



CBO's Projections of Demographic and Economic Trends

The Congressional Budget Office's long-term outlook for the federal budget is based on projections over the next three decades of trends in a host of demographic and economic variables. Through 2027, the projections presented in this report are the same as those that CBO published in January.¹ For the years beyond 2027, CBO's projections generally reflect historical trends and anticipated demographic changes. (Average values for 2017 to 2047, the period encompassed by CBO's extended baseline, as well as for shorter periods, are shown in Table A-1.² The table also provides historical data for comparison. A set of annual projections is included in the supplemental data that accompany this report, available online at www.cbo.gov/publication/52480.)

CBO anticipates that total economic output will be lower over the next three decades than it projected in last year's report. That adjustment is mainly the consequence of slower expected growth in productivity, which will modestly reduce returns on capital, interest rates, levels of investment, output per worker, and real (inflation-adjusted) income. The population is also expected to grow at a slower pace, mainly because CBO now projects a lower rate of immigration than it did last year. However, the agency has raised its estimates of labor force participation and therefore expects the labor force to grow more rapidly than it projected last year, in spite of slower population growth.

Demographic Variables

Both the size and composition of the U.S. population influence the overall growth of the economy and affect federal tax revenues and spending. Estimated rates of fertility, immigration, and mortality determine the population and thus the projected size of the labor force and the number of people receiving benefits from federal programs such as Social Security and Medicare. Because of revised projections of immigration and mortality rates, CBO now projects that the population will be slightly smaller in the future than it projected last year.

Population

CBO anticipates that the total population will increase from 330 million at the beginning of 2017 to 390 million in 2047 and that the annual growth rate of the U.S. population will gradually decline from 0.7 percent in 2017 to 0.4 percent in 2047. The population is projected not only to grow more slowly but also to become older, on average, than in the past. Over the 30-year projection period, the share of the population that is 65 or older grows, whereas the share that is of working age (defined as those between ages 20 and 64) shrinks. As a result, CBO projects, a growing portion of the population will receive benefits from the Social Security and Medicare programs while a shrinking portion will pay into the trust funds that support them.

Fertility

CBO projects a total fertility rate of 1.9 children per woman for the 2017–2047 period.³ (That rate is the average number of children that a woman would have in her lifetime if, at each age of her life, she experienced the

1. See Congressional Budget Office, *The Budget and Economic Outlook: 2017 to 2027* (January 2017), www.cbo.gov/publication/52370.

2. The extended baseline generally reflects current law, following CBO's 10-year baseline budget projections through 2027 and then extending most of the concepts underlying those baseline projections for the rest of the long-term projection period.

3. In its long-term model, the likelihood that a particular woman will have a child depends on such factors as that woman's education, marital status, immigration status, and childbearing history.

Table A-1.

Average Annual Values for Demographic and Economic Variables That Underlie CBO's Extended Baseline

	1987–2016	2017–2027	2028–2037	2038–2047	Overall, 2017–2047
Demographic Variables					
Growth of the Population (Percent)	0.9	0.7	0.6	0.4	0.6
Fertility Rate (Children per woman)	2.0	1.9	1.9	1.9	1.9
Immigration Rate (Per 1,000 people in the U.S. population)	3.8	3.2	3.2	3.2	3.2
Life Expectancy at Birth, End of Period (Years) ^a	79.1	80.5	81.6	82.8	82.8
Life Expectancy at Age 65, End of Period (Years) ^a	19.3	20.1	20.8	21.5	21.5
Economic Variables (Percent)					
Growth of GDP					
Real GDP	2.5	1.9	2.0	1.9	1.9
Nominal GDP	4.8	3.9	4.0	4.0	4.0
Growth of the Labor Force	1.0	0.6	0.4	0.4	0.5
Labor Force Participation Rate	65.7	62.0	60.2	59.4	60.6
Unemployment					
Unemployment rate	6.0	4.8	4.9	4.8	4.8
Natural rate of unemployment	5.2	4.7	4.6	4.6	4.6
Growth of Average Hours Worked	-0.1	-0.1	-0.1	-0.1	-0.1
Growth of Total Hours Worked	1.0	0.4	0.3	0.4	0.3
Earnings as a Share of Compensation	81	81	81	80	81
Growth of Real Earnings per Worker	1.0	1.1	1.2	1.1	1.1
Share of Earnings Below the Taxable Maximum	85	81	79	79	80
Growth of Productivity					
Total factor productivity	1.2	1.1	1.2	1.2	1.2
Labor productivity	1.5	1.5	1.6	1.6	1.6
Inflation					
Growth of the CPI-U	2.6	2.4	2.4	2.4	2.4
Growth of the GDP price index	2.2	2.0	2.0	2.0	2.0
Interest Rates					
Real rates					
On 10-year Treasury notes and Social Security bonds	2.5	0.9	1.5	2.1	1.5
Nominal rates					
On 10-year Treasury notes and Social Security bonds	5.1	3.2	3.9	4.5	3.8
On all federal debt held by the public ^b	5.2	2.7	3.6	4.1	3.4

Source: Congressional Budget Office.

The extended baseline generally reflects current law, following CBO's 10-year baseline budget projections through 2027 and then extending most of the concepts underlying those baseline projections for the rest of the long-term projection period.

