CBO's Projections of Demographic and Economic Trends

The Congressional Budget Office's assessment of the 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 2028, the economic and demographic projections presented in this report are the same as those that CBO published in April.[1] For the years beyond 2028, CBO's projections generally reflect historical trends and anticipated demographic changes. (Average values for 2018 to 2048, 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 this report's supplemental data, available online at www.cbo.gov/publication/53919.)

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. Rates of fertility, immigration, and mortality determine the population and thus the size of the labor force and the number of people receiving benefits from federal programs such as Social Security and Medicare. CBO projects the population to be about the same in the future as it projected last year.

Population

In CBO's projections, the total population increases from 332 million at the beginning of 2018 to 392 million in 2048, and its annual growth rate gradually declines from 0.7 percent in 2018 to 0.4 percent in 2048. The population is projected not only to grow more slowly but also to become older, on average, than in the

past. In the agency's projections, over the 30-year 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 2018–2048 period.[3] (That rate, which represents the average number of children that a woman would have in her lifetime, is calculated as the sum of fertility rates for all ages between 15 and 49 in a given year.)[4] The total fertility rate for the 1988–2007 period averaged 2.0 children per woman. Fertility rates often decline during recessions and rebound during recoveries. However, the U.S. fertility rate did not recover after the 2007–2009 recession; the rate (which was 2.1 in 2007) dropped and has remained below 1.9.[5] CBO's projected rate is consistent with the rate recommended to the Social Security Advisory Board by its 2015 Technical Panel on Assumptions and Methods, the board's most recent panel.[6]

---

1. See Congressional Budget Office, *The Budget and Economic Outlook: 2018 to 2028* (April 2018), www.cbo.gov/publication/53651.

2. The extended baseline generally reflects current law, following CBO's 10-year baseline projections through 2028 and then extending most of the concepts underlying those baseline projections for the rest of the long-term projection period.

3. In CBO's 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.

4. The total fertility rate can also be defined as the average number of children that a woman would have in her lifetime if, in each year of her life, she experienced the birth rates observed or assumed for that year and if she survived her entire childbearing period.

5. Recent data show that total fertility rates have remained below 1.9. See Brady E. Hamilton and others, *Births: Provisional Data for 2017*, Vital Statistics Rapid Release Report 4 (National Center for Health Statistics, May 2018), www.cdc.gov/nchs/nvss/vsrr/reports.htm.

6. See 2015 Technical Panel on Assumptions and Methods, *Report to the Social Security Advisory Board* (September 2015), p. 9, https://go.usa.gov/cJYR5 (PDF, 3.4 MB).

Table A-1.

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

	1988–2017	2018–2028	2029–2038	2039–2048	Overall, 2018–2048
Demographic Variables					
Growth of the Population (Percent)	0.9	0.7	0.5	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)	3.7	3.1	3.2	3.2	3.2
Life Expectancy at Birth, End of Period (Years)[a]	79.1	80.5	81.7	82.8	82.8
Life Expectancy at Age 65, End of Period (Years)[a]	19.4	20.2	20.9	21.7	21.7
Economic Variables (Percent)					
Growth of GDP					
Real GDP	2.5	1.9	1.9	1.9	1.9
Nominal GDP (Fiscal Year)	4.7	4.1	4.0	4.0	4.0
Growth of the Labor Force	1.0	0.5	0.4	0.4	0.4
Labor Force Participation Rate	65.6	62.1	60.3	59.6	60.7
Unemployment					
Unemployment rate	5.9	4.4	4.8	4.7	4.6
Natural rate of unemployment	5.1	4.6	4.5	4.5	4.5
Growth of Average Hours Worked	-0.1	*	-0.1	-0.1	*
Growth of Total Hours Worked	1.0	0.5	0.3	0.4	0.4
Earnings as a Share of Compensation	81	81	81	81	81
Growth of Real Earnings per Worker	0.9	1.5	1.2	1.1	1.2
Share of Earnings Below the Taxable Maximum	85	81	81	80	81
Growth of Productivity					
Total factor productivity	1.2	1.1	1.2	1.2	1.2
Labor productivity[b]	1.5	1.4	1.6	1.6	1.5
Inflation					
Growth of the CPI-U	2.6	2.4	2.4	2.4	2.4
Growth of the GDP price index	2.1	2.1	2.0	2.0	2.0
Interest Rates					
Real rates					
On 10-year Treasury notes and Social Security bonds	2.3	1.4	1.6	2.1	1.7
Nominal rates					
On 10-year Treasury notes and Social Security bonds	4.9	3.8	4.0	4.5	4.1
On all federal debt held by the public[c]	5.0	3.1	3.6	4.1	3.6

Source: Congressional Budget Office.

