to increasing the leverage of the federal government, which increases risk. The additional risk-taking is appropriate, though, because the spread between private and Treasury returns is greater without any change in the amount of perceived risk or its price.

Yet, buying private financial assets may not be feasible because doing so would raise a host of complex issues involving the role of the government in the economy and the ability of the government to purchase assets in a neutral manner across companies and sectors. If buying financial assets is not feasible, the additional debt should be used for higher federal nonfinancial investment and consumption and for lower taxes.

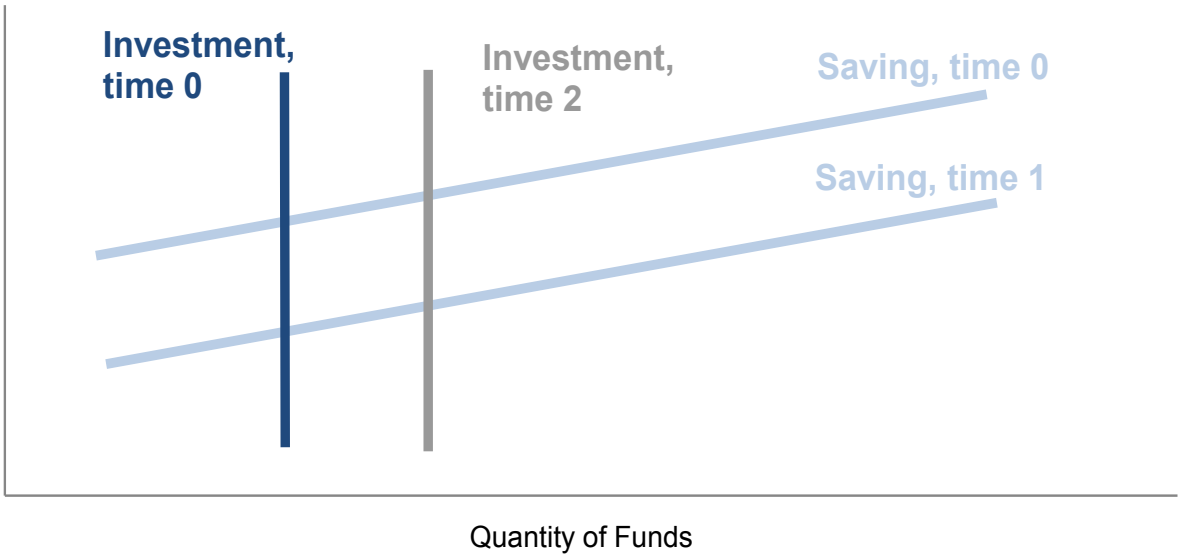
V.E. Implications of persistently low Treasury interest rates stemming from higher desired saving and investment insentivity to the cost of capital

If Treasury interest rates are lower because desired saving is higher and investment is insensitive to the cost of capital, debt should be higher, with the funds used for higher federal nonfinancial investment, and, perhaps for more consumption and for lower taxes.

To understand this conclusion, begin with a closed economy. This scenario presumes that people would like to save more but private investment does not increase enough to make use of the additional desired saving,

so the rate of return falls. Figure 29 shows an extreme version of this case, where private investment is fixed and totally unresponsive to changes in borrowing costs. In this case, an increase in desired saving at the initial interest rate simply lowers the rate of return, so that actual saving (and investment) is unchanged. With a lower rate of return, more federal investment projects are worth it, and public investment should increase.[45] This increase in investment provides a mechanism for people to actually increase their saving, and there is no crowd out of private investment.

Figure 29: Inelastic Investment, Elastic Savings



As noted above, this scenario is consistent with a secular stagnation view of the world, where an increase in desired saving may result in lower output, rather than a shift from consumption to investment. In this case, both increased public investment and increased public non-investment spending or lower taxes might be needed to maintain full employment. Even in a full-employment economy, however, under this scenario federal deficits do not affect investment. Instead, they simply crowd out private consumption—an increase in federal consumption outlays increases interest rates, causing people to save more.

Now suppose instead that the economy is open and all of the additional desired saving represents demand for U.S. assets by foreigners. Because private investment does not increase, the rate of return falls, diminishing both domestic saving and the inflow of funds from foreigners. For domestic savers who wanted to save more but were discouraged by the drop in the rate of return, a social planner would increase federal nonfinancial investment to absorb some of their desired saving (as in the closed economy). For foreign savers who are willing to provide funds at a lower rate of return, a social planner would issue more debt and use it to finance additional federal nonfinancial investment and consumption as well as lower taxes.

