

The Uncertainty of Long-Term Budget Projections

Budget projections are inherently uncertain. The projections in this report generally reflect current law and estimates of future economic conditions and demographic trends. However, if future policies governing taxes and spending diverge from what is prescribed in current law, budgetary outcomes will differ from those in the Congressional Budget Office’s extended baseline, as the preceding chapter shows. Even if laws do not change, the economy, demographics, and other factors will undoubtedly differ from what CBO projects, and those variations will in turn cause budgetary outcomes to deviate from the projections in this report. Those differences could be within the ranges of experience observed in the relevant historical data—which, for the factors that CBO analyzes, cover roughly the past 50 to 70 years—or they might depart from historical experience. Moreover, significant budgetary effects could result from channels that CBO has not attempted to quantify in its analysis.

To illustrate some of the uncertainty associated with long-term budgetary outcomes, CBO constructed alternative projections that show what would happen to the budget if the values for various underlying factors differed from those used in the extended baseline. The alternative projections are based largely on the variation over time in the underlying factors’ 30-year averages, as well as on consideration of possible future economic and demographic developments. The agency focused on four factors that are among the most fundamental—and yet most uncertain—inputs into its long-term economic and budget projections. Specifically, CBO quantified the consequences of alternative paths for the following variables:

- The labor force participation rate,
- The growth rate of total factor productivity—that is, the growth of real (inflation-adjusted) output that is not explained by the growth of labor and capital,¹

- Interest rates on federal debt held by the public, and
- The growth rate of federal spending per beneficiary for Medicare and Medicaid.

Different paths for those four factors would affect the budget in various ways. For example, lower-than-projected labor force participation rates would diminish the size of the labor force and thereby reduce tax revenues. Faster growth in spending per beneficiary for Medicare and Medicaid would boost outlays for those two programs. Either of those changes would increase deficits and debt, which would lead to reduced output and higher interest rates—leading to macroeconomic feedback that would further worsen the budget outlook. By contrast, faster growth in total factor productivity (henceforth referred to in this chapter simply as productivity) or lower interest rates on federal debt held by the public would have the opposite effects on the budget. Those changes would reduce deficits and debt—in the former case, by increasing output and revenues, and in the latter case, by lowering the government’s interest payments.

The projected budgetary outcomes under the alternative paths vary widely. In CBO’s analysis, when only one factor at a time changes, projections of federal debt held by the public in 2046 range from 103 percent of gross domestic product (GDP) to 192 percent; under the extended baseline, federal debt as a share of GDP is projected to be 141 percent. Among the four factors, the simulated variation in labor force participation rates has much smaller effects on the budget over 30 years than the simulated variations in productivity, interest rates, and spending for Medicare and Medicaid. When all four factors change at once—but by only 60 percent as much as when they vary individually—projections of federal debt in 2046 range from 93 percent to 196 percent of GDP. Those projected levels of debt are all high by historical standards; compared to the peak reached in 1946, when federal debt amounted to 106 percent of GDP, the projections range from slightly less than that record high to nearly twice that amount. Even at the low end of that range, debt would be higher than it is now.

1. Total factor productivity is different from labor productivity, which is the amount of goods and services that can be produced per hour of labor.

The four factors listed above are not the only ones that could differ from what is projected in CBO's extended baseline and affect budgetary outcomes. For example, higher rates of fertility or greater immigration flows would mean an increase in the ratio of working-age adults to older adults—with increased revenues collected from workers more than offsetting the additional spending resulting from increases in the number of older people receiving benefits. Moreover, changes in earnings inequality could affect the budget relative to CBO's projections through revenues from individual income taxes, spending on means-tested programs, and so on. Similarly, decisions by states about how much they spend on Medicaid could increase or decrease federal spending relative to CBO's projections.

Other types of developments could also have significant effects on the budget that are not quantified in this analysis—for example, an economic depression, such as the one that occurred in the United States in the 1930s; unexpectedly large losses on federal credit or insurance programs, such as those involving mortgage guarantees; a catastrophe or major war; unexpectedly significant effects of climate change; or the development of a previously underused natural resource. Any of those occurrences could create conditions in the next 30 years that are substantially better or worse than those reflected in the historical data on which CBO's based its analysis. The analytic approach the agency used for this long-term analysis focuses on projecting average outcomes.

Policymakers could address the uncertainty associated with long-term budget projections in various ways. For instance, they might design policies that partly insulated the federal budget from some unanticipated events; however, those policies could have unwanted consequences, such as shifting risk to individuals. Another possibility is that policymakers might aim for a smaller amount of federal debt to provide a buffer against the budgetary impact of adverse events and allow for more flexibility in responding to unexpected crises in the future.

Long-Term Budgetary Effects of Changes in Four Key Factors

Budgetary outcomes could differ from CBO's projections if values for the four factors mentioned above—labor force participation rates, the growth rate of productivity, interest rates on federal debt, or the growth of federal spending per beneficiary on Medicare and Medicaid—diverged from those underlying the extended baseline projections

in this report. Unexpected changes in labor force participation rates would alter the size of the labor force, output, and tax revenues. Changes in productivity would lead to changes in economic output, which would affect both revenues and spending. Changes in the interest rates on federal debt would affect the amount of interest paid by the government. And changes in the growth rate of federal health care spending, one of the largest components of the budget, would have significant implications for overall federal spending.

For CBO's alternative projections, the variation in those four factors over time offers a guide (though an imperfect one) to the amount of uncertainty that surrounds projections of those individual factors over the next 30 years. History is not an indicator of all future uncertainty, however. For that reason, CBO also considered the effects of possible future developments on the ranges used in the alternative projections.

Furthermore, to better capture the overall uncertainty of the combined effects of those individual factors, CBO also constructed two projections in which all four factors simultaneously varied from their values under the extended baseline. In one of those cases, all of the factors varied in ways that increased the amount of federal debt; in the other, they varied in ways that reduced the amount of the debt.²

In CBO's extended baseline, which reflects the expected outcomes of those four factors, federal debt held by the public would equal 141 percent of GDP in 2046. Alternative projections of the factors would lead to the following outcomes:

2. Another approach to quantifying the uncertainty of budget projections would be to create a distribution of outcomes from a large number of simulations in which factors such as productivity growth, interest rates, and the rate of increase in health care costs varied around an expected outcome. CBO generally uses that approach in its reports on the financial outlook for the Social Security trust funds. See Congressional Budget Office, *CBO's 2015 Long-Term Projections for Social Security: Additional Information* (December 2015), www.cbo.gov/publication/51047, and *Quantifying Uncertainty in the Analysis of Long-Term Social Security Projections* (November 2005), www.cbo.gov/publication/17472. However, the analysis presented here focuses on uncertainty as it relates to the expected outcomes themselves, rather than variation around those outcomes. Determining the appropriate variation in expected outcomes and estimating the distribution of outcomes for the federal budget as a whole would require additional modeling tools that CBO has not yet developed.

- If the labor force participation rate was, on average, about 2 percentage points higher or lower over the 2017–2046 period than is projected in CBO’s extended baseline, and was about 3.0 percentage points higher or lower in 2046, federal debt held by the public that year would be 137 percent of GDP (if participation was higher) or 144 percent (if participation was lower).
- If productivity grew 0.5 percentage points per year more quickly or more slowly than it does in CBO’s extended baseline, federal debt held by the public in 2046 would be 112 percent of GDP (if productivity growth was faster) or 173 percent (if productivity growth was slower).
- If the average interest rate on government debt was 1.0 percentage point lower or higher than that in CBO’s extended baseline, federal debt held by the public in 2046 would be 108 percent of GDP (if the rate was lower) or 188 percent (if the rate was higher).
- If spending per beneficiary for Medicare and Medicaid grew 1.0 percentage point per year more slowly or more quickly than it does in CBO’s extended baseline, federal debt held by the public in 2046 would be 103 percent of GDP (if spending grew more slowly) or 192 percent (if spending grew more quickly).
- If all four factors deviated from their baseline values in ways that reduced deficits but did so by only 60 percent as much as in the cases specified above, federal debt held by the public in 2046 would be 93 percent of GDP; if all four factors deviated in ways that increased deficits but did so by only 60 percent as much as in the cases described above, federal debt held by the public would be 196 percent of GDP.

Those alternative projections incorporate macroeconomic feedback. For example, increased government borrowing would eventually reduce private investment in productive capital. The result would be a smaller stock of capital and lower output and income in the long term than would otherwise be the case. Lower income would reduce tax revenues. Federal noninterest spending would be lower if income was lower—although the effect would be smaller than that on revenues—because Social Security benefits are linked to earnings and because total spending on health care tends to vary with total income over the long term. CBO assumed that changes in income would not affect other noninterest spending. Therefore, budgetary feedback from increased government borrowing would

lead to lower spending and still lower revenues, which would result in increased deficits and federal debt. Budgetary feedback from decreased government borrowing would work in the opposite direction.

Labor Force Participation

The labor force participation rate is the percentage of people in the civilian noninstitutionalized population who are age 16 or older and either working or actively seeking work. That rate reflects people’s decisions about the attractiveness of working or searching for work compared with such alternatives as attending school, caring for family members, or retiring. Key determinants include the demographic characteristics of the population and economic conditions. In CBO’s extended baseline, labor force participation is projected to decline from about 63 percent in 2017 to about 58 percent in 2046.³

The average rate of labor force participation during the 30-year period from 1986 through 2015 was about 6 percentage points higher than it was from 1949 through 1978, the earliest period for which published data are available (see Figure 7-1). That increase was largely driven by long-term increases in women’s labor force participation. The rate of participation for women climbed from 33 percent in 1949 to a peak of 60 percent in 1999 before slowly declining to 57 percent in 2015. The increase in women’s labor force participation was partially offset by declines in men’s rate of participation, which fell from 87 percent in 1948 to 69 percent in 2015.