The extended baseline generally reflects current law, following CBO's 10-year baseline budget projections through 2028 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; * = between -0.05 percent and 0.05 percent.

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 measure of labor productivity reported here is the ratio of real output to hours worked in the economy. Note that elsewhere CBO reports different measures of labor productivity, such as the ratio of potential real output to the potential labor force.

c. 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.

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) would grow by an average of 0.7 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 2018 to 1.3 million people in 2048. Expressed another way, the rate of net annual immigration per thousand people in the U.S. population would rise from an average of 3.1 over the next decade to 3.2 in 2048.

CBO's projection of 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 of 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 United States in 2015 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.[7]

CBO projects that the increase in net immigration over the next decade would be mostly driven by increases in the number of legal permanent residents. The annual increase in the number of legal temporary and unauthorized immigrants is projected to be relatively steady over the next 10 years.

For projections beyond the next decade, CBO employed a simplified approach: After 2028, under current law, the agency projects that net immigration would grow at an average rate of 0.6 percent annually, slightly faster than the overall average rate of population growth.[8]

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 dropped more quickly for younger people than for older people during that period. Mortality rates for each five-year age group are projected to decline at the same average pace each group experienced from 1950 through 2014. 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, do not receive benefits through the Social Security Disability Insurance (DI) program, or are in higher-income groups.[9] (For people under 30, the mortality projections account for age and sex only.)

CBO's projections result in an average life expectancy at birth of 82.8 years in 2048, compared with 79.2 years in 2018.[10] Similarly, CBO projects life expectancy at age

---

7. For the most recent estimates, see Jens Manuel Krogstad, Jeffrey S. Passel, and D'Vera Cohn, *As Mexican Share Declined, U.S. Unauthorized Immigrant Population Fell in 2015 Below Recession Level* (Pew Research Center, April 2017), https://tinyurl.com/mn5zbb5. For more details, see Jeffrey S. Passel and D'Vera Cohn, *Overall Number of U.S. Unauthorized Immigrants Holds Steady Since 2009* (Pew Research Center, September 2016), https://tinyurl.com/j45zw05. Official data on unauthorized immigrants do not exist, so historical estimates are very uncertain.

8. That rate is based on the Census Bureau's projections for late in the coming decade. See Census Bureau, "2014 National Population Projections: Summary Tables," Table 1, https://go.usa.gov/xQGwc. The Census Bureau has recently released a new set of projections, but information from those projections has not been incorporated in this analysis. In those projections, the population is slightly smaller than the Census Bureau projected in 2014.

9. For more information about mortality differences among groups with different earnings, see Tiffany Bosley, Michael Morris, and Karen Glenn, *Mortality by Career-Average Earnings Level*, Actuarial Study 124 (Social Security Administration, April 2018), https://tinyurl.com/yct5qdew (PDF, 301KB); 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.

10. 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.

65 to be 21.7 years in 2048, or 2.2 years longer than life expectancy at age 65 in 2018.[11]

Changes in Demographic Projections Since Last Year
CBO's projections of population growth in most years are very similar to those published in last year's report, except for small changes to CBO's projections of net immigration and mortality rates. Net immigration was projected to grow, on average, more quickly in the decade following 2017 in last year's report than it is projected to grow in the decade following 2018 in this year's report. That is because last year's projections included growth in 2017 that was higher than in the rest of the 10-year period. The average growth in net immigration over the decade following 2018 in this year's report does not include that year of higher growth.

The life expectancies CBO now projects are only slightly different from those reported last year. Life expectancy at birth is projected to be 82.7 years in 2047, 0.1 year shorter than CBO projected last year, and life expectancy at age 65 is projected to be 21.6 years, 0.1 year longer than in last year's projection. Those changes reflect recent data that show higher mortality rates than CBO expected last year for people ages 15 to 74 and lower mortality rates than expected last year for people 75 or older. Those data led CBO to increase its projection of mortality rates for people ages 15 to 74 in the near term and to reduce their rates of mortality improvement over the next three decades, which reduced CBO's projection of life expectancy at birth. In contrast, for people 75 or older, CBO decreased its projection of mortality rates and increased the rate of mortality improvement, which increased CBO's projection of life expectancy at age 65 throughout the 30-year period.