CPI-U = consumer price index for all urban consumers; GDP = gross domestic product.

a. Life expectancy as used here is period life expectancy, which is the amount of time that a person in a given year would expect to survive beyond his or her current age on the basis of that year's mortality rates for various ages.

b. The interest rate on all federal debt held by the public equals net interest payments in the current fiscal year divided by debt held by the public at the end of the previous fiscal year.

birth rate observed or assumed for that year and if she survived her entire childbearing period.) The total fertility rate for the 1987–2007 period averaged 2.0 children per woman. Fertility rates often decline during recessions and rebound during recoveries. However, after the 2007–2009 recession, the U.S. fertility rate (which was 2.1 in 2007) dropped and has remained below 1.9. CBO’s projected rate is consistent with the rate recommended by the Social Security Advisory Board’s 2015 Technical Panel on Assumptions and Methods.⁴

Immigration

Under current law, CBO projects, net immigration to the United States (a measure that accounts for all people who either enter or leave the United States in any year) will grow by an average of 1.1 percent per year over the next decade. Thereafter, net immigration is projected to grow more slowly, at a rate of 0.6 percent per year. On the basis of those projections, CBO expects net annual immigration to rise from 1.1 million people in 2017 to 1.3 million people in 2047. Expressed another way, CBO projects that the rate of net annual immigration per thousand people in the U.S. population will rise from 3.2 in 2017 to 3.3 in 2047.

CBO’s projection for total net immigration over the next decade is informed by the agency’s economic projections and by recent demographic trends, both of which have particularly important implications for projections of net unauthorized immigration. CBO’s projections for unauthorized immigration are the result of two offsetting effects, to which the agency gave equal weight in its analysis. On the one hand, in CBO’s estimation, periods of moderate growth in the U.S. economy over the past two decades have been associated with increases in unauthorized immigration; consequently, CBO’s projections of economic growth suggest growth in such immigration over the coming decade. On the other hand, although unauthorized immigration is very difficult to measure, historical estimates indicate that the number of unauthorized immigrants in the U.S. in 2014 was about the same as in 2005. The implication is that factors other than the strength of the economy have been more important recently and may continue to be in the future.⁵

4. See 2015 Technical Panel on Assumptions and Methods, *Report to the Social Security Advisory Board* (September 2015), p. 9, <http://go.usa.gov/cJYR5> (PDF, 3.4 MB); and Congressional Budget Office, *The 2016 Long-Term Budget Outlook* (July 2016), www.cbo.gov/publication/51580.

CBO projects that there will be a net annual increase of unauthorized immigrants of roughly the same amount over each of the next 10 years. Increases in other types of immigration are projected to be relatively steady over the next decade.

For projections beyond the next decade, CBO employed a simplified approach: After 2026, the agency projects, net immigration will grow at an average rate that reflects the Census Bureau’s projections for late in the coming decade.⁶ That rate, 0.6 percent annually, is slightly faster than the overall average rate of population growth.

Mortality

The mortality rate, which is the number of deaths per thousand people, has generally declined in the United States for at least the past half century. For the most part, the mortality rate has improved more quickly for younger people than for older people during that period.⁷ CBO projects that mortality rates for each five-year age group will decline at the average pace experienced from 1950 through 2013. After projecting average mortality rates for men and women in each age group, CBO incorporates differences in those rates on the basis of marital status, education, disability insurance status, and lifetime household earnings. CBO projects lower mortality rates and thus longer life expectancies for people who are married, have more education, are not on disability insurance, or are in higher-income groups.⁸ (For people under 30, the mortality projections account for age and sex only.)

5. See Jeffrey S. Passel and D’Vera Cohn, *Overall Number of U.S. Unauthorized Immigrants Holds Steady Since 2009* (Pew Research Center, September 2016), <http://tinyurl.com/j45zwo5>. Official data on unauthorized immigrants do not exist, so historical estimates are very uncertain.

6. See Census Bureau, “2014 National Population Projections: Summary Tables,” Table 1, <http://go.usa.gov/x9Jyh>.

7. For more information about differences in the two age groups’ mortality improvement, see Congressional Budget Office, *The 2016 Long-Term Budget Outlook* (July 2016), Appendix A, www.cbo.gov/publication/51580.

8. For more information about mortality differences among groups with different earnings, see Congressional Budget Office, *Growing Disparities in Life Expectancy* (April 2008), www.cbo.gov/publication/41681; and Julian P. Cristia, *The Empirical Relationship Between Lifetime Earnings and Mortality*, Working Paper 2007-11 (Congressional Budget Office, August 2007), www.cbo.gov/publication/19096.

CBO's projections result in an average life expectancy at birth of 82.8 years in 2047, compared with 79.2 years in 2017.⁹ Similarly, CBO projects that life expectancy in 2047 will be 21.5 years at age 65, or 2.1 years longer than life expectancy at age 65 in 2017.¹⁰

Changes in Demographic Projections Since Last Year

CBO's projections of population growth have been adjusted downward relative to those published in last year's report, mainly because of revised projections of immigration but also because of changes in projected mortality rates. As a result, the share of the population that is of working age is smaller in the long term than CBO projected last year.

CBO has significantly reduced its projections of net immigration. Through 2026, the overall net rate of immigration per thousand people is projected to average 3.2, down from 3.9 last year. That reduction is primarily attributable to the agency's putting more weight on the evidence of low levels of unauthorized immigration in recent years. In later years, the total net immigration rate is projected to rise slightly, from 3.2 to 3.3, as the net number of immigrants grows more quickly than the population; in last year's projection, the expected rate of net immigration fell, from 3.9 to 3.7.

The life expectancies CBO now projects are a bit shorter than those reported last year, when life expectancy at birth was projected to be 83.0 years in 2046, 0.3 years longer than currently projected, and life expectancy at age 65 was projected to be 21.6 years, 0.1 year longer than currently projected. Recent data show higher mortality rates than CBO expected last year. Those data led CBO to increase its projection of mortality rates in the near term and to reduce rates of mortality improvement over the next three decades.