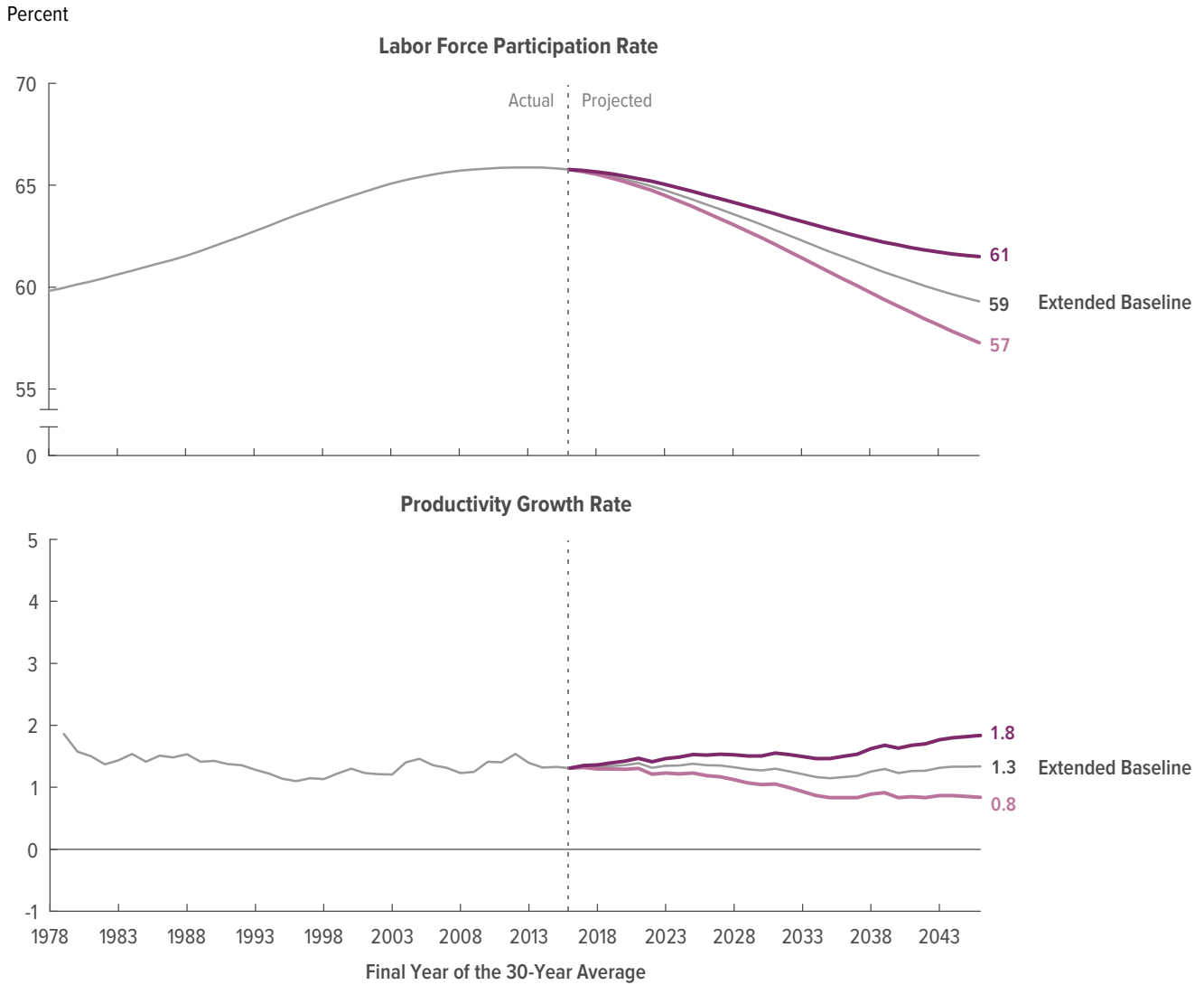
Variations in labor force participation rates affect the federal budget by changing output and income and by changing the interest rates the federal government pays on public debt.⁴ For example, income from higher labor force participation increases tax revenues. With respect to interest rates, higher labor force participation increases the ratio of labor to capital—factories and computers, for example—and thereby makes capital more productive, which implies a higher rate of return on investment in private capital, all else being equal. According to widely

3. For more information on CBO’s labor force projections, see Appendix A of this report and Congressional Budget Office, *The Budget and Economic Outlook: 2016 to 2026* (January 2016), Chapter 2, www.cbo.gov/publication/51129.

4. To simplify this uncertainty analysis, CBO did not project budgetary effects of changes in labor force participation rates on means-tested programs beyond the agency’s estimates of the way potential GDP affects spending for such programs.

Figure 7-1.

The 30-Year Averages CBO Used to Illustrate Uncertainty in Long-Term Budget Projections



Sources: Congressional Budget Office; Bureau of Labor Statistics; Federal Reserve; Social Security Administration.

To illustrate some of the uncertainty associated with long-term budgetary outcomes, CBO constructed alternative projections that show what would happen to the budget if four underlying factors differed from the values that were used to construct the extended baseline. This figure shows the projected variation in those factors, which is based largely on the historical variation in the factors' 30-year averages and begins in 2017.

The extended baseline generally reflects current law, following CBO's 10-year baseline budget projections through 2026 and then extending most of the concepts underlying those baseline projections for the rest of the long-term projection period.

The 30-year average for a given year is the average of the data value for that year and the values for the preceding 29 years. For example, the 30-year average for productivity growth in 2015 is the average of the growth of productivity in years 1986 through 2015.

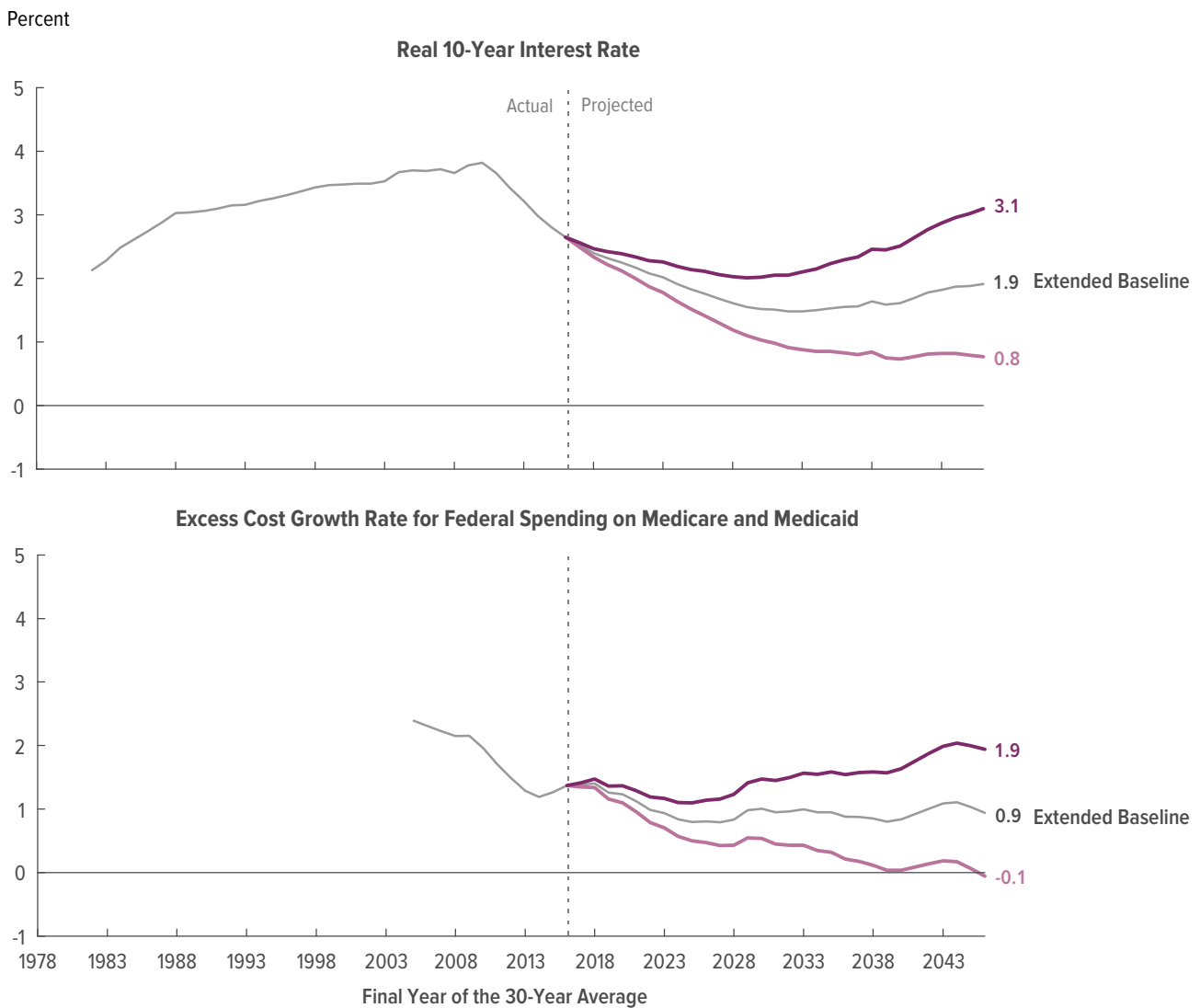
The labor force participation rate is the percentage of people in the civilian noninstitutionalized population who are age 16 or older and either working or actively seeking work.

Productivity growth is the growth of total factor productivity—that is, the growth of real (inflation-adjusted) output that is not explained by the growth of labor and capital.