Economic Variables
The performance of the U.S. economy in coming decades will affect the federal government's tax revenues, spending, and debt accumulation. In CBO's analysis, the long-term effects depend on key economic variables such as the growth of gross domestic product (GDP), the size and composition of the labor force, the number of hours worked, earnings per worker, capital accumulation, and productivity. Over the short term, the effects also depend on variables that fluctuate over the business cycle, such as 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 2018–2048 period. In the agency's projections, real GDP growth over that period averages 1.9 percent per year, about what was projected last year for the 2017–2047 period. However, the pattern of that growth is different in this year's projections; CBO now projects that real GDP grows faster over the next few years. As a result, the level of real GDP remains higher over the projection period.

Projections of GDP. CBO anticipates that recent changes to the tax code, changes in discretionary spending, and continuing increases in aggregate demand will spur a pickup in the growth of real GDP over the next few years (see Box 1 on page 26 for details on the effects of the recent changes to the tax code).[12] Thereafter, growth in real GDP is projected to make a 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.[13]

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.[14]

---

11. CBO projects life expectancy in 2090 to be 86.9 years at birth and 24.4 years at age 65. CBO's projections of life expectancies are longer than those of the Social Security trustees (85.8 and 23.5 years, respectively) but shorter than the projections (88.3 and 25.3 years, respectively) recommended by the 2015 Technical Panel on Assumptions and Methods in *Report to the Social Security Advisory Board* (September 2015), pp. 13–20, https://go.usa.gov/cJYR5 (PDF, 3.4 MB).

12. 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.

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

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

Projected real GDP growth over the next three decades is slower than the average annual rate of 2.5 percent recorded over the past three decades, primarily because the labor force is anticipated to grow more slowly in the coming years. Moreover, with the labor force growing 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 2018–2048 period, compared with 1.6 percent for the past 30 years.

Changes in Projections of GDP Since Last Year. In CBO's current projections, the level of real GDP is about 1.4 percent higher in 2027 than the agency projected last year. That gap shrinks over the next two decades; by 2047 real GDP is 0.7 percent higher than it was last year. The higher level of real GDP in this year's projections stems primarily from three factors: revisions to historical data, changes in federal fiscal policy, and improvements in analytical methods.

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 slightly 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 2018 to 61.0 percent in 2028 and to 59.5 percent in 2048. The aging of the population is the most important factor driving down the overall participation rate over the next 30 years; 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 16 percent in 2018 to 22 percent in 2048, and the share of the population ages 20 to 64 is expected to decline from 59 percent to 55 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 2018—the

labor force participation rate would stay roughly constant over the next 30 years, in CBO's judgment.[15]

The effects of several other trends and fiscal policies roughly offset one another. Three trends put downward pressure on the participation rate:

- Men of the generations that followed the baby boomers tend to participate in the labor force at lower rates than male baby boomers did at the same age. (The participation of women from generations following the baby boomers has remained relatively constant.)

- The share of people receiving DI benefits is generally projected to continue to rise, and people who receive such benefits are less likely to work.

- 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 two trends. As the population becomes more educated, labor participation rates are expected to increase because workers with more education tend to participate in the labor force at higher rates than do people with less education. Second, increasing longevity is expected to lead people to continue working to increasingly older ages.[16]

In addition to the effects of those demographic trends, recent changes in tax law, combined with economic and budgetary trends, would also affect the labor force:

- CBO estimates that, under current law, lower tax rates on labor would increase participation in the labor force over most of the next decade because individuals would see a greater return on their labor. However, the lower tax rates are scheduled to expire

---

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

16. The agency recently updated its methods for projecting labor force participation to more adequately account for recent trends in educational attainment and aging. See Josh Montes, *CBO's Projection of Labor Force Participation Rates*, Working Paper 2018-04 (Congressional Budget Office, March 2018), www.cbo.gov/publication/53616.

at the end of 2025, reducing the incentive to work, which would in turn reduce participation in the labor force toward the end of the decade.

- In addition, major tax legislation enacted in 2017 adopted an alternative measure of inflation for the tax code that grows slightly more slowly than the inflation measure used previously. Tax brackets, which are set to increase with inflation, will increase more slowly because of this new measure. Consequently, real income growth in the future will cause an increased share of labor income to be pushed into higher tax brackets. Over time, under an assumption that current laws remain unchanged, that bracket creep would reduce incentives to work.

- Rising federal deficits are projected to slow growth in the stock of private capital and limit the growth of after-tax wages, also reducing the supply of labor. However, recent changes to the tax code provide greater incentives to invest, mitigating some of the effects of higher deficits on the stock of private capital.