9. Life expectancy as used here is period life expectancy, which is the amount of time that a person in a given year would expect to survive beyond his or her current age on the basis of that year's mortality rates for various ages.

10. CBO projects that life expectancy in 2090 will be 86.9 years at birth and 24.3 years at age 65. CBO's projections of life expectancies are longer than those of the Social Security trustees (85.9 and 23.6 years, respectively) but shorter than the projections (88.3 and 25.3 years, respectively) recommended in the report of the 2015 Technical Panel on Assumptions and Methods, *Report to the Social Security Advisory Board* (September 2015), pp. 13–20, <http://go.usa.gov/cJYR5> (PDF, 3.4 MB).

Economic Variables

The performance of the U.S. economy in coming decades will affect the federal government's tax revenues, spending, and debt accumulation. To estimate those effects, CBO projects business-cycle fluctuations over the short term. Over the long term, it projects trends in key economic variables that contribute to the growth of gross domestic product (GDP), such as the size and composition of the labor force, the number of hours worked, earnings per worker, capital accumulation, productivity, inflation, and interest rates. The agency also considers ways in which fiscal policy influences economic activity.

Gross Domestic Product

CBO expects total output in the economy to grow moderately over the 2017–2047 period but at a slightly slower pace than the agency projected last year, resulting in a lower projection of GDP.

Projections of GDP. CBO projects that continuing recovery in aggregate demand will spur slightly faster growth in real GDP over the next two years than the economy has experienced, on average, since the recession ended.¹¹ Thereafter, growth in real GDP is projected to transition to a pace that reflects the increases in the supply of labor, capital services, and productivity described below. That projected pace also takes into consideration the influences of the marginal tax rates and increases in federal debt that CBO projects in its extended baseline.¹²

Over the long term, total GDP is projected to be one-half of one percent below its potential (maximum sustainable) amount, as it has roughly been, on average, over past decades. Those projected outcomes reflect CBO's assessment that, during and after economic downturns, actual output has fallen short of potential output to a greater extent and for longer periods than actual output has exceeded potential output during economic booms.¹³

Projected GDP growth is significantly slower than the average annual rate of 2.5 percent recorded over the past three decades, primarily because of the anticipated slower growth of the labor force. Moreover, as the labor force

11. Aggregate demand is total purchases by consumers, businesses, government, and foreigners of a country's output of final goods and services during a given period.

12. The marginal tax rate is the percentage of an additional dollar of income from labor or capital that is paid in taxes.

13. See Congressional Budget Office, *Why CBO Projects That Actual Output Will Be Below Potential Output on Average* (February 2015), www.cbo.gov/publication/49890.

grows more slowly than the overall population, per capita real GDP is expected to increase at a slower pace than it has in the past—at an average annual rate of 1.4 percent over the 2017–2047 period, compared with 1.6 percent for the past 30 years.

Changes in GDP Since Last Year. CBO’s projection of real GDP growth—an average annual rate of 1.9 percent over the 2017–2047 period—is slower than last year’s projection for the 2016–2046 period. In CBO’s current projections, GDP is about 2.5 percent lower in 2027 than the agency projected last year. By 2046, that gap grows to about 5 percent.

The Rate of Labor Force Participation

The size of the labor force is determined by the size of the population and the rate at which people participate in the labor market. CBO has significantly raised its projection of the labor force participation rate since last year.

Projections of the Labor Force Participation Rate. In CBO’s projections, the rate of labor force participation—that is, the share of the civilian noninstitutionalized population age 16 or older that is either working or seeking work—declines from 62.8 percent in 2017 to 61.0 percent in 2027 and to 59.3 percent in 2047. The aging of the population is the most important factor driving down the overall participation rate over the next 30 years, while the effects of other factors roughly offset one another.

Because older people tend to participate in the labor force at lower rates than younger people, the aging of the population is expected to significantly dampen the rate of participation over the next 30 years. The share of people over the age of 65 is projected to increase from 15.2 percent in 2017 to 21.5 percent in 2047, and the share of the population ages 20 to 64 is expected to decline from 59.0 percent to 54.8 percent during that 30-year period. Without the effects of an aging population—that is, if the age-and-sex composition of the population remained the same as it is expected to be in 2017—the labor force participation rate would stay roughly constant over the next 30 years, in CBO’s judgment.¹⁴

The effects of several other trends and fiscal policies roughly offset one another. Three trends put downward pressure on the participation rate. First, members of subsequent generations, who are replacing baby boomers in the labor force, tend to participate in the labor force at lower rates than their predecessors did at the same age. Second, the share of people receiving disability insurance benefits is generally projected to continue to rise, and people who receive such benefits are less likely to participate. Third, the marriage rate is projected to continue to fall, especially among men, and unmarried men tend to participate in the labor force at lower rates than married men.

CBO expects those forces to be mostly offset by three trends that are expected to increase participation. First, the population is becoming more educated, and workers with more education tend to participate in the labor force at higher rates than do people with less education. Second, the racial and ethnic composition of the population is changing in ways that, on net, increase participation. Consistent with patterns observed in the past, CBO expects Hispanic and non-Hispanic whites to participate at higher rates than the average. Like the Census Bureau, CBO expects that Hispanics will make up an increasing share of the population, which will increase the overall participation rate, and that non-Hispanic whites will make up a diminishing share, which will decrease the participation rate. The net result will be a modest increase in participation. Third, increasing longevity is expected to lead people to work longer.