45 Although the deficit may increase if the federal government borrows to finance public investment, the increased borrowing does not lower national saving.

This scenario is quite similar to the earlier scenario with a lower marginal product of private capital. In that earlier scenario, additional private investment was less valuable because it would earn a lower rate of return; in the current scenario, additional private investment is not occurring for some unspecified reason. In both scenarios, desired saving does not find productive uses through additional private investment but can do so through additional federal investment. And in both scenarios, the lower return on investment implies that national consumption should increase.

However, debt should not be changed further to finance larger or smaller holdings of financial assets because the risk and return of Treasury debt relative to financial assets are unchanged.

V.F. Implications of persistently low Treasury interest rates for any reason that moves rates notably closer to the effective lower bound

Shortfalls in aggregate demand relative to the economy's potential output generate very large economic and social costs, especially through excess unemployment and underemployment. For example, between 2008 and 2015, output was below potential by a cumulative amount of nearly $6 trillion, according to the estimates in CBO (2015b); that shortfall represents roughly a third of current annual GDP. During that same

period, again by CBO's estimates, an average of 4 million additional people were unemployed relative to what would have occurred if output had remained at its potential. Therefore, the implementation of effective countercyclical economic policies is very important.

Moreover, countercyclical policies are even more important if the economy displays substantial hysteresis in the sense that shortfalls in actual output relative to its potential affect future potential output. The CBO figures just cited incorporate a small reduction in estimated potential output attributable to lost capital investment, a reduction in the labor force, and weaker productivity growth stemming from the recession and slow recovery. Therefore, from CBO's perspective, the loss in output from the downturn is a little larger than the figures just cited. But some other analysts have argued that hysteresis is more significant than CBO has estimated. For example, Blanchard, Cerutti, and Summers (2015) examine recessions in the OECD economies in the past 50 years and find strong evidence that the level of GDP five to ten years later is lower than prerecession trends—that is, recessions appear to have permanent effects on output.[46] Reviewing the long-term effects of weak demand in Japan, Adam Posen (2015) recently wondered "whether a message we should take from the Japanese experience is to avoid bad states of the economy at almost any cost." To the extent that hysteresis is important, the benefits of macroeconomic stabilization are substantially larger than otherwise.

Unfortunately, persistently low Treasury interest rates move rates notably closer to the effective lower bound, which significantly reduces the ability of countercyclical monetary policy to achieve macroeconomic stabilization. As a result, federal debt should be higher than otherwise, with the funds used for higher federal nonfinancial investment and consumption and for lower taxes. In addition, federal debt should be more strongly countercyclical. However, if buying private financial assets is feasible and rates are not stuck

46 See also Ball (2009), DeLong and Summers (2012), and Fatas and Summers (2015).

at the effective lower bound, then debt should still be higher than otherwise but the funds raised should be used to buy financial assets instead. Note also that the limitation on monetary policy created by low interest rates depends on nominal rates rather than the inflation-adjusted rates we have been discussing so far, and it does not depend on why rates are low.

V.F.1. Reduced effectiveness of countercyclical monetary policy with low Treasury rates

When actual output falls short of potential output, expansionary monetary policy can substantially boost employment relative to what it would otherwise be. Achieving sufficiently expansionary policy in recent recessions has required substantial reductions in the federal funds rate to low levels. Between 1989 and 1992, the Federal Reserve cut the federal funds rate by almost 7 percentage points (from 9¾ percent to 3 percent); between 2001 and 2002, the Federal Reserve cut the funds rate by more than 5 percentage points (from 6½ percent to 1¼ percent); and between 2007 and 2008, the Federal Reserve cut the funds rate by 5 percentage points (from 5¼ percent to a range of 0 to ¼ percent) and then turned to quantitative easing to provide additional monetary stimulus.