Changes in Projections of the Labor Force Participation Rate Since Last Year. CBO's current projections of the labor force participation rate through 2025 are higher than its projections last year because of the enactment of individual tax provisions that raise after-tax wages during the next several years. Last year, CBO projected the participation rate would be 61.3 percent by 2025. This year, CBO projects the participation rate to be 61.7 percent in 2025.

Beyond 2025, participation rates over the next three decades are slightly higher than the rates published last year. Last year, the participation rates were projected to be 61.0 percent in 2027 and 59.3 percent in 2047. In the current projections, those rates are 61.2 percent and 59.5 percent, respectively.

When combined with CBO's projections of the population, the projected rates of labor force participation imply that the labor force grows by 0.4 percent per year, on average, over the 2018–2048 period. That rate is slightly less than the 0.5 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 agency has changed its projections of those variables over the past year because of updates to historical data and reexamination of recent trends.

Unemployment. In CBO's projections, the unemployment rate, which was 4.1 percent at the end of 2017, declines to 3.3 percent in 2019, gradually rises to 4.8 percent by 2024, and then remains at that level, on average, through 2028. 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) is projected to remain at 4.6 percent from 2018 to 2028. From 2024 onward, the unemployment rate is expected to remain about one-quarter of one percentage point above the natural rate, a difference that is consistent both 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 2028, 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.) By 2048, the natural rate of unemployment is projected to be slightly less than 4.4 percent, and the actual rate is projected to be about 4.7 percent.

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, over the long term, the composition of the labor force is projected to 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 2048, the average number of hours that people work is expected to be about 1 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, total hours worked are estimated to increase at an average annual rate of 0.4 percent between 2018 and 2048.

Earnings as a Share of Compensation. Workers' total compensation consists of taxable earnings and non-taxable 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 2017—mainly because the cost of health insurance has risen more quickly than total compensation.[17]

CBO expects that trend in health care costs to continue, which 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 2022. 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. In CBO's projections, the effects of the tax on the mix of compensation 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. As a result, the share of compensation that workers receive as earnings is projected to remain close to 81 percent through most of the 2018–2048 period.

Growth of Real Earnings per Worker. Projections of prices, nonwage compensation (such as employment-based health insurance), average hours worked, and labor productivity (discussed below) imply that real earnings per worker grow by an average of 1.2 percent annually over the 2018–2048 period. That rate is higher than the average annual growth—0.9 percent—of real earnings per worker over the last 30 years.

Distribution of Earnings. Over the past several decades, earnings have grown faster for higher earners than for lower earners. In CBO's projections, the unequal growth in earnings continues for the next three decades. The distribution of earnings affects revenues from income taxes and payroll taxes, among other things. Income taxes are affected by the earnings distribution because of the progressive rate structure of the income tax; people with lower earnings pay a smaller share of their earnings than people with higher earnings.

Social Security payroll taxes are also affected by the earnings distribution. Those taxes are levied only on earnings up to a certain annual amount ($128,400 in 2018). 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 83 percent in 2016.[18] The portion of earnings subject to Social Security taxes is projected to fall to about 81 percent by 2028 and to fall below 80 percent by 2048.

Changes in Projections of Other Labor Market Outcomes Since Last Year. Projections of most other labor market outcomes are similar to what CBO projected last year. For example, CBO's long-term projection of the natural rate of unemployment is only slightly lower than its projection a year ago because of updates to historical data and trends.

An important change since last year in the labor market outcomes discussed in this section is to the projected distribution of earnings. 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. As a result, in this year's projections, households with lower individual income tax rates earn a larger share of total income than CBO projected last year, and total income tax revenues are lower than would otherwise be the case.

Additionally, with a smaller share of wages and salaries received by higher earners, a larger share is received by

---

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

18. 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.

people whose annual earnings are below the maximum amount subject to Social Security payroll taxes. Thus, the share of earnings below the taxable maximum is expected to decline more slowly than CBO projected last year. In last year's projections, the share of earnings below the taxable maximum declined until 2027 and then remained at roughly that level through the end of the projection period. In this year's projections, the share of earnings below the taxable maximum declines gradually through 2048. By 2027 that share is 1.4 percentage points higher than in last year's projections, and declines to roughly the same level in 2047 as CBO projected last year. Over the 30-year period, that share is about half of a percentage point higher, on average, than CBO estimated last year.

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—that is, the growth of output that is not explained by the growth of labor and capital. Combined, the growth rates projected for the labor supply, the capital stock, and TFP result in a projection of the average growth of labor productivity (output per worker).

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. Recent reductions in statutory tax rates on corporations permanently increase incentives to invest in capital and consequently raise the level of capital services.