Continued

Figure 7-1. Continued

The 30-Year Averages CBO Used to Illustrate Uncertainty in Long-Term Budget Projections



Excess cost growth refers to the extent to which the growth rate of nominal health care spending per person—adjusted for demographic characteristics of the relevant populations—exceeds the growth rate of potential gross domestic product per person. (Potential gross domestic product is the maximum sustainable output of the economy.)

The different periods shown for actual data reflect the availability of those data.

used economic models, if growth in labor force participation increases, that rate of return remains higher over time. Because the federal government competes with private borrowers for investors’ money, higher returns from private investment should push up interest rates paid by the federal government.⁵

To assess the budgetary effects of labor force participation rates that differ from CBO’s central estimates, the agency projected outcomes if the labor force participation rate grew or shrank each year for 30 years relative to CBO’s extended baseline.⁶ In CBO’s baseline projection, the labor

force participation rate is 58 percent in 2046. In the alternative projections, the labor force participation rate

- For example, in the Solow-type growth model that CBO used for this analysis, if labor force participation rates in 2046 were 3 percentage points higher than projected in the extended baseline, the average interest rate on federal debt held by the public that year would be about 0.4 percentage points higher than the baseline value. For details of that model, see Congressional Budget Office, *CBO’s Method for Estimating Potential Output: An Update* (August 2001), www.cbo.gov/publication/13250.
- CBO’s central estimates represent expected outcomes when key inputs to the analysis are at the midpoints of their ranges.

over the entire 2017–2046 period is, on average, about 2 percentage points higher or lower than in CBO’s baseline, and it is about 3 percentage points higher or lower in 2046. The labor force participation rate could be that high or low for various reasons:

- People who were ages 16 to 24 in the midst of the 2007–2009 recession and during the slow recovery that followed have displayed historically low rates of labor force participation. Because it is uncertain how much those participation rates have been held down for temporary reasons (such as weakness in the labor market) or persistent ones (such as people over age 16 spending a greater proportion of time as full-time students), projections of their future labor force participation are particularly uncertain. If, as members of that group got older, they were to participate in the labor force at higher rates than CBO projects in its extended baseline, the overall rate of participation would rise above 58 percent, the level projected for 2046. Furthermore, it is uncertain whether labor force participation rates for that group foretell the participation rate for future generations. If, over the next 30 years, people turning age 16 increased their labor force participation relative to those who turned 16 over the past decade, the overall labor force participation rate would be higher than projected in CBO’s extended baseline. Labor force participation would fall below CBO’s projections if, in the future, the participation rate of people over age 16 decreased relative to the baseline as they got older or if they entered the labor force at lower rates than projected in CBO’s baseline.
- The structure of the tax system under current law is projected to raise effective tax rates on earnings from labor and thus reduce the amount of labor that workers choose to supply. Those changes are mainly attributable to the following: the gradual shift of income into higher tax brackets, because income grows faster than prices; and the implementation of a new tax on certain employment-based health insurance plans with high premiums, which is scheduled to go into effect in 2020 and is projected to affect a growing number of people over time. Workers’ responses to tax rates could be much stronger or weaker than CBO has projected.⁷
- Social and technological developments, such as changes in the roles of men and women in the rearing of children or the diffusion of a new medical technology that improves the health of the

population, could significantly alter labor force participation rates in the future.

CBO estimated likely ranges for the first two of those contributing factors—examining high and low values for the participation rates of cohorts of young workers and high and low values of labor-supply responses to changes in tax rates—and considered effects of the third contributing factor, other potential factors, and their interactions. The resulting alternative projections for labor force participation are about 3 percentage points higher (or lower) in 2046. The alternative labor force projections would lead to the following alternative budget projections:

- If the labor force participation rate was 61 percent in 2046, the resulting higher GDP would lead to more revenues, higher interest rates, smaller budget deficits, and less federal debt. Federal debt held by the public would be 137 percent of GDP in 2046 rather than the 141 percent that CBO projects under the extended baseline (see Figure 7-2).
- If the labor force participation rate was 55 percent in 2046, the slower economic growth would result in larger budget deficits and more debt. That debt would be 144 percent of GDP in 2046.

Productivity

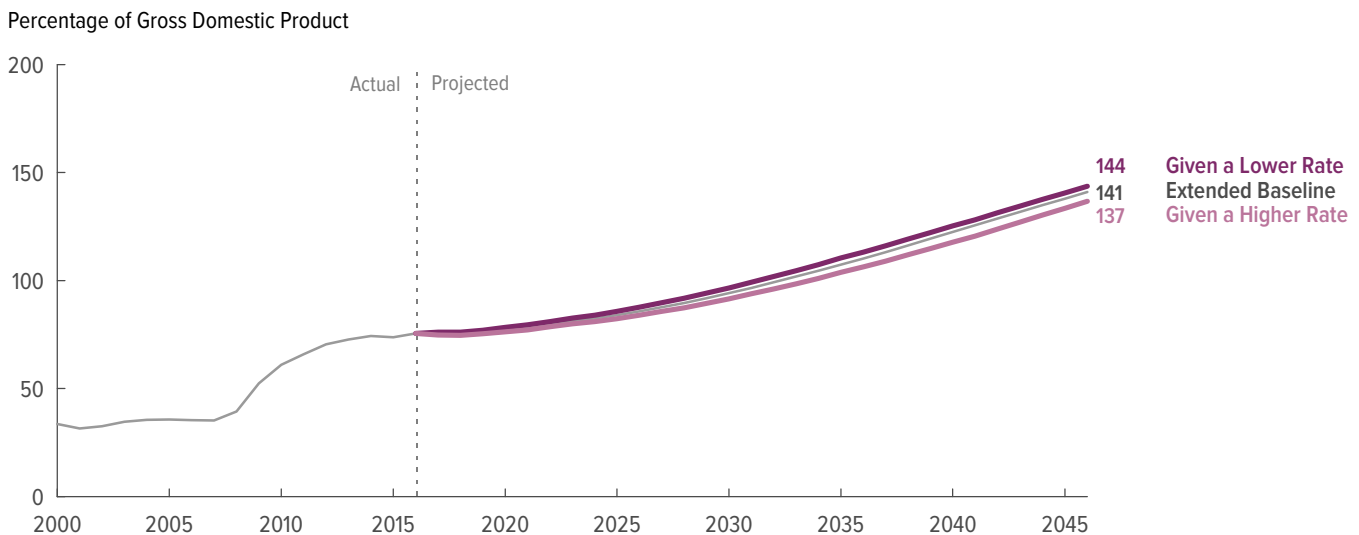
Productivity is an important determinant of economic output. Its growth stems from a number of sources, such as the introduction and spread of new technology, increases in workers’ education and skill levels, and the use of new processes that improve the efficiency of organizations. CBO estimates that the growth of productivity, which has averaged 1.5 percent per year since 1950, has accounted for more than 40 percent of the increase in real (inflation-adjusted) nonfarm business output over that time. Productivity is projected to increase, on average, by 1.3 percent per year in the coming decades in CBO’s extended baseline.

However, the growth rate of productivity has often varied for extended periods. Periods of rapid growth have generally resulted from major technological innovations. For example, innovations in four critical areas—electricity

7. For further discussion, see Congressional Budget Office, *How the Supply of Labor Responds to Changes in Fiscal Policy* (October 2012), www.cbo.gov/publication/43674; and Edward Harris and Shannon Mok, *How CBO Estimates the Effects of the Affordable Care Act on the Labor Market*, Working Paper 2015-09 (Congressional Budget Office, December 2015), www.cbo.gov/publication/51065.

Figure 7-2.

Federal Debt Given Different Labor Force Participation Rates



Source: Congressional Budget Office.

The extended baseline generally reflects current law, following CBO's 10-year baseline budget projections through 2026 and then extending most of the concepts underlying those baseline projections for the rest of the long-term projection period.

Federal debt refers to debt held by the public. Values are CBO's central estimates from ranges determined by alternative assessments of two factors: how much deficits crowd out investment in capital goods such as factories and computers (because a larger portion of private saving is being used to purchase government securities); and how much people respond to changes in after-tax wages by adjusting the number of hours they work.

The labor force participation rate is the percentage of people in the civilian noninstitutionalized population who are age 16 or older and either working or actively seeking work.

The alternative projections of labor force participation rates begin in 2017. In 2046, they are about 3 percentage points higher and lower than they are in the extended baseline.

generation, internal combustion engines, chemicals, and telecommunications—triggered a surge in productivity in the 1920s and 1930s. Another surge occurred in the 1950s and 1960s, spurred by the electrification of homes and workplaces, suburbanization, completion of the nation's highway system, and production of consumer appliances. The latest surge in productivity—a more modest one—began in the 1990s and is attributed to innovations involving computers and other types of information technology.⁸ Productivity growth has been relatively weak since the 2007–2009 recession, however, and it is expected to remain weak over the next few years.

A great deal of uncertainty surrounds the future growth rate of productivity. The nation could experience faster growth in productivity than is reflected in CBO's extended baseline, either steadily (as a result of ongoing gains from

the integration of information technology into the economy, for example) or more suddenly (from a technological breakthrough, such as the development of a new source of energy). Conversely, the growth of productivity could be slower than is projected in CBO's extended baseline (if, for example, the rate of increase in workers' education levels declined or if technological innovation or the dispersion of previous technological innovations throughout the economy diminished more than expected).

Changes in the rate of productivity growth would affect the federal budget by changing output and income and also, in CBO's assessment, by changing the interest rates the federal government pays on public debt. Higher productivity would increase revenues because of greater output and income. Higher productivity, like greater labor force participation, also indicates that capital is more productive, which implies a higher rate of return from private capital investment, all else being equal. Because the federal government competes with private borrowers for investors' money, higher returns from private investment would push up interest rates paid by the federal government.