In addition to those trends, CBO estimates that some fiscal policies projected in the extended baseline will tend to reduce incentives to work. Notably, rising federal debt and the increasing share of the population that is subject to higher marginal tax rates (attributable to growth in real income) will limit the growth of after-tax wages and reduce the supply of labor, as would people’s responses to other fiscal policies.

Changes in the Labor Force Participation Rate Since Last Year. CBO’s current projections of the labor force participation rate at the end of the first decade are slightly higher than those published last year, and the agency now projects a slower decline thereafter. Last year, the participation rate was projected to be 60.6 percent in 2026, compared with 61.1 percent in the current projections. The rate fell to 57.0 percent in 2046, a drop of

14. That calculation includes an adjustment for age and sex, but the sex composition of the population is projected to change only slightly. Consequently, the decline in the labor force participation rate is attributable almost entirely to aging.

3.7 percentage points. In the current projection, that rate drops by just 1.8 percentage points.

The changes since last year result from revisions in the estimated effects of several factors that influence labor force participation and from adding race and ethnicity as a factor in the analysis. Revised estimates of the effects of education and the marriage rate account for most of the changes. CBO now projects that increasing educational attainment will have a larger positive effect on participation than it estimated a year ago and that the declining marriage rate will have a smaller negative effect. In addition, factoring in race and ethnicity increases the overall projected participation rate.¹⁵

When combined with CBO's projections of the population, the projected rates of labor force participation imply that the labor force will grow by 0.5 percent per year, on average, over the 2017–2047 period. That rate is higher than the 0.4 percent per year projected a year ago.

Other Labor Market Outcomes

Among the factors accounted for in CBO's labor market projections—in addition to the size of the population and the rate of labor force participation—are the unemployment rate, the average and total number of hours that people work, and various measures of workers' earnings.

The Unemployment Rate. CBO projects that the unemployment rate will decline from 4.8 percent at the end of 2016 to 4.4 percent in 2018, gradually rise again to 5.0 percent by 2021, and then remain at that level, on average, through 2027. In the meantime, the natural rate of unemployment (the rate that results from all sources other than fluctuations in overall demand related to the business cycle) will gradually decline from over 4.7 percent to slightly below that rate, reflecting projected changes in the composition of the labor force.¹⁶ From 2021 onward, the unemployment rate is expected to remain about one-quarter of one percentage point

above the natural rate, consistent with the historical average relationship between the two measures and with the projected gap of one-half of one percent between actual and potential GDP.

After 2027, both the actual and the natural rates of unemployment are projected to decline gradually as the labor force ages and becomes increasingly more educated. Older and more educated workers tend to have lower actual and natural rates of unemployment, so those rates are expected to decline as the workforce ages and becomes more educated. By 2047, the natural rate is projected to be slightly less than 4.6 percent, and the actual rate is projected to be about 4.8 percent. Those rates are similar to the projections CBO published last year.

Average Hours Worked. Different subgroups of the labor force work different numbers of hours, on average. Men tend to work more hours than women do, for example, and people between the ages of 30 and 40 tend to work more hours than people between the ages of 50 and 60. In CBO's estimation, those differences among groups will remain stable. However, the agency also expects that over the long term, the composition of the labor force will shift toward groups that tend to work less (such as older workers). As a result, the average number of hours worked by the labor force as a whole is expected to decline slightly. By 2047, the average number of hours that people work is expected to be about 2 percent less than it is today.

Total Hours Worked. On the basis of projections of the size of the labor force, average hours worked, and unemployment, CBO anticipates that total hours worked will increase at an average annual rate of 0.3 percent between 2017 and 2047.

Earnings as a Share of Compensation. Workers' total compensation consists of taxable earnings and nontaxable benefits, such as employers' contributions to health insurance and pensions. Over the years, the share of total compensation paid in the form of earnings has declined—from about 90 percent in 1960 to about 81 percent in 2016—mainly because the cost of

15. For more details on CBO's long-term projections of the labor force and on changes from last year, see Congressional Budget Office, "CBO's Long-Term Projections of Labor Force Participation," *CBO Blog* (January 13, 2017), www.cbo.gov/publication/52365. For a discussion of CBO's 10-year projections of the labor force, see Congressional Budget Office, "Labor Market Projections," *CBO Blog* (February 2, 2017), www.cbo.gov/publication/52393.

16. That decline reflects the decreasing share of younger workers and the rising share of older workers in the working-age population: Older workers have lower unemployment rates than younger ones do, so the changing shares will reduce the overall rate.

health insurance has risen more quickly than total compensation.¹⁷

CBO expects that trend in health care costs to continue, which, by itself, would further decrease the proportion of compensation that workers receive as earnings. However, under current law, a new excise tax on certain employment-based health insurance plans that have premiums above specified amounts is scheduled to take effect in 2020. Some employers and workers are expected to respond by shifting to less expensive plans, thereby reducing the share of compensation consisting of health insurance premiums and increasing the share that consists of earnings. CBO projects that the effects of the tax on the mix of compensation will roughly offset the effects of rising costs for health care until the effects of rising costs outweigh those of the excise tax late in the projection period.¹⁸ As a result, the share of compensation that workers receive as earnings is projected to remain close to 80 percent through 2047.

Growth of Real Earnings per Worker. Trends in prices, nonwage compensation (such as employment-based health insurance), average hours worked, and labor productivity (discussed below) imply that real earnings per worker will grow by an average of 1.1 percent annually over the 2017–2047 period.