However, persistently low inflation-adjusted Treasury rates combined with low inflation will lead to low equilibrium values for the federal funds rate when output is near potential and thereby sharply limit the

ability of monetary policy to counteract future recessions. For most of the past eight years, monetary policy has been constrained by the effective lower bound on the federal funds rate: Although the Federal Reserve undertook quantitative easing to spur aggregate demand, that was not a complete substitute for the ability to lower the funds rate further. Looking ahead, the average prediction by members of the Federal Open Market Committee (FOMC) is that the nominal federal funds rate will reach a little under 3 percent “in the longer run” (Federal Reserve Board, 2016). If that prediction is accurate, the Federal Reserve would be unable to ease monetary policy nearly as much as it did in any of the three previous recessions. Moreover, participants in financial markets are anticipating lower funds rates during the next several years than the FOMC is anticipating. Therefore, the risk that the Federal Reserve will be unable to reduce the funds rate as much as is warranted in the next recession is substantially higher than most analysts expected a dozen years ago when assessments of that risk were undertaken.[47]

An extreme version of this situation would arise if the equilibrium short-term interest rate remained below zero. That outcome would represent secular stagnation—when aggregate demand is weak enough that actual output falls below potential even with a federal funds rate near zero. Summers (2013, 2014, 2015a, 2015b) and others have argued that the economy might experience such secular stagnation.[48] Moreover, secular stagnation is self-reinforcing because weakness in output relative to potential tends to lower inflation, which makes it more difficult for the Federal Reserve to reduce real interest rates.

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47 See Laubach and Williams (2003, 2015). There is a further risk that some factors that are lowering interest rates are also making the economy less responsive to any given reduction in interest rates. Dudley (2012) argued that the aging of the baby boomers has made the economy less responsive to monetary policy “because such age groups tend to spend less of their incomes on consumer durables and housing,” which are the sorts of spending where lower interest rates generally encourage consumers to “pull forward” purchases they might otherwise have waited to make.

48 For more discussion, see Bernanke (2015), Krugman (2015), and Teulings and Baldwin (2014).

Secular stagnation might arise because of weakness in domestic demand or weakness in foreign demand for U.S. goods and services. One possible source of such weakness that has received particular attention recently is an increased demand by foreigners for U.S. assets that might stem from stagnation in other countries; the resulting inflow of funds would push up the exchange value of the dollar and thereby reduce U.S. exports and increase U.S. imports. Caballero, Farhi and Gourinchas (2015) argued that a "growing global shortage of safe assets imparted a strong downward secular trend to world real (safe) interest rates for more than two decades" and that "capital flows acted as the propagating mechanism by which the asset-scarce regions [China, the Middle East, and Japan] dragged [the interest rates of] asset-rich regions [such as the United States] down." They concluded that, when interest rates are extremely low around the world, "lower global output … rebalances global asset markets … [as] liquidity traps emerge naturally and countries drag each other into them."

Secular stagnation differs from a situation in which potential output is increasing slowly—say, because of slow growth of the labor force or productivity. When potential output grows slowly, economic growth will generally be slow, but short-term interest rates could be well away from the effective lower bound. Indeed, if potential output grew slowly but demand was strong, monetary policymakers might need to raise interest rates to fairly high levels to prevent an increase in inflation.

The U. S. economy is not in secular stagnation now, and we do not think that it will be in the future—

although that outcome is a risk. Despite tepid economic growth in the past few years, economic slack has diminished considerably, as can be seen in the decline in the unemployment rate and other measures of labor underutilization. That pattern implies that, although monetary policy has been constrained by the effective lower bound on short-term interest rates, the Federal Reserve has been able to lower the cost of credit below its equilibrium level, and output has grown slowly because its potential has grown slowly. In addition, we think there are still headwinds to household and business demand stemming from the financial crisis, recession, and slow recovery—as we discussed above—so we expect the equilibrium rate to increase over time. Still, given the many reasons that interest rates are likely to be much lower than in the past, and the fact that the Federal Reserve's target for inflation is below the average inflation rate in the past, secular stagnation is a risk.

Moreover, even if the economy avoids secular stagnation and equilibrium short-term interest rates remain positive, such rates will probably stay quite low relative to the experience of the past few decades, which means that countercyclical monetary policy will probably be significantly constrained relative to past experience. Faced with shocks to aggregate demand of the sort we have seen in past downturns, the Federal Reserve would not be able to reduce interest rates as much as it did previously.