8. For further discussion, see Robert Shackleton, *Total Factor Productivity Growth in Historical Perspective*, Working Paper 2013-01 (Congressional Budget Office, March 2013), www.cbo.gov/publication/44002.

Although empirical estimates of the relationship between productivity and interest rates vary, the theoretical relationship is clear enough for CBO to incorporate an effect on interest rates into this analysis.⁹

CBO assessed average productivity growth over the 37 30-year periods that occurred between 1950 and 2015. Beginning with the 1950–1979 period and ending with the 1986–2015 period, average productivity growth varied by about 1 percentage point (see Figure 7-1 on page 78). CBO therefore projected economic and budgetary outcomes that would occur if productivity grew by either 0.8 percent or 1.8 percent per year over the next 30 years—that is, 0.5 percentage points more slowly or more quickly than the 1.3 percent that is incorporated in the extended baseline.¹⁰

Those alternative projections for productivity growth would lead to the following alternative budget projections:

- If productivity grew by 1.8 percent annually, 0.5 percentage points more quickly than in the extended baseline, then the greater GDP would result in more revenues, higher interest rates, smaller budget deficits, and less federal debt as a share of GDP. Federal debt held by the public would be 112 percent of GDP in 2046 rather than the 141 percent that CBO projects in the extended baseline (see Figure 7-3).
- If productivity grew by 0.8 percent annually, 0.5 percentage points more slowly than in the extended baseline, the slower economic growth would result in larger budget deficits and more debt as a share of GDP. That debt would be 173 percent of GDP in 2046.

9. For example, in the Solow-type growth model that CBO used for this analysis, if productivity grew 0.5 percentage points more quickly than it is projected to grow in the extended baseline, the average interest rate on federal debt held by the public in 2046 would be about 0.7 percentage points higher than the extended baseline value. For details of that model, see Congressional Budget Office, *CBO's Method for Estimating Potential Output: An Update* (August 2001), www.cbo.gov/publication/13250.

10. For another approach to measuring uncertainty in long-run projections of productivity growth, see Ulrich K. Müller and Mark W. Watson, “Measuring Uncertainty About Long-Run Predictions,” *Review of Economic Studies* (March 2016), <http://dx.doi.org/10.1093/restud/rdw003>. Müller and Watson’s approach yields a range of uncertainty around productivity growth that is similar in size to the range that CBO calculated.

Faster or slower productivity growth could also affect the budget in ways that are not accounted for in this analysis—for example, by changing the shares of the nation’s income received by workers (in the form of wages and salaries, for instance) and by the owners of productive capital (in the form of corporate profits, for example). In recent years, technological change appears to have affected productivity in ways that put downward pressure on labor’s share of income (for example, by expanding options for using capital in place of labor), a trend that some economists believe will be long-lasting.¹¹

Interest Rates on Federal Debt

Changes in interest rates on federal debt held by the public—or federal borrowing rates—have direct effects on the budget. Federal borrowing rates are currently at historic lows, but CBO projects that they will rise in the coming years, from an average of 1.7 percent in 2015 to 4.4 percent in 2046. As a result of those projected increases and the resulting increase in deficits, interest payments on federal debt, which are currently a little over 1 percent of GDP, are projected to grow to about 6 percent of GDP by 2046. As federal debt grows to 141 percent of GDP in 2046, changes in the federal borrowing rate will have larger impacts on the federal budget.

However, given how much interest rates on federal debt have varied in the past, projections of those rates involve a great deal of uncertainty. CBO estimates that in real terms (that is, with adjustments to exclude the effects of inflation), the interest rate on 10-year Treasury notes averaged about 3 percent in the 1960s, about 1 percent in the 1970s, about 6 percent in the 1980s, about 4 percent in the 1990s, about 2 percent between 2000 and 2007, and about 1 percent over the past eight years.¹²

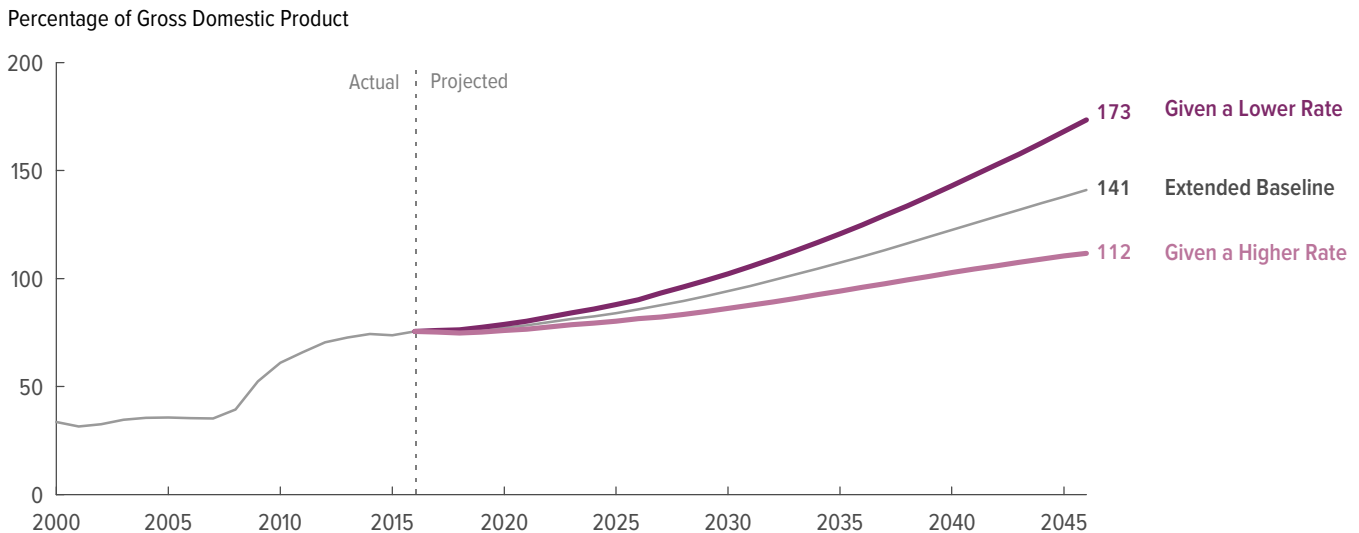
Many factors affect the real federal borrowing rate. Some of them reflect economic growth and investment flows; some relate to the current amount of federal borrowing and debt; and several others depend on financial conditions. Economic factors include the rate of growth of the

11. For further discussion, see Congressional Budget Office, *How CBO Projects Income* (July 2013), www.cbo.gov/publication/44433.

12. To calculate real interest rates, actual rates were adjusted using changes in the consumer price index. Past values of the consumer price index were adjusted to account for changes over time in the way that the index measures inflation. See Bureau of Labor Statistics, “CPI Research Series Using Current Methods (CPI-U-RS)” (April 13, 2016), www.bls.gov/cpi/cpiurs.htm.

Figure 7-3.

Federal Debt Given Different Productivity Growth Rates



Source: Congressional Budget Office.

The extended baseline generally reflects current law, following CBO's 10-year baseline budget projections through 2026 and then extending most of the concepts underlying those baseline projections for the rest of the long-term projection period.

Federal debt refers to debt held by the public. Values are CBO's central estimates from ranges determined by alternative assessments of two factors: how much deficits crowd out investment in capital goods such as factories and computers (because a larger portion of private saving is being used to purchase government securities); and how much people respond to changes in after-tax wages by adjusting the number of hours they work.

Productivity growth is the growth of total factor productivity—that is, the growth of real (inflation-adjusted) output that is not explained by the growth of labor and capital.

The alternative projections of productivity growth rates begin in 2017. Through 2046, the higher productivity growth rate is 0.5 percentage points higher, and the lower productivity growth rate is 0.5 percentage points lower, than the annual rate of 1.3 percent used for each year in the extended baseline.

labor force, the rate of growth of productivity, private saving, and the amount of inflows of capital from foreign investors (see Appendix A). Federal borrowing rates also depend on the size of deficits and the amount and duration of federal debt. Finally, the federal borrowing rate is affected by financial factors such as changes in investors' appetite for risk, which can vary with changes in portfolio preferences among U.S. and foreign investors, the perception of the underlying risk of private securities relative to federal debt, the response of financial institutions to regulations that require the holding of low-risk assets, and the liquidity of federal government debt relative to that of private securities.

For this analysis, CBO focused on the effects of changes to the federal borrowing rate caused by unexpected changes in financial factors. Changes in interest costs would, in turn, lead to changes in the deficit, which would affect national saving and interest rates and lead to changes in output. By design, changes to the federal borrowing rate that are attributable to unexpected changes in financial factors

are not caused by changes in economic conditions or changes in the federal budget.¹³ By contrast, in CBO's uncertainty analyses of productivity and labor force participation, federal borrowing rates change in response to economic developments.