Share of Earnings Below the Taxable Maximum. Social Security payroll taxes are levied only on earnings up to a maximum annual amount (\$127,200 in 2017). Below that amount, earnings are taxed at a combined rate of 12.4 percent, split between the employer and employee (self-employed workers pay the full amount); no tax is paid on earnings above the cap. The taxable maximum has remained a nearly constant proportion of the average wage since the mid-1980s, but because earnings have grown more for higher earners than for others, the portion of covered earnings on which Social Security payroll taxes are paid has fallen from 90 percent in 1983 to

82 percent now.¹⁹ CBO anticipates that the unequal growth in earnings will continue for the next decade and then stop. The portion of earnings subject to Social Security taxes is projected to fall to 79 percent by 2027 and to remain at that level thereafter.

Changes in Other Labor Market Outcomes Since Last Year. The most important change since last year in the labor market outcomes discussed in this section is to the projected share of earnings below the taxable maximum. Reflecting a reexamination of recent trends, that share is expected to be about 2 percentage points higher, on average, over the 30-year period than CBO estimated last year. Data for the past few years show smaller-than-expected increases in the share of wages and salaries received by higher earners. In response, the agency made a downward revision to projected increases in that share over the next decade. With a smaller share of wages and salaries received by higher earners, a larger share will be received by people whose annual earnings are below the maximum amount subject to Social Security payroll taxes.²⁰

Capital Accumulation and Productivity

In addition to growth in the labor force and the number of hours worked, two other important factors affect the growth in output. One is the accumulation of capital, including physical structures, equipment, land, and inventories used in production, along with intangible capital such as computer software. The accumulated stock contributes a stream of services to production. The second is the growth of total factor productivity (TFP), which is the growth of real output per unit of combined labor and capital services, or the growth of output that is not explained by the growth of labor and capital. The growth rates projected for the labor supply, the capital stock, and TFP result in CBO's projection of the average growth of labor productivity (output per worker). This year, CBO projects slightly lower rates of capital accumulation and productivity than it did last year.

17. For more details, see Congressional Budget Office, *How CBO Projects Income* (July 2013), www.cbo.gov/publication/44433.

18. CBO anticipates that the effects of the excise tax on the taxable share of compensation will diminish over time, both because the agency expects that most people will continue to want a significant amount of health insurance and because the Affordable Care Act set minimum amounts of coverage for health insurance plans. Therefore, the number of additional people moving to less expensive insurance plans will eventually dwindle.

19. Covered earnings are those received by workers in jobs subject to Social Security payroll taxes. Most workers pay payroll taxes on their earnings, although a small number—mostly in state and local government jobs or in the clergy—are exempt.

20. The revision also implies that households with lower individual income tax rates will earn a larger share of total income than CBO projected last year, so that total income tax revenues will be lower than previously projected.

Capital Services. Over the longer term, in CBO's view, growth in the nation's stock of capital will be driven by private saving, federal borrowing, and international flows of financial capital. Private saving and international capital flows tend to move with the after-tax rate of return on investment, which measures the extent to which investment in the stock of capital results in a flow of income. That rate is affected both by tax rates and by the growth of TFP. Capital services are expected to expand slightly more slowly than output after 2027 because of rising federal borrowing and increasing effective marginal tax rates.

Total Factor Productivity. The annual growth of TFP is projected to increase from about 1.1 percent in 2017 to about 1.2 percent in 2023 and then to remain at that rate through 2047, yielding an average annual growth rate of roughly 1.2 percent from 2017 to 2047. That projected average rate is about 0.3 percentage points slower than the average annual rate of nearly 1.5 percent observed since 1950 and about 0.1 percentage point slower than the average rate recorded since 1990.

The projected path for TFP reflects several considerations that, in CBO's judgment, suggest growth in coming decades will be slower than the long-term historical average. For example, with the exception of a period of rapid growth in the late 1990s and early 2000s, productivity has tended to grow more slowly in recent decades than it did during the 1950s and 1960s. The long-term trend suggests that projections for the next few decades should place greater weight on more recent, slower growth than on the relatively rapid growth of the more distant past. Thus, although CBO's projections include an acceleration in the growth of TFP from its unusually slow recent growth, the agency anticipates that TFP will return to a growth rate that is slower than its long-term average.

Some developments in particular support such projections for TFP. One important such development is the anticipated growth in labor quality, a measure of workers' skills that accounts for educational attainment and work experience that, in CBO's framework, is implicitly a part of TFP. Following a relatively rapid rise during the 1980s and 1990s, growth in labor quality slowed after 2000. In CBO's judgment, that change results both from a gradual and persistent slowdown in the increase in average educational attainment and from the burgeoning retirement

of a relatively large and skilled portion of the workforce—the baby-boom generation. In coming decades, however, the slowdown in the growth of labor quality is expected to be partly offset by the aging of those remaining in the labor force, especially as better health and longer life expectancy lead people to stay in the workforce longer than did members of previous generations. (An older workforce generally has a larger proportion of more highly educated workers because they tend to remain in the labor force longer than do workers with less education.) Nevertheless, CBO anticipates slower growth in labor quality than in the past.

Another factor that is projected to slow the growth of TFP relative to its long-term average is the expected reduction in spending for federal investment. Under the assumptions used for CBO's baseline, the government's nondefense discretionary spending is projected to decline over the next decade to a much smaller percentage of GDP than it has averaged in the past. About half of nondefense discretionary spending from the 1980s onward consisted of federal investment in physical capital (such as roads and other infrastructure), education and training, and research and development—all of which, in CBO's judgment, contributed to TFP growth. Consequently, lower nondefense discretionary spending as a percentage of GDP would mean less federal investment, causing TFP to grow more slowly.

Labor Productivity. Taken together, the projections of labor supply, capital services, and TFP result in labor productivity that is expected to grow by 1.6 percent annually over the 2017–2047 period.