V.F.2. Possible responses apart from federal budget policy

There are at least three possible responses to the limitations of monetary policy in an environment of low interest rates that do not involve federal budget policy. First, the Federal Reserve could employ greater amounts of quantitative easing during future downturns. However, quantitative easing does not appear to be a complete substitute for reductions in the funds rate (see, for example, Curdia and Ferrero, 2013).

Second, there might be institutional changes that would relax the effective lower bound on interest rates. The effective lower bound is sometimes described as the "zero lower bound," but several central banks, including the ECN and the Central Banks of Denmark, Sweden, Switzerland, and Japan have lowered certain short-term interest rates below zero in recent years. Their actions raise the possibility that the Federal Reserve could make the funds rate at least slightly negative. Moreover, some economists are trying to devise fundamental changes in the monetary system that would eliminate a lower bound on interest rates (see, for example, Centre for Economic Policy Research, 2015). How effective such changes might be is very unclear to us.

Third, the Federal Reserve could raise inflation and thereby raise equilibrium nominal interest rates by increasing its inflation target and implementing looser monetary policy to move inflation up to that target. Such a change would raise a variety of issues, including the future credibility of the Federal Reserve and the costs of higher inflation. Yellen (2015) offered a set of objections to raising the inflation target.

Although examining those three possible responses in depth is beyond the scope of this paper, we think it is unlikely that those responses will be implemented to a sufficient degree to entirely eliminate the problem of interest rates being notably closer to the effective lower bound than they have been in the past.[49] Therefore, we turn next to the appropriate response by federal budget policy, considering first the response if rates are stuck at the effective lower bound (supposing that occurred in the future) and then the response if they are not.

V.F.3. Budget policy if interest rates are stuck at the effective lower bound

If interest rates are stuck at the effective lower bound at some point in the future, then federal debt should be higher than otherwise, with the funds used for higher federal nonfinancial investment and consumption and for lower taxes.

In this scenario, the country would have unused labor and capital resources. Higher federal spending (on investment or consumption) and lower taxes would increase resource utilization and thereby allow for higher national consumption both currently and in the future. The best combination of changes in those elements of the federal budget would depend both on their direct value to people and on their effect on aggregate demand.[50] For any combination, net debt should be higher to finance the higher federal spending and lower taxes.

Debt should be higher to create higher net debt. The only alternative way to create higher net debt would be for the federal government to sell financial assets. However, most of the financial assets it owns are related to specific federal programs, and the feasibility of selling those assets is not clear. Moreover, even if such sales were feasible, they might be less effective at increasing resource utilization than would raising federal spending and reducing taxes.

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49 Another concern that has been raised about low interest rates is their effect on risk-taking. Stein (2013), Becker and Ivashina (2015), and others have argued that very low rates encourage so much risk-taking by private investors that the fragility of the financial system is increased. That concern appears to involve inflation-adjusted interest rates, so it cannot be addressed through higher inflation; whether it can be addressed through the other responses listed here is not clear.

50 For a discussion of budget policies that might increase aggregate demand without changing the overall budget balance significantly, see Feldstein (2015). However, those policies would probably have limited effects relative to the scale of a substantial economic downturn.

In addition to increasing resource utilization by raising aggregate demand, issuing more debt would have two other effects that would lessen the degree of constraint on monetary policy imposed by the effective lower bound. First, it would generate upward pressure on Treasury interest rates. As argued by Caballero et al. (2015): "There are no good substitutes in sight for the role played by U.S. Treasuries in satisfying global safe asset demand … dragging down (safe) interest rates and inflation, and therefore keeping the world economy (too) near the dangerous" lower bound. Second, it would create additional assets that could be purchased by the Federal Reserve for quantitative easing without playing favorites among private debt issuers. That advantage would be even more important if Fannie Mae and Freddie Mac were privatized.

The situation envisioned here presumably could not continue indefinitely. Rising federal debt would ultimately tend to increase interest rates by raising the perceived riskiness of Treasury securities.

V.F.4. Budget policy if interest rates are not stuck at the effective lower bound

If interest rates are not stuck at the effective lower bound but are notably closer to it than in past periods, then federal debt should be higher than otherwise, with the funds used for higher federal nonfinancial investment and consumption and for lower taxes. In addition, debt should vary more over the business cycle than if rates were not close to the lower bound. However, if buying private financial assets is feasible, then debt should still be higher than otherwise but the funds raised should be used to buy financial assets instead.