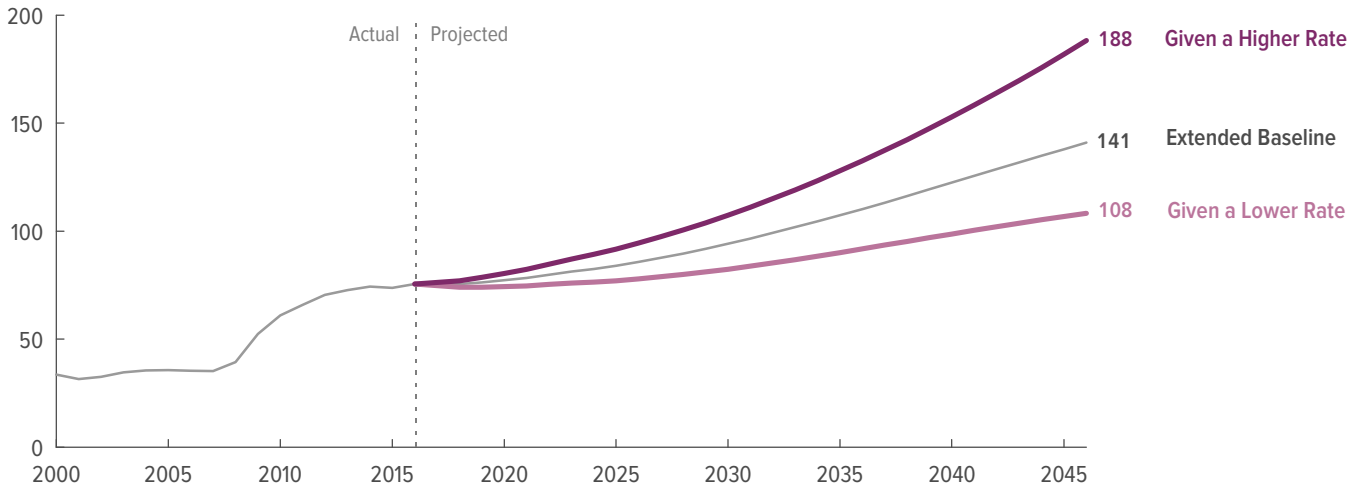
Although there are many ways to estimate the extent to which unexplained financial factors contribute to federal borrowing rates, one approach suggests those factors accounted for approximately 1.0 percentage point of the variation over 30-year periods between 1949 and 2015. Other specifications result in moderately wider or narrower ranges. In addition, the recent large and unexpected

13. Unexpected changes in financial factors are the historical variations in the federal borrowing rate that are not explained by economic and budgetary factors. CBO estimates the historical variations in the federal borrowing rate that are explained both directly and indirectly by economic and budgetary factors; the remaining unexplained historical variation is the contribution of unexpected changes in financial factors.

Figure 7-4.

Federal Debt Given Different Federal Borrowing Rates

Percentage of Gross Domestic Product



Source: Congressional Budget Office.

The extended baseline generally reflects current law, following CBO's 10-year baseline budget projections through 2026 and then extending most of the concepts underlying those baseline projections for the rest of the long-term projection period.

Federal debt refers to debt held by the public. Values are CBO's central estimates from ranges determined by alternative assessments of two factors: how much deficits crowd out investment in capital goods such as factories and computers (because a larger portion of private saving is being used to purchase government securities); and how much people respond to changes in after-tax wages by adjusting the number of hours they work.

The federal borrowing rate is the interest rate on federal debt. The alternative projections of federal borrowing rates begin in 2017. Through 2046, the higher borrowing rate is 1.0 percentage point higher, and the lower borrowing rate is 1.0 percentage point lower, than the rate used for each year in the extended baseline. The borrowing rate is not the same measure as the interest rate on 10-year Treasury notes that is shown in Figure 7-1.

changes in the 10-year real interest rates on Treasury notes point to significant uncertainty around CBO's projection of the federal borrowing rate. On the basis of that evidence, CBO constructed its range of uncertainty around federal borrowing rates by raising and lowering the federal borrowing rate by 1.0 percentage point, before accounting for macroeconomic feedback. Incorporating macroeconomic feedback widens the range of uncertainty around federal borrowing rates. For example, if unexpected changes in financial factors caused the average federal borrowing rate over the next 30 years to increase or decrease by 1.0 percentage point, after accounting for macroeconomic feedback, the average 10-year real interest rate over the next 30 years ranges from 1.2 percent to 3.5 percent relative to a projection of 2.3 percent under the extended baseline (see Figure 7-1 on page 78).

Those alternative projections for the federal borrowing rate on federal debt held by the public would lead to the following alternative budget projections:

- If unexpected changes in financial factors caused the average federal borrowing rate to be 1.0 percentage point lower before accounting for macroeconomic feedback, then net interest would equal 3.1 percent of GDP by 2046 instead of the 5.8 percent projected in the extended baseline.¹⁴ Federal debt held by the public would be 108 percent of GDP in 2046 rather than the 141 percent that CBO projected in that baseline (see Figure 7-4).
- If unexpected changes in financial factors caused the average borrowing rate to be 1.0 percentage point higher before accounting for macroeconomic feedback, then interest would be 10.3 percent of GDP in 2046, CBO projects, and federal debt held by the public would reach 188 percent of GDP.

14. The estimated direct effects on budget projections of changes in the government's borrowing rates do not incorporate any changes in remittances by the Federal Reserve or in the relative amounts of different types of taxable income (for example, profits and interest income). Such changes would have additional budgetary implications.

Federal Spending on Medicare and Medicaid

The federal government pays for health care through Medicare, Medicaid, and other programs; through subsidies for insurance purchased through the health insurance marketplaces established under the Affordable Care Act; and through tax preferences, especially the exclusion for employment-based health insurance.¹⁵ In CBO's extended baseline, federal spending on health care per beneficiary increases more slowly in the future than it has, on average, in recent decades, although it still outpaces the growth of potential (that is, maximum sustainable) output per capita. Because substantial uncertainty surrounds the future growth of health care costs, the effects of that growth on the federal budget are similarly uncertain. Consequently, CBO assesses those effects by varying the growth rate of costs in the two largest components of federal spending on health care, Medicare and Medicaid.

Many factors will affect Medicare and Medicaid spending per beneficiary in the long term (for further discussion, see Chapter 3). Perhaps the most important factor is the extent to which advances in health care technology will raise or lower costs. New and less expensive medical procedures or treatments could prove effective in helping patients, which could lower costs. But other beneficial procedures and treatments might be more expensive; and even services that are relatively inexpensive could make spending rise quickly if growing numbers of patients used them.¹⁶ In particular, technologies that work to extend the life of Medicare recipients tend ultimately to increase expenditures for the program over time. Other factors that could affect health care costs are changes in the structure of payment systems and innovations in the delivery of health care.

In addition, Medicare and Medicaid spending will be affected by the health of the population. Outlays for Medicare and Medicaid depend in part on the prevalence among beneficiaries of certain medical conditions—for example, cardiovascular and pulmonary disease, diabetes, arthritis, and depression. The prevalence of such conditions could evolve in unexpected ways for various reasons,

including changes in behavior (for example, rates of smoking, amounts of physical activity, or dietary patterns), new treatments for various illnesses, new medical interventions that reduce the occurrence or severity of certain conditions or diseases, and the emergence of epidemics.

The measure that CBO examined for this analysis of uncertainty was excess cost growth, which is the growth rate of health care spending per person after removing the effects of demographic changes—most notably, changes in the age distribution of the population—relative to the growth rate of potential GDP per person.¹⁷ Starting with the 1976–2005 period and ending with the 1986–2015 period, average excess cost growth for Medicare and Medicaid over various 30-year periods declined by about 1.0 percentage point, both because of changes in laws and other factors (see Figure 7-1 on page 78). In assessing possible values for the average rate of excess cost growth over the next 30 years, CBO considered that, if current laws remained unchanged, the 30-year average rate could continue to decline (although probably not as quickly as the historical decline that included changes in laws). Conversely, it could revert toward the higher rate observed in the past. CBO also drew upon an alternative approach to measuring uncertainty that uses information about trends and cycles in excess cost growth over time; it produced a potential range for excess cost growth through 2046 that was larger than the range of historical variation.¹⁸ Using those approaches to help determine the extent of the range, CBO analyzed the effects of rates of excess cost growth for Medicare and Medicaid that were 1.0 percentage point above and below the rate of growth for each year in the extended baseline. (CBO focused on Medicare and Medicaid because the projected size of those programs means that variations in their rates of growth would have particularly large effects on the federal budget; for additional discussion of the extended baseline projections for those programs, see Chapter 3.)

Those alternative projections for the growth of health care spending would lead to the following alternative budget projections:

15. Most payments that employers and employees make for health insurance coverage are exempt from income and payroll taxes. For more information, see Congressional Budget Office, *Federal Subsidies for Health Insurance Coverage for People Under Age 65: 2016 to 2026* (March 2016), www.cbo.gov/publication/51385.

16. See Congressional Budget Office, *Technological Change and the Growth of Health Care Spending* (January 2008), www.cbo.gov/publication/41665.

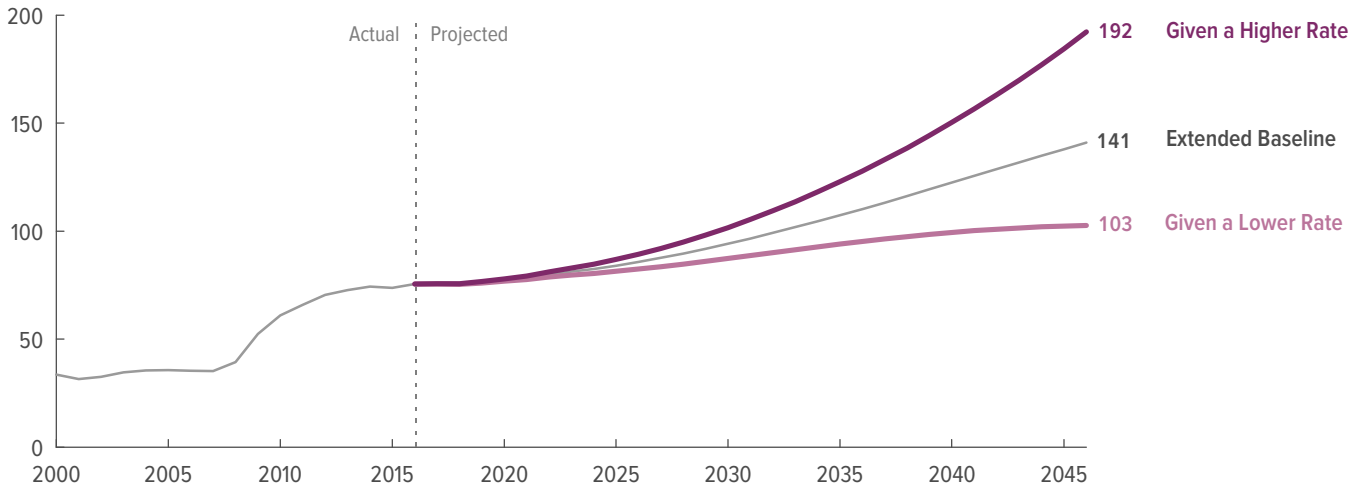
17. The definition and calculation of excess cost growth are discussed in more detail in Chapter 3.