Changes in Capital Accumulation and Productivity Since Last Year. CBO's projection of growth in capital services is below the rate it projected last year, largely because the agency has lowered its projection for the growth of TFP relative to the rate of growth in recent decades. With TFP projected to grow more slowly relative to its historical average, the rate of return on capital and incentives to invest is dampened.

CBO's projection for average TFP growth is about 0.1 percentage point slower than projected last year. Part of the revision reflects the agency's reassessment of the relative contributions of labor and capital services to output in history and in the projection and has essentially no

net effect on the projected growth of GDP.²¹ However, the revision also reflects updated information that indicates relatively weak recent growth in comparison to recent decades.

In addition, the revision reflects three improvements in CBO's method of estimating growth of potential, or trend, TFP. First, CBO has changed the primary measure of labor market slack that it uses to measure the effects of business-cycle fluctuations when estimating underlying trends in key economic variables: Rather than using the unemployment gap (the difference between the actual and natural unemployment rates), the agency now uses the employment gap (the difference between the actual and potential employment rates). Second, in assessing the slow growth of TFP since 2007, CBO now attributes it less to cyclical weakness and more to underlying trends, resulting in an estimate of slower growth in potential TFP during the 2000s. Those changes reduce the projected growth of TFP in ways that directly affect GDP growth. A third, minor methodological change involves the way CBO accounts for the acceleration of TFP growth in the late 1990s and early 2000s. CBO now estimates that less of that acceleration reflected temporarily strong economic conditions and more of it reflected stronger growth in potential TFP. That change slightly boosts projected potential TFP growth and partly offsets the negative effects of the other two changes.

Inflation

CBO projects rates of inflation for two categories: prices of consumer goods and services and prices of final goods and services in the economy.²² Those rates influence nominal levels of income and interest rates and thereby influence tax revenues, various types of federal expenditures that are indexed for inflation, and interest

payments on federal debt. CBO's projections of inflation this year are essentially unchanged.

Prices of Consumer Goods and Services. Consumer price inflation is measured by the annual rate of change in both the consumer price index for urban wage earners and clerical workers and the consumer price index for all urban consumers (CPI-U). Over the 2017–2047 period, CBO projects, inflation in both measures will average 2.4 percent. That long-term rate is slightly less than the average rate of inflation since 1990, when growth in the CPI-U averaged 2.5 percent per year.

Prices of Final Goods and Services. After 2018, the annual inflation rate for all final goods and services produced in the economy, as measured by the rate of increase in the GDP price index, is projected to average 0.4 percentage points less than the annual increase in the consumer price indexes. The GDP price index grows more slowly than the consumer price indexes because it is based on the prices of a different set of goods and services and a different method of calculation.

Changes in Inflation Since Last Year. Inflation in both measures of consumer prices is projected to be the same as the rates CBO projected last year for the 2016–2046 period. The projected gap between the CPI-U and the GDP price index also remains unchanged from last year's estimate.

Interest Rates

CBO makes projections of the interest rates, both real and nominal, that apply to federal borrowing, including the rate on 10-year Treasury notes and special-issue Social Security bonds. It also projects the average nominal interest rates on federal debt held by the public and on the bonds held in the Social Security trust funds. Those rates influence the evolution of the trust funds and the cost of the government's debt burden.

After considering a number of factors, including slower growth of the labor force, CBO expects real interest rates on federal borrowing to be lower in the future than they have been, on average, over the past few decades. The real interest rate on 10-year Treasury notes (calculated by subtracting the rate of increase in the consumer price index from the nominal yield on those notes) averaged

21. The agency also reassessed the relative contributions of labor and capital services to output, aligning them more closely with recent trends in income shares and with estimates by other leading researchers. That change increased the estimated historical and projected contribution of capital services to output, but also had the offsetting effect of reducing the estimate of historical and projected TFP, leaving the projection of GDP essentially unchanged.

22. Final goods and services are those purchased directly by consumers, businesses (for investment), and governments, as well as net exports.

roughly 3.1 percent between 1990 and 2007.²³ That rate has averaged 0.9 percent since 2009 and is projected to be 1.2 percent in 2027. In CBO's projections, the rate continues to rise thereafter, reaching 2.3 percent in 2047, 0.8 percentage points lower than its average over the comparison period, 1990 to 2007. CBO's projections for interest rates in this year's long-term budget outlook are generally lower than last year's.

Factors Affecting Interest Rates. Interest rates are determined by a number of factors. CBO projects interest rates by comparing how the values of those factors are expected to differ in the long term relative to their average values in the past. However, conclusions from such analyses depend strongly on the period considered: Real interest rates were low in the 1970s because of an unexpected surge in inflation. In the 1980s, when inflation declined at an unexpectedly rapid pace, real rates were high.²⁴ Interest rates fell sharply during the financial crisis and recession that began in 2007.

To avoid using any of those possibly less representative periods, CBO considered average interest rates and their determinants for the 1990–2007 period and then judged how different those determinants might be over the long term.²⁵ That period was chosen for comparison because it

featured fairly stable expectations of inflation and no severe economic downturns or financial crises.