Debt should be higher, on average, because upward pressure on Treasury rates would lessen the frequency with which the effective lower bound becomes a constraint and would lessen the degree of constraint when it was binding. For example, in CBO's estimates based on a Solow-type growth model, 1 percentage point of additional federal debt relative to GDP raises Treasury interest rates by 1 basis point; thus, if the debt-to-GDP ratio stayed at its current level, interest rates would be about 40 basis points higher than if the debt-to-GDP ratio returned to its average of the past 50 years. In addition, the availability of additional assets that could be purchased by the Federal Reserve for quantitative easing would lessen the degree of constraint from the effective lower bound, as noted above.

Net debt, federal investment, federal consumption, and taxes should vary more over the business cycle in this scenario. When the effective lower bound is a constraint, higher federal spending and lower taxes would increase resource utilization and thereby allow for higher national consumption both currently and in the future. But to achieve a chosen average level of debt across slumps and booms, smaller deficits or surpluses would be needed during booms. Variability in the federal budget can itself generate costs, and those costs should be considered in deciding what components of spending and taxes should vary most. For example, variation in tax rates and in the federal share of Medicaid spending would probably have smaller costs than variation in infrastructure investment. In addition, efforts should be made to build automatic fiscal stabilizers that are more powerful than existing stabilizers and that respond very rapidly.

If buying financial assets is feasible, then the additional debt should be used to purchase such assets during periods when the effective lower bound is not a constraint. During those periods, the price of future national consumption relative to current consumption is unchanged and net debt would ideally not be changed. By

the same logic, federal nonfinancial investment, consumption, and taxes should not be changed during those periods either.

If buying financial assets is infeasible, then debt should be higher to create more net debt. Federal nonfinancial investment and consumption should be higher, and taxes lower, on average, as uses of the funds from higher debt.

VI. IMPLICATIONS OF PERSISTENTLY LOW TREASURY INTEREST RATES FOR FEDERAL INVESTMENT

The previous subsections describe why most alternative explanations for persistently low Treasury interest rates imply that federal investment should be higher than otherwise. Assessing whether such investment should be increased from current levels requires a broader assessment of the costs and benefits of doing so. That broader assessment lies beyond the scope of this paper, but three sets of points deserve mention.

First, under the current statutory limits on annual appropriations, federal nondefense investment as classified by OMB will soon fall to the smallest share of GDP in a half-century. That is, federal investment will be declining even though persistently low interest rates imply that it should be rising. That decline would be appropriate only if other factors imply that federal investment should be lower than it is. Some categories of federal spending that are not classified as investment by OMB but that nonetheless contribute to future output—such as certain benefits for poor families with children—will rise, and others will fall, under current law.

Second, the return to federal investments is generally very difficult to assess and varies significantly across investments. Returns to some types of investments, such as highways, have been the subject of research for decades, and the economic return to benefits for poor families is now receiving increasing attention from researchers. Still, returns to many other types of investments have not been the subject of careful study. Moreover, returns vary considerably within broad types; consider the different values of improving key highway links versus building “bridges to nowhere.”

Essentially as a placeholder, CBO (2014b) assumes that the return to additional unspecified federal investment in terms of future GDP would be half the return on private capital (with a range of uncertainty from zero up to the return on private capital). CBO states that the range is set below the return to private capital for two reasons: One is that public investments are often chosen not solely for their effect on future GDP but also for their effects on other aspects of well-being; consider, for example, better parks or better highways to reduce commuting times. The other reason is that additional federal investment probably reduces investment by state and local governments and by the private sector (as has been shown for highway funding). Neither of these factors lowers the social return to federal investment, and so should not be used when deciding whether a public infrastructure project will improve welfare.[51] CBO’s estimate also excludes the effect of federal investment on output through the boost to aggregate demand, and it excludes any long-term effect from hysteresis.

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51 Investments in projects that improve air quality, for example, can have significant social benefits without showing up as increased GDP. And, when an increase in federal spending on transportation is offset by a fall in state spending on transportation, net state and local saving borrowing decreases, leading to interest savings for state and local governments.