18. See Ulrich K. Müller and Mark W. Watson, "Measuring Uncertainty About Long-Run Predictions," *Review of Economic Studies* (March 2016), <http://dx.doi.org/10.1093/restud/rdw003>.

Figure 7-5.

Federal Debt Given Different Rates of Excess Cost Growth for Federal Spending on Medicare and Medicaid

Percentage of Gross Domestic Product



Source: Congressional Budget Office.

The extended baseline generally reflects current law, following CBO's 10-year baseline budget projections through 2026 and then extending most of the concepts underlying those baseline projections for the rest of the long-term projection period.

Federal debt refers to debt held by the public. Values are CBO's central estimates from ranges determined by alternative assessments of two factors: how much deficits crowd out investment in capital goods such as factories and computers (because a larger portion of private saving is being used to purchase government securities); and how much people respond to changes in after-tax wages by adjusting the number of hours they work.

Excess cost growth refers to the extent to which the growth rate of nominal health care spending per person—adjusted for demographic characteristics of the relevant populations—exceeds the growth rate of potential gross domestic product per person. (Potential gross domestic product is the maximum sustainable output of the economy.)

The alternative projections of rates of excess cost growth begin in 2017. Through 2046, the higher rate of excess cost growth is 1.0 percentage point higher, and the lower rate is 1.0 percentage point lower, than the rate used for each year in the extended baseline.

- If Medicare and Medicaid spending per beneficiary rose 1.0 percentage point per year more slowly than in the extended baseline, federal debt held by the public would be 103 percent of GDP in 2046 rather than the 141 percent that CBO projects in the extended baseline (see Figure 7-5).
- If Medicare and Medicaid spending per beneficiary rose 1.0 percentage point per year more quickly than in the extended baseline, federal debt held by the public would be 192 percent of GDP in 2046.

Multiple Factors

The previous cases illustrated what would happen to the federal budget if a single factor differed from the projections that CBO used in the extended baseline. Undoubtedly, outcomes for multiple factors would differ from CBO's projections. Estimating the budgetary consequences of such a circumstance is more complicated than simply adding together the outcomes of the individual cases. For example, higher-than-projected health care

costs would have a larger effect on the budget if interest rates on federal debt were also higher than CBO projects—because the government would have to pay more interest on debt that resulted from the additional health care spending.

The four factors could affect each other directly—for example, higher productivity would lead to higher wages and higher labor force participation rates—or they could be jointly affected by other changes to the economy. To account for such interactions among the key variables, CBO examined two alternative projections in which they were assumed to change together. The agency used only part of the full range for each of the four factors because the chances of federal debt being above or below the estimates when all four factors are at the high and low ends of their ranges is much smaller than when each individual factor is at the high and low end of its range. Specifically, the agency analyzed illustrative cases in which all four factors varied from the baseline by 60 percent of their individual ranges. For example, in the cases discussed

above, the range for the rate of productivity growth was 1 percentage point, yielding growth rates that were 0.5 percentage points higher and lower than the values in the extended baseline; but for the combined projections, the range for the rate of productivity growth is 0.6 percentage points, yielding growth rates that are 0.3 percentage points higher or lower than the values underlying the extended baseline.

Although the range for each of the four key factors when considered jointly is 60 percent of the range when they are considered individually, the resulting effects on federal debt as a share of GDP, relative to the extended baseline, turn out to be less than 60 percent of the sum of the estimated effects for the individual factors because of interactions among the factors. For example, simultaneous changes in rates of productivity growth and labor force participation—which individually affect the federal borrowing rate—interact to create an effect on the interest rate that differs from the sum of the individual factors' effects on interest rates. A decrease in productivity lowers the return on capital, as does a drop in the labor force participation rate. Both together lower the return on capital even more than they would if each factor was considered individually and added together. The reduction in the return on capital is reflected in a reduction in federal borrowing rates. That reduction in borrowing rates leads to lower net interest costs than would result from adding together the reductions in interest costs from the four analyses that vary one factor at a time.

Varying the four factors simultaneously so that all four collectively increase or decrease the deficit leads to the following budget projections:

- If labor force participation was about 2 percentage points higher in 2046, productivity grew 0.3 percentage points per year more quickly, unexplained financial factors lowered the federal borrowing rate by 0.6 percentage points, and federal costs per beneficiary for Medicare and Medicaid grew by about 0.6 percentage points per year more slowly than under the extended baseline, federal debt held by the public would be 93 percent of GDP in 2046 rather than the 141 percent that CBO projects under the extended baseline (see Figure 7-6).
- If labor force participation was about 2 percentage points lower in 2046, productivity grew 0.3 percentage points per year more slowly, unexplained financial factors increased the federal borrowing rate by

0.6 percentage points, and federal costs per beneficiary for Medicare and Medicaid grew by about 0.6 percentage points per year more quickly than under the extended baseline, federal debt held by the public would be 196 percent of GDP in 2046.

Uncertainty Arising From Other Inputs to CBO's Projections

CBO's long-term budget estimates depend on projections of numerous variables in addition to those analyzed above. Although the factors discussed in the previous section are four of the more important ones, they are intended to provide illustrative examples, not to be exhaustive. Every variable has some uncertainty associated with it. For instance, demographics, earnings inequality, and decisions by states about Medicaid are also important, but CBO has not quantified the potential effects on the budget of uncertainty involving all of those factors.

Changes in Demographics

Demographic factors have significant effects on economic and budgetary outcomes. For instance, GDP depends to a large degree on the size of the labor force, which is related to the number of adults between the ages of 20 and 64, and federal outlays for Medicare, Medicaid, and Social Security are closely linked to the number of people who are at least 65 years old. Higher rates of fertility or greater immigration flows would generally cause federal spending to decrease relative to GDP because they would increase the ratio of adults ages 20 to 64 to older adults (which would increase GDP). Faster improvement in mortality rates would generally cause federal spending to increase relative to GDP because people of all ages would be expected to live longer, which would increase the number of people who received benefits from Social Security, Medicare, Medicaid, and certain other mandatory spending programs and thereby increase federal outlays for those programs.¹⁹

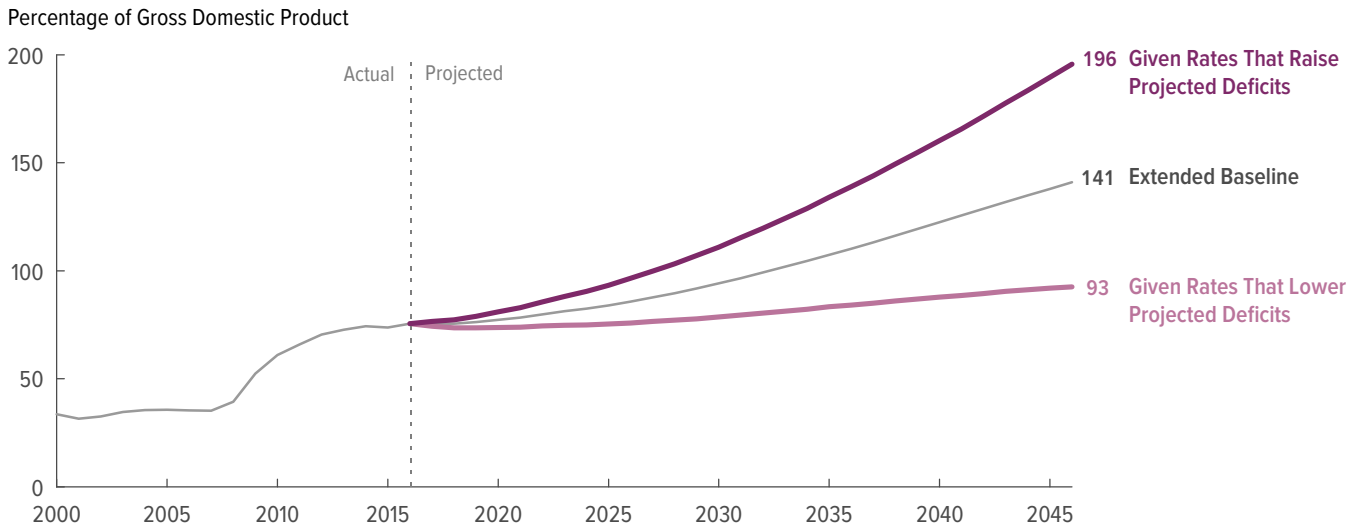
Changes in Earnings Inequality

CBO expects that—as has occurred over the past several decades—workers with high earnings will experience faster earnings growth during the next 10 years than will workers with low earnings. Thereafter, CBO expects, the earnings of all workers will grow at the same rate. That is, CBO expects earnings inequality to increase over the next

19. For a review of the effects of alternative estimates of future mortality rates on long-term budget projections, see Congressional Budget Office, *The 2015 Long Term Budget Outlook* (June 2015), Chapter 7, www.cbo.gov/publication/50250.

Figure 7-6.