Some factors reduce interest rates; others increase them. In CBO's assessment, over the 2017–2047 period, several factors will reduce interest rates on government securities relative to their 1990–2007 average:

- The labor force is projected to grow much more slowly than it has for the past few decades. Excluding associated changes in the behavior of other variables (including the unemployment rate), that slower growth in the number of workers will tend to increase the amount of capital per worker in the long term, reducing the return on capital and, therefore, also reducing the return on government bonds and other investments.²⁶
- The share of total income received by higher-income households is expected to be larger in the future than it has been during the past few decades. Higher-income households tend to save a greater proportion of their income, so the difference in the distribution of income is projected to increase the total amount of saving available for investment, other things being equal. As a consequence, the amount of capital per worker is projected to rise and interest rates are expected to fall.
- TFP will grow more slowly in the future than it has in recent decades, CBO projects. For a given rate of investment, lower productivity growth reduces the return on capital and results in lower interest rates, all else being equal.
- The risk premium—the additional return that investors require to hold assets that are riskier than Treasury securities—will probably remain higher in the future than its average over the 1990–2007 period. Financial

23. Between 1970 and 2007, the real interest rate on 10-year Treasury notes averaged 3.2 percent; the average from 1953 to 2007 was 2.9 percent. Historical inflation rates are taken from the consumer price index, 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)" (updated April 13, 2016), www.bls.gov/cpi/cpiurs.htm.

24. CBO calculates real interest rates by subtracting expected rates of inflation from nominal interest rates. Borrowers and lenders agree to nominal interest rates after accounting for their expectations of what inflation will be. However, if inflation ends up being higher than was expected when the rates were agreed to, real interest rates will turn out to be lower than anticipated. If inflation ends up lower than expected, the opposite will occur. CBO's approach is based on an assumption that the actual consumer price index, adjusted to account for changes over time in the way that the index measures inflation, is a useful proxy for expectations of inflation. One drawback is that if trends in inflation are fluctuating rapidly over time, changes in expectations may lag behind changes in actual inflation. Although CBO's approach could mismeasure expectations of inflation and real interest rates in some years, the way inflation has varied over time suggests that CBO's approach yields useful measurements of 30-year averages.

25. A Bank of England study identified a similar set of determinants that account for the decline in real interest rates over the past 30 years. See Rachel Lukasz and Thomas D. Smith, *Secular Drivers of the Global Real Interest Rate*, Staff Working Paper 571 (Bank of England, December 2015), <http://tinyurl.com/z6zqnb7> (PDF, 1.8 MB).

26. For more information about the relationship between the growth of the labor force and interest rates, see Congressional Budget Office, *How Slower Growth in the Labor Force Could Affect the Return on Capital* (October 2009), www.cbo.gov/publication/41325.

markets were already showing less appetite for risk in the early 2000s, resulting in higher risk premiums than in the 1990s. The demand for low-risk assets was further strengthened by the economic fallout from the financial crisis, the slow subsequent recovery, and financial institutions' response to increased regulatory oversight. Moreover, in the past several years, the perception that investments in emerging market economies were riskier than investments in the United States probably contributed to the increased demand for U.S. assets (particularly federal debt) that are considered to be relatively risk-free. The rise in demand for Treasury securities from those sources contributed to lower returns (that is, to lower interest rates). CBO expects the risk premium to gradually decline over the next three decades but to remain above its average level during the comparison period from 1990 to 2007.

At the same time, in CBO's assessment, several factors will tend to boost interest rates on government securities relative to their average over the 1990–2007 period:

- Under CBO's extended baseline, federal debt is expected to be much larger as a percentage of GDP than it was before 2007—reaching 90 percent by 2027 and 150 percent by 2047. The latter figure is more than three-and-a-half times the average over the 1990–2007 period. Higher federal borrowing tends to crowd out private investment in the long term, reducing the amount of capital per worker and increasing both the return on capital and interest rates over time.
- Net inflows of capital from other countries will be smaller as a percentage of GDP in the future than they have been, on average, in recent decades, CBO projects. In the 1990s and early to middle 2000s, rapid economic growth and high rates of saving in various nations with emerging market economies led to large flows of capital from those countries to the United States. Recent weakness in the outlook for global economic growth suggests demand for investment abroad will be somewhat restrained and, therefore, flows of capital into the United States will remain strong for the next several years. Beyond the next decade, however, as foreign economies continue to grow, their consumption will probably increase relative to saving because markets for their debt will develop and because average citizens will tend to receive more of

the gains from economic growth. Consequently, their demand for domestic investments will rise. That increased demand is projected to gradually reduce capital flows to the United States relative to those in the 1990s or early 2000s, decreasing domestic investment and the amount of capital per worker and boosting rates of return. (Those developments are consistent with CBO's projection that the U.S. trade deficit, the gap between its imports and exports, will be narrower in the future as a percentage of GDP than it has been for the past few decades.)

- The capital share of income—the percentage of total income that is paid to owners of capital—has been on an upward trend for the past few decades. CBO projects that the share will decline somewhat over the next decade from its current, elevated level but remain higher than its average over recent decades. The factors that appear to have contributed to its rise (such as technological change and globalization) are likely to persist, keeping it above the historical average. In CBO's estimation, a larger share of income accruing to owners of capital will directly boost the return on capital and, thus, interest rates.
- The retirement of members of the baby-boom generation and slower growth of the labor force will reduce the number of workers in their prime saving years relative to the number of older people who are drawing down their savings, CBO projects. As a result, the total amount of saving available for investment will decrease (all else being equal), which will tend to reduce the amount of capital per worker and thereby push up interest rates. (CBO estimates that this effect will only partially offset the positive effect on saving of increased income inequality, leaving a net increase in savings available for investment.)

CBO also has considered other influences on interest rates but has concluded that they will have relatively small effects.

Some factors mentioned above are easier than others to quantify. For instance, the effect of labor force growth and rising federal debt can be estimated from available data, theoretical models, and estimates in the literature. The extent to which other factors will affect interest rates is more difficult to estimate. A shift in preferences for low- rather than high-risk assets is not directly observable, for

example. And although the distribution of income is observable, neither models nor empirical estimates offer much guidance for quantifying its effect on interest rates.