Improving the choice of federal investments through more rigorous analysis could increase the average return, and that is a key goal of some components of federal investment programs and of some proposals for a federal infrastructure bank. However, employing more rigorous analysis comprehensively is difficult, in part because the federal government often delegates the specific decisions about investments to state and local governments (as with most highway funding, for example). In any event, additional federal investment would be more favorable for future budget outcomes than would additional federal consumption.[52]

Third, the returns to certain federal investments are probably high enough that borrowing to finance such investments would "pay for itself" in budgetary terms, but it is unclear whether that would be true for an across-the-board increase in federal investment. Certainly, such an outcome is more likely when actual output falls short of potential and the federal funds rate is very close to the effective lower bound—and is more likely if hysteresis is significant.[53] More importantly, whether borrowing to finance government investments pays for itself in budgetary terms is not the appropriate criterion in deciding whether to follow that approach, because requiring a project to pay for itself is too high a bar. Instead, the government should pursue any projects which are expected to provide a risk-adjusted return that is greater than the government's borrowing costs; the risk-adjusted return should include returns not measured in GDP or taxable income, but also should include a measure of the deadweight loss associated with financing the project.

Some analysts advocate an increase in public investment, but only so long as it is paid for—that is, so long as it does not increase the deficit. In our view, this is not the correct way to approach the question. Borrowing to finance worthwhile public investment is appropriate: even if that borrowing crowds out private investment, there is still a net benefit to society. The only caveat to this conclusion is if there is an issue with "fiscal space." Although worthwhile public investments may increase the capacity of the federal government to pay off its debts, it is possible that foreign creditors would not distinguish between debt that finances investment and debt that finances consumption; in that case, there might be some argument for doing certain investments only if they are paid for.

In some situations, a government might want to both increase public infrastructure and increase national saving–this would be an appropriate response to population aging, for example—and, in this case, the government should take measures to "pay for" the investment. But, in other cases—for example, in response to the global savings glut—the government may want to increase public infrastructure without reducing national consumption, and in such cases borrowing to finance infrastructure projects with social returns exceeding borrowing costs is perfectly appropriate.

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52 See Ostry, Ghosh, and Espinosa (2015) for discussion.

53 See DeLong and Summers (2012). In addition, Draghi (2015) said: "If interest rate savings are used for current spending the risk increases that the debt becomes unsustainable when interest rates go up. Ideally, the savings are instead spent on public investments whose rates of return permit repayment of the interest when it rises. Growth is maintained today and future public finances are not destabilised when rates go up. Obviously it's not simple because, as we know, there aren't many public investments with a high rate of return."

VII. CONCLUSION

This paper has analyzed the main factors that should affect federal budget policy now: the high current level of the debt relative to GDP, the projected deficits stemming from population aging, and the implications of persistently low Treasury borrowing rates. Some of our conclusions reflect the conventional wisdom: Given the budgetary pressures of population aging, reductions in federal spending or increases in taxes relative to what would occur under current law eventually will be needed, and the desirability of increasing fiscal space argues for making those changes sooner rather than later. But persistently low interest rates imply that policy changes should be deferred and reduced in size, a consideration that has received far less attention from analysts and is not well understood by policymakers. Similarly, persistently low interest rates imply that increasing government investment should be an important current priority for policymakers.

Our analysis should be viewed as an attempt to understand the various determinants of optimal budget policy. We are unable to determine the optimal ratio of debt to GDP or the optimal path of government deficits. Our analysis suggests however, that the response to the high level of debt and to population aging should be quite gradual.