Federal Debt Given Different Labor Force Participation Rates, Productivity Growth Rates, Federal Borrowing Rates, and Rates of Excess Cost Growth for Federal Spending on Medicare and Medicaid



Source: Congressional Budget Office.

The extended baseline generally reflects current law, following CBO's 10-year baseline budget projections through 2026 and then extending most of the concepts underlying those baseline projections for the rest of the long-term projection period.

Federal debt refers to debt held by the public. Values are CBO's central estimates from ranges determined by alternative assessments of two factors: how much deficits crowd out investment in capital goods such as factories and computers (because a larger portion of private saving is being used to purchase government securities); and how much people respond to changes in after-tax wages by adjusting the number of hours they work.

The labor force participation rate is the percentage of people in the civilian noninstitutionalized population who are age 16 or older and either working or actively seeking work.

Productivity growth is the growth of total factor productivity—that is, the growth of real (inflation-adjusted) output that is not explained by the growth of labor and capital.

Excess cost growth refers to the extent to which the growth rate of nominal health care spending per person—adjusted for demographic characteristics of the relevant populations—exceeds the growth rate of potential gross domestic product per person. (Potential gross domestic product is the maximum sustainable output of the economy.)

For this figure, CBO used values for the four factors whose deviation from the extended baseline was about 60 percent as large as the deviation used for the individual cases shown in Figures 7-2 to 7-5. The alternative projections of the four factors begin in 2017.

10 years and to remain near that level thereafter. The significant uncertainty regarding that projection is a source of uncertainty regarding the budget projections in CBO's extended baseline. For example, faster-than-projected earnings growth for those with relatively high earnings and lower-than-projected earnings growth for those with relatively low earnings would lead to higher-than-projected tax revenues and higher-than-projected spending on means-tested transfer programs.

In assessing that uncertainty, CBO considered the way that many factors contributed to the evolution of earnings inequality over the past several decades. Determining

the contribution of each of those factors is difficult, and studies of the issue have not reached consensus about the relative importance of each. Among the economic factors contributing to changes in earnings inequality were increases in the employment of women, the movement of some jobs to other countries, and increases in the immigration of less-skilled workers. In addition, changes in technology that increased the productivity of higher-skilled workers and the slowing growth of the educational attainment of workers have been factors. Changes in federal policy probably also contributed to changes in earnings inequality. For instance, changes in means-tested programs and tax credits, which provide cash payments

or assistance in obtaining health care, food, housing, or education to people with relatively low income or few assets, may have affected the incentives of less-skilled people to work. A number of other factors have also had an impact on labor markets and earnings inequality: The federal minimum wage, after adjusting for changes in prices, has not increased substantially over the past several decades; rates of incarceration have increased; the number of workers in unions has declined; the size and structure of firms has changed; and the share of workers in the manufacturing sector has declined as the share of workers in the service sector has increased.

Many of the factors discussed above will continue to affect changes in the distribution of earnings, although some will be less relevant in the future. For instance, although increases in the employment of women were a factor in the changing distribution of earnings over the past several decades, those increases ended in about 2000 and are no longer contributing factors. In addition, the speed with which technology increased the productivity of more highly skilled workers appears to have slowed in recent decades, even as the growth in educational attainment has slowed.

Some other factors will be more relevant. For instance, changes in the size and structure of industries and firms will probably continue to affect the earnings distribution in the future. In CBO's projections, the supply of more-educated workers increases more quickly than the supply of less-educated ones, which could cause the premium paid to more-educated workers to rise more slowly than it has in the past or to stop rising altogether. That process would tend to slow the growth of earnings for high earners and possibly slow the growth of overall earnings inequality in the future.

In the absence of compelling evidence about which factors have contributed the most to rising inequality and how those factors would affect inequality in the future, that disparity in earnings is projected to continue to increase for the first decade of the forecast period, but not thereafter, in CBO's estimation. CBO continues to assess the sources of earnings inequality and their implications for the federal budget.

Decisions by States About Medicaid

State governments have flexibility in administering their Medicaid programs, and the decisions they make about

eligibility, benefits, and payments to providers affect the federal budget because the federal government pays a large share of Medicaid's costs. One source of uncertainty is whether states will make decisions that increase or decrease spending by providing coverage to more adults, decreasing covered benefits, or changing payments to providers. Decisions by states could significantly decrease or increase federal expenditures for Medicaid relative to the amounts in CBO's projections.

Potential Developments in the Economy and Their Effects on the Budget

The sources of uncertainty discussed above are not the only ones associated with long-term budget projections. They do not account for other plausible but unpredictable developments that could increase or decrease federal debt relative to CBO's projections. Such possible developments could include a severe economic depression; unexpectedly large losses on federal financial obligations; unexpectedly significant effects of climate change; catastrophes, such as a major natural disaster or world war; or the development of natural resources.

A Severe Economic Downturn

In general, when economic output rises or falls, the federal budget is automatically affected. For example, economic downturns can reduce revenues significantly and raise some outlays, such as those for unemployment insurance and nutrition assistance.²⁰ In addition, downturns have historically prompted policymakers to enact legislation that further reduces revenues and increases federal spending—to help people suffering from the weak economy, to bolster the financial condition of state and local governments, and to stimulate additional economic activity and employment. The budgetary effects of the recent recession were particularly large: Federal debt increased from 35 percent of GDP at the end of 2007 to 70 percent at the end of 2012, in large part because of the recession and weak recovery and the policy responses enacted to counter those developments.

The long-term projections of output and unemployment in this report reflect economic trends from the end of World War II to the present, a period that included several

20. See Congressional Budget Office, *The Budget and Economic Outlook: 2015 to 2025* (January 2015), Appendix D, www.cbo.gov/publication/49892.

economic downturns that were not fully offset by upturns of similar magnitude.²¹ However, the projections do not account for the possibility of a severe economic downturn like the Great Depression of the 1930s. Such events are rare; for that reason and others, their magnitude and timing cannot be readily predicted. If such an event occurred in the next 30 years, federal debt would probably be substantially greater than is projected in CBO's extended baseline.

Losses on Federal Insurance or Credit Programs

The federal government supports a variety of private activities through federal insurance and credit programs that provide loans and loan guarantees.²² CBO includes the expected losses from those credit and insurance programs in its baseline projections. Significantly greater losses could result from certain unexpected events, such as a major disruption in the financial system or a deep slump in the economy. Alternatively, long periods of financial and economic stability could lead to smaller losses.

Federal insurance and credit programs generate losses when the support provided by the federal government exceeds the money taken in by the programs through fees, loan repayments, interest payments, sales of assets, wage garnishment, and other means. For example, in the

wake of the recent housing crisis, widespread defaults on guaranteed mortgages led to substantial outlays by the federal government. Widespread defaults on student loans or the bankruptcy of numerous companies with underfunded pension plans could lead to analogous costs for the federal government in the future.²³ Conversely, long periods of particularly strong economic growth could allow federal insurance and credit programs to collect higher-than-projected repayments and cover lower-than-projected expenses.

Moreover, significant implicit liabilities, apart from the liabilities created by official government programs, could affect the federal government. In the event of a financial crisis, for example, federal policymakers might decide to provide monetary support to the financial system, as they did during the recent financial crisis. Such support could increase federal outlays above the amounts projected in the extended baseline.

Catastrophes or Wars

The federal government also faces implicit obligations in the case of catastrophes and can spend large sums in fighting a major war. Small-scale natural and manmade disasters occur fairly often in the United States; they may seriously damage local communities and economies, but they have rarely had significant, lasting impacts on the national economy. By contrast, a catastrophe could affect budgetary outcomes by reducing economic growth over a number of years, leading to substantial increases in federal spending. For example, the nation could experience a massive earthquake, a pandemic, an asteroid strike, a geomagnetic storm from a large solar flare, or a nuclear meltdown or attack that rendered a significant part of the country uninhabitable. Participation in a major war could also have significant economic and budgetary impacts: The ratio of federal debt held by the public to GDP rose by 60 percentage points during World War II, for instance. Because such events are extremely rare, it is very difficult to estimate the probability of their future occurrence and their possible effects on the budget.

Climate Change

Substantial uncertainty surrounds any projection that attempts to account for the impact of climate change on the economy or on the budget. Many estimates—based

21. Since the end of World War II, the unemployment rate has been about one-quarter of one percentage point higher, on average, than CBO's estimate of the natural rate of unemployment (the rate arising from all sources except fluctuations in aggregate demand). That difference implies that periods of significant economic weakness (such as the 2007–2009 recession and its aftermath) have pushed the unemployment rate above CBO's estimate of the natural rate more than periods of significant economic strength have pushed it below that estimate. Consistent with that finding is CBO's projection that the unemployment rate in the long term will be 5.3 percent, which is about one-quarter of one percentage point higher than CBO's estimate of the natural rate of unemployment in the long term. For further discussion, see Appendix A.

22. Federal insurance programs provide coverage for deposits at financial institutions (through the Federal Deposit Insurance Corporation), for workers' pensions (through the Pension Benefit Guaranty Corporation), and for property against damage by floods (through the National Flood Insurance Program), among other things. The largest federal credit programs provide mortgage loan guarantees (through the Federal Housing Administration, Fannie Mae, and Freddie Mac); student loans; and federally backed loans to businesses (through the Small Business Administration, for example). There are a number of smaller programs, including the loan guarantees provided by the Department of Energy and the terrorism risk insurance program administered by the Treasury.