In light of those sources of uncertainty, CBO relies not only on economic models and findings from the research literature to guide its assessments of the effects of various factors on interest rates over the long term, but also on information from financial markets. The current rate on 30-year Treasury bonds, for example, reflects market participants' judgments about the path that interest rates on short-term securities will take 30 years into the future. That market forecast informs CBO's assessment of market expectations for the risk premium and for investment opportunities in the United States and abroad, and it points to considerably lower interest rates well into the future relative to those of recent decades.

Projections of Interest Rates. The estimates and assumptions that underlie CBO's extended baseline projections suggest a real interest rate on 10-year Treasury notes that averages about 1.5 percent over the 2017–2047 period. In 2047, the rate is projected to reach 2.3 percent. The nominal interest rate on those notes is projected to average 3.8 percent over the 2017–2047 period and to reach 4.7 percent in 2047.

The average interest rate on all federal debt held by the public tends to be somewhat lower than the rates on 10-year Treasury notes because interest rates are generally lower on shorter-term debt than on longer-term debt and because Treasury securities are expected to mature, on average, over periods of less than 10 years.²⁷ In combination, CBO's projections of interest rates for assets of different maturities and estimates of the average maturity of federal debt for the period beyond the agency's 10-year baseline lead to a 0.3 percentage-point difference between the rate on 10-year Treasury notes and the effective rate on federal debt over the 2028–2047 period. That difference is projected to average 0.6 percentage points over the next decade. The difference is larger over that period than is projected for later years because a significant portion of federal debt that was outstanding during that period was issued at the very low interest rates prevailing in the aftermath of the 2007–2009 recession. (The average interest

rate on all federal debt is projected to rise more slowly than the 10-year rate because only a portion of federal debt matures each year.) Thus, CBO projects, the average nominal interest rate on all federal debt held by the public will be about 3.4 percent for the 2017–2047 period, reaching 4.4 percent in 2047.

The Social Security trust funds hold special-issue bonds that generally earn interest at rates that are higher than the average rate on federal debt. CBO projects an interest rate on bonds newly issued to the trust funds that averages 3.8 percent for the 2017–2047 period and reaches 4.7 percent in 2047. The corresponding real rates are 1.5 percent, on average, over the full period and 2.3 percent in 2047. Because interest rates on newly issued bonds are expected to increase in coming years, CBO projects that the average interest rate earned by all bonds held by the Social Security trust funds will be slightly lower over the next decade. That rate, which is used to calculate the present value of future streams of revenues and outlays for those funds, averages 3.6 percent for the 2017–2047 period.²⁸

Changes in Interest Rates Since Last Year. CBO's projections for interest rates in this year's long-term budget outlook are lower than last year's. The real rates on 10-year Treasury notes and the Social Security bonds are projected to average 1.5 percent over the 30-year projection period and to be 2.3 percent in 2046. Last year, CBO projected both rates to average 1.9 percent over the 30-year period and to be 2.3 percent in 2046.

CBO's downward revisions to its projections of interest rates are rooted in a number of factors. Relative to the growth that occurred during the 1990–2007 period, CBO now projects that TFP will grow more slowly over the 2017–2047 period than the agency anticipated last year for the 2016–2046 period. Slower growth in TFP implies lower returns on capital and, in turn, lower interest rates. All told, the average projected interest rate on 10-year Treasury notes over the 2016–2046 period is 0.5 percentage points lower than that projected a year ago.

27. In particular, from 2017 to 2027, the difference between the rate on 3-month Treasury bills and the rate on 10-year Treasury notes shrinks from 1.5 percentage points to its longer-run level of 0.8 percentage points.

28. A present value is a single number that expresses a flow of future income or payments in terms of an equivalent lump sum received or paid at a specific point in time; the present value of a given set of cash flows depends on the rate of interest—known as the discount rate—that is used to translate them into current dollars.

Over the next decade, CBO anticipates, investors' appetite for risk will be lower (and, consequently, the demand for Treasury securities will be higher) than the agency previously projected. CBO also expects foreign economic growth to be slower and, therefore, that both foreign and domestic demand for U.S. Treasury securities (relative to foreign securities) will be higher than previously estimated. CBO's revisions to both of those factors imply higher prices for Treasury securities and, therefore, lower interest rates for them.²⁹

29. After the release of last year's long-term projections, CBO revised its projection of the interest rate on Treasury securities over the next 10 years. The bulk of those revisions occurred last summer and are discussed in Congressional Budget Office, *An Update to the Budget and Economic Outlook: 2016 to 2026* (August 2016), www.cbo.gov/publication/51908. CBO subsequently made additional but smaller downward revisions to projected interest rates on Treasury securities in the near term. Those revisions are discussed in Congressional Budget Office, *The Budget and Economic Outlook: 2017 to 2027* (January 2017), www.cbo.gov/publication/52370.

Beyond the next decade, CBO expects the effects of lower appetite for risk and slower foreign growth to dissipate, but at a slower pace than previously projected. CBO anticipates that investors' appetite for risk will increase (and thus will reduce their demand for Treasury securities) as they gain confidence that the economy will continue to grow at a moderate pace with low inflation. CBO also projects that as foreign economic growth improves, the demand for U.S. Treasury securities (on the part of both foreign and domestic investors) will diminish. Relative to last year's projection, CBO expects the waning effects of those factors to be more gradual, which implies that interest rates will rise more slowly over the long term while the effect on rates in 2046 is roughly unchanged. CBO's downward revisions to interest rates are consistent with signals from financial markets that participants appear to have lowered their long-term expectations for interest rates since the agency released its previous long-term projections.