Table 2: Implications for Fed. Budget Policy of Persistently Lower Treasury Int. Rates	
If Treasury rates are lower because …	**Then—relative to whatever levels would be appropriate with higher rates—net debt (debt less holdings of assets), federal nonfinancial investment, financial asset holdings**
The marginal product of private capital is lower because TFP has declined	The effects on net debt are ambiguous: On the one hand, the price of future consumption relative to current consumption is higher, suggesting national saving should fall. On the other hand, future generations are poorer than they otherwise would be, suggesting national saving should increase. The net effect depends on parameters of the utility and production functions. If the capital stock is beyond the Golden Rule level, then net debt should increase to lower the capital stock. If the rate of return on federal nonfinancial investment has not changed, then investment should increase because its value relative to that of private investment is higher. This investment should be debt financed. Debt should not be changed further to finance larger or smaller holdings of financial assets because the risk and return of Treasury debt relative to financial assets are unchanged.
The marginal product of private capital is lower because domestic time preference has decreased	If domestic savers want to increase saving and are willing to accept lower returns then the government should lower net debt to reflect those changing preferences.[54] Public investment should increase because its value relative to the marginal cost of funds is higher. This investment should be debt financed. Debt should not be changed further to finance larger or smaller holdings of financial assets because the risk and return of Treasury debt relative to financial assets are unchanged.
The marginal product of private capital is lower because foreign time preference has decreased	If changes in foreign preferences result in increased foreign investment in the US and a lower marginal product of capital, the US government should increase its net debt. The change in the marginal product of capital means that the price of future consumption relative to current consumption has increased. And because the US as a whole has a roughly zero net foreign asset position, the change in the marginal product of capital has no income effect for the country as a whole, so only the substitution effect operates and national saving should decrease. Furthermore, from the perspective of the US government, a fall in the interest rate has a positive income effect, strengthening the case for more debt. Public investment should increase because its value relative to the marginal cost of funds is higher. This investment should be debt financed. Debt should not be changed further to finance larger or smaller holdings of financial assets because the risk and return of Treasury debt relative to financial assets are unchanged.

54 Assuming that the mix of private/public consumption was correct before the change in preferences, an increase in the desire to save should probably be accommodated by reducing both public and private consumption.

The risk premium on private assets is higher	Net debt should not be changed because the price of future national consumption relative to current consumption is unchanged Federal nonfinancial investment, consumption, and taxes should not be changed because the risk-adjusted value of federal and private consumption relative to that of private investment is unchanged. Debt should not be changed to finance larger or smaller holdings of financial assets because the larger difference in return on financial assets corresponds to greater risk or price of risk (unless the government's ability to bear risk, relative to that of the private sector, has also increased).
The demand for Treasury securities is higher for institutional reasons	Debt should be higher to increase the gains from low-cost lending by foreign holders and to reduce the implicit tax on domestic holders. If buying financial assets is feasible: Net debt should not be changed because the price of future national consumption relative to current consumption is unchanged. Debt should not be increased to finance higher federal nonfinancial investment because the value of such investment relative to private investment is unchanged. Federal consumption and taxes should not be changed because the value of federal and private consumption relative to that of private investment is unchanged. If buying financial assets is infeasible: Net debt should be higher to allow for higher debt. Federal nonfinancial investment and consumption should be higher, and taxes lower, as uses of funds from higher debt.
Desired saving is higher and investment is insensitive to the cost of capital	Federal nonfinancial investment should be higher to make use of some of the additional desired saving and to account for the lower cost of capital. If the increase in desired saving is foreign, then net debt should be higher because the relative cost of future consumption has increased. Debt should be higher to create higher net debt, but it should not be changed further to finance larger or smaller holdings of financial assets because the risk and return of Treasury debt relative to financial assets are unchanged.
Any reason that moves rates notably closer, on average, to the effective lower bound on rates	If rates are stuck at the effective lower bound: Net debt should be higher because higher federal spending or lower taxes would increase resource utilization and thereby allow for higher national consumption both currently and in the future.

	Debt should be higher to create higher net debt. Also, the resulting increase in Treasury rates and assets that could be purchased by the Fed would lessen the constraint of the effective lower bound. Federal nonfinancial investment and consumption should be higher, and taxes lower, to increase resource utilization. If rates are not stuck at the effective lower bound: Debt should be higher, on average, because upward pressure on Treasury rates would lessen the frequency with which the effective lower bound becomes a constraint, and that upward pressure and additional assets for purchase by the Federal Reserve would lessen the degree of constraint when it occurs. Net debt, federal investment, federal consumption, and taxes should vary more over the business cycle, because when the effective lower bound is a constraint, higher federal spending or lower taxes would increase resource utilization and thereby allow for higher national consumption both currently and in the future. If buying financial assets is feasible: The additional debt should be used to purchase such assets during periods when the effective lower bound is not a constraint, because the price of future national consumption relative to current consumption is unchanged and net debt ideally would not be changed. Federal nonfinancial investment, consumption, and taxes should not be changed during those periods either. If buying financial assets is infeasible: Debt should be higher to create more net debt. Federal nonfinancial investment and consumption should be higher, and taxes lower, on average, as uses of funds from higher debt.

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