23. For more discussion, see James D. Hamilton, *Off-Balance-Sheet Federal Liabilities*, Working Paper 19253 (National Bureau of Economic Research, July 2013), www.nber.org/papers/w19253.

on a range of scenarios about the extent of climate change in the future—suggest that such effects on the nation’s economic output, and hence on federal tax revenues, will probably be small over the period covered by CBO’s long-term projections and larger, but still modest, in later years.²⁴ Even under scenarios in which significant climate change is assumed, the projected long-term effects on GDP would tend to be modest relative to underlying economic growth for two primary reasons. First, only a small share of the U.S. economy is directly affected by changes in climate; the largest effects would probably occur in the agricultural sector, which currently represents about 1 percent of total U.S. output. Second, some activities within the agricultural sector—crop production in the northern United States, for example—could experience gains because of climate change. In any event, some of the effects of climate change (such as the loss of biodiversity) neither directly relate to measured economic output nor affect tax revenues.

The uncertainty surrounding such projections arises from several sources: the unpredictability of global economic activity and technology development, both of which affect the amount of emissions in the future; limitations in current data; and the imperfect understanding of physical processes and of many aspects of the interacting components (land, air, water, ice, and all forms of life) that make up the Earth’s climate system. CBO continues to monitor research on the effects of climate change on the U.S. economy, to consider how those effects might alter the federal budget outlook and to evaluate federal policies that could lead to lower emissions or mitigate damage from changes in the climate.

For those reasons, CBO’s extended baseline does not explicitly incorporate the effects of climate change. It implicitly includes some small effects by reflecting historical spending on such programs as federal crop insurance, federal flood insurance, and the Federal Emergency Management Agency’s disaster relief program.²⁵ Aside from those implicit changes in federal outlays, the extended baseline does not incorporate any budgetary effect that climate change might have; it does not, for example, account for the effect on federal tax revenues that climate change could have if it affected the nation’s economic output.

24. Congressional Budget Office, *Potential Impacts of Climate Change in the United States* (May 2009), www.cbo.gov/publication/41180.

Although CBO has not undertaken a full analysis of the budgetary costs stemming from climate change, it has recently analyzed the potential costs of future hurricane damage caused by climate change and coastal development.²⁶ Three factors that influence the rate of growth of future hurricane damage are sea levels, the frequency of severe hurricanes, and the amount of development in coastal areas (because the damage caused by hurricanes will depend, in part, on the amount of people and property in harm’s way). All told, CBO projects that the increase in the amount of hurricane damage attributable to coastal development and climate change will probably be less than 0.05 percent of GDP in the 2040s. The federal expenditures projected to result from those economic effects would not significantly affect the budget categories in which hurricane-related spending falls.

Although CBO’s baseline projections—which incorporate the assumption that current law would generally remain in place—do not capture possible changes in law, changes related to concerns about the effects of climate change could affect the budget if they were to occur. In the future, if weather-related disasters increase in frequency and magnitude, lawmakers could respond by increasing funding above the amounts in CBO’s projections. For example, increased damage from storm surges might lead the Congress to pass additional emergency supplemental appropriations for disaster relief or to approve legislation providing funding to protect infrastructure that is vulnerable to rising sea levels. Or lawmakers could amend existing laws to reduce federal spending on weather-related disasters. For instance, the Congress might decide to alter flood insurance or crop insurance programs in a way that provides insured parties with a greater incentive to avoid potential damage.

25. Some of the programs most affected by weather-related disasters—such as federal crop insurance and flood insurance—fall into the category of other mandatory spending in CBO’s long-term projections. In CBO’s extended baseline, spending in that category (apart from outlays for refundable tax credits) is projected to continue to decline as a share of GDP after the 10-year baseline projection period. That decline is projected to be at roughly the same rate as that projected for the last 5 years of the baseline. Other programs affected by weather-related disasters—such as the Federal Emergency Management Agency’s disaster relief program—are discretionary; spending for those programs is projected to remain roughly constant as a share of GDP in the years following the baseline projection period.

26. Congressional Budget Office, *Potential Increases in Hurricane Damage in the United States: Implications for the Federal Budget* (June 2016), www.cbo.gov/publication/51518.

Natural Resources

The future discovery and development of productive natural resources may cause federal receipts to increase. For example, recent advances in combining two drilling techniques, hydraulic fracturing and horizontal drilling, have allowed access to large deposits of shale resources—that is, crude oil and natural gas trapped in shale and certain other dense rock formations. Virtually nonexistent a decade ago, the development of shale resources has boomed in the United States in recent years, affecting two kinds of federal receipts—federal tax revenues and payments to the government by private developers of federally owned resources. By boosting GDP, shale development has increased tax receipts. Because some of the shale resources being developed are federally owned, developers must make payments to the federal government; however, most of the nation’s shale resources are not federally owned, so those payments do not increase federal receipts by a significant amount.²⁷ Advances in the development of other resources might also contribute to federal receipts by bolstering the economy and making federally owned resources more valuable.

Implications of Uncertainty for the Design of Fiscal Policy

Policymakers could take uncertainty into account in various ways when making fiscal policy choices.²⁸ For example, they might decide to design policies that reduced the budgetary implications of certain unexpected events. Policymakers might also decide to provide a buffer against events with negative budgetary implications by aiming for lower debt than they would if such uncertainty did not exist.

Whether or not the federal budget directly bears the risk of uncertain outcomes, all risk is ultimately distributed among individuals—as taxpayers, as beneficiaries of federal programs, or as both. If federal spending for certain programs turned out to be higher than projected, the additional imbalance could be offset only through higher revenues or lower spending for other programs or activities

27. Congressional Budget Office, *The Economic and Budgetary Effects of Producing Oil and Natural Gas From Shale* (December 2014), www.cbo.gov/publication/49815.

28. See Alan J. Auerbach and Kevin Hassett, “Uncertainty and the Design of Long-Run Fiscal Policy,” in Auerbach and Ronald D. Lee, eds., *Demographic Change and Fiscal Policy* (Cambridge University Press, 2001), pp. 73–92, <http://tinyurl.com/p93enf>.

at some point in the future. If the additional imbalance was not offset, then deficits would be larger, resulting in lower future income. Conversely, if spending turned out to be lower or revenues greater than projected, then an opportunity would exist to lower taxes or boost spending; it would also be possible to reduce future deficits, resulting in higher income. Which income groups or generations benefited the most—or bore the largest burden—from unexpected budgetary developments would depend on the policies that lawmakers enacted as a result.

Reducing the Effects of Unexpected Events on the Federal Budget

Fiscal policy cannot eliminate the risk factors that create uncertainty about budgetary outcomes, but it can reduce the budgetary implications of those factors. However, reducing budgetary uncertainty for the federal government could have unwanted consequences, such as shifting risk to individuals. Under current law, for example, growth in Medicare and Medicaid outlays per beneficiary depends in part on the growth of per capita health care costs. Some proposals would instead link growth in federal outlays per beneficiary to measures of overall economic growth or general price inflation.²⁹ Such a change could affect national spending for health care, the federal budget, individuals’ costs, and the budgets of state and local governments. It might greatly reduce uncertainty about future federal outlays for Medicare and Medicaid, but it might also greatly increase uncertainty about the future costs borne by the programs’ beneficiaries and by state and local governments.³⁰

Similarly, policymakers could reduce the budgetary implications of uncertainty about future life expectancy by indexing the eligibility age for programs such as Social Security or Medicare to average life spans. Under current law, if longevity increased more than expected, outlays for federal health care and retirement programs would exceed projections. If policies were changed so that the

29. For an example of such a proposal, see Congressional Budget Office, *Preliminary Analysis of the Rivlin-Ryan Health Care Proposal* (attachment to a letter to the Honorable Paul D. Ryan, November 17, 2010), www.cbo.gov/publication/21928, and Option 1 in Congressional Budget Office, *Health-Related Options for Reducing the Deficit: 2014 to 2023* (December 2013), www.cbo.gov/publication/44906, pp. 6–14.

30. Most proposed policy changes of that sort would affect both the expected amounts of federal outlays and the uncertainty about those outlays, but those two effects are conceptually distinct.

age of eligibility for those programs rose automatically with increases in longevity, the budgetary effects of such increases would be dampened. However, people would face greater uncertainty about the timing and size of the benefits that they would receive, and the effects would vary among subgroups of the population.

In addition, policymakers could reduce the budgetary implications of unexpected rises in interest rates by increasing the share of government borrowing that is done through longer-term securities. Using that approach, the Treasury could lock in interest rates for a considerable period. However, interest rates on longer-term debt are typically higher than rates on shorter-term debt, so that approach would probably increase the interest that the federal government paid. Moreover, if interest rates were locked in for a long period, the federal government would benefit less from unexpected declines in interest rates.

Reducing Federal Debt

As an alternative or complementary approach, policymakers could improve the federal government's ability to withstand the effects of events that would significantly worsen the budgetary outlook. In particular, reducing the amount of federal debt held by the public would give future policymakers more flexibility in responding to

extraordinary events. For example, a financial crisis in the future might have significant negative economic and budgetary implications, just as the 2007–2009 financial crisis did: The ratio of federal debt held by the public to GDP increased by 35 percentage points between 2007 and 2012. If another financial crisis prompted a similar increase when the ratio of federal debt to GDP was already high (such as its current level of 75 percent), policymakers might be reluctant to accept the initial cost of a proposed intervention in the financial system or the economy, even if they expected to recoup at least part of that cost over time.

In addition, a high ratio of debt to GDP increases the risk of a fiscal crisis in which investors lose confidence in the government's ability to manage its budget and the government in turn loses its ability to borrow at affordable rates.³¹ There is no way to predict the amount of debt that might precipitate such a crisis, but starting from a position of relatively low debt would reduce the risk.

31. That sort of crisis might be triggered by an adverse event that quickly drove up the ratio of debt to GDP, such as a depression or a war. For further discussion, see Congressional Budget Office, *Federal Debt and the Risk of a Fiscal Crisis* (July 2010), www.cbo.gov/publication/21625.