Total Factor Productivity. The annual growth of TFP is projected to increase from about 0.9 percent in 2018 to about 1.2 percent in 2022 and then to remain at that rate through 2048, yielding an average annual growth rate of roughly 1.2 percent from 2018 to 2048. That projected growth rate is about 0.3 percentage points

slower than the average annual rate of 1.5 percent observed since 1950 and slightly slower than the average rate recorded since 1990.

The projected path for TFP reflects several considerations that, in CBO's judgment, suggest slower growth in coming decades 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 projects an acceleration of TFP growth from its unusually slow recent rate, the agency anticipates it to return to a rate that is slower than its long-term historical average.

A number of developments support slow-growth projections for TFP. One is the anticipated slowing of growth in labor quality, a measure of workers' skills that accounts for educational attainment and work experience that, in CBO's analysis, 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 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 projected 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 has 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.

In contrast, changes to the tax code are projected to raise productivity by discouraging multinational corporations' profit-shifting strategies that historically have reduced official estimates of TFP. Because TFP is a component of GDP, CBO projects an increase in GDP as tax incentives encourage firms to claim as domestic production the services of intellectual property that were previously claimed as production abroad. CBO has slightly increased its projections of TFP to account for this anticipated increase in output, which is not matched by an increase in production inputs.

Labor Productivity. Taken together, the projections of labor supply, capital services, and TFP result in labor productivity that is expected to grow by 1.5 percent annually over the 2018–2048 period.[19]

Changes in Projections of Capital Accumulation and Productivity Since Last Year. CBO projects roughly the same average TFP growth that it projected last year. However, CBO's projection of capital services is above the level it projected last year, largely because of stronger investment incentives in the tax code that cause businesses to raise investment.

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.[20] Those rates influence nominal (current year) 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.

Prices of Consumer Goods and Services. One measure of consumer price inflation is the annual rate of change in the consumer price index for all urban consumers (CPI-U). Over the 2018–2048 period, inflation in that measure averages 2.4 percent in CBO's projections. That long-term rate is slightly less than the average rate of inflation since 1990 of 2.5 percent per year. CBO projects that, under a chained measure of inflation, prices grow at a rate 0.25 percent less than the annual increase in the consumer price index.[21]

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 Projections of Inflation Since Last Year. Inflation in both measures of consumer prices is projected to be roughly the same as the rates CBO projected last year for the 2017–2047 period.

Interest Rates
CBO projects 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 cost of the government's debt burden and the evolution of the trust funds.

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

---

19. The measure of labor productivity reported here is the ratio of real output to hours worked in the economy. Note that elsewhere CBO reports different measures of labor productivity, such as the ratio of potential real output to the potential labor force.

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

21. The chained CPI-U tends to grow more slowly than the standard CPI-U because it uses a formula that better accounts for households' tendency to substitute similar goods and services for each other when relative prices change and because, unlike the CPI-U, it is little affected by statistical bias related to the sample sizes that the Bureau of Labor Statistics uses in computing each index. Historically, inflation as measured by the chained CPI-U has been 0.25 percentage points lower, on average, than inflation as measured by the CPI-U. CBO's projections reflect that average difference between the two measures.

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 roughly 2.9 percent between 1990 and 2007.[22] That rate has averaged 1.0 percent since 2009 and is projected to be 1.4 percent in 2028. In CBO's projections, the rate continues to rise thereafter, reaching 2.4 percent in 2048, 0.5 percentage points below its average over the 1990–2007 period. CBO's projections of interest rates this year are higher than last year's.

Factors Affecting Interest Rates. Interest rates are determined by a number of factors. CBO projects the 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 greatly on the period being considered, as some recent decades show: 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.[23] 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 over the 1990–2007 period and then judged how different those determinants might be over

the long term.[24] That period was chosen for comparison because it featured fairly stable expectations of inflation and no severe economic downturns or significant financial crises.

Some factors reduce interest rates; others increase them. In CBO's estimates for the 2018–2048 period, several factors tend to reduce interest rates on government securities relative to their 1990–2007 average:

- The labor force is projected to grow much more slowly than it did from 1990 to 2007. That slower growth in the number of workers would 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.[25]

- The share of total income received by higher-income households is expected to be larger in the future than during the 1990–2007 period. 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 be lower.

- TFP is projected to grow more slowly in the future than it did from 1990 to 2007. For a given rate of investment, lower productivity growth reduces the return on capital and results in lower interest rates, all else being equal.

- CBO expects investors' preferences for Treasury securities relative to riskier assets to remain elevated compared with inclinations over the 1990–2007 period. Investors began to have less appetite for risk

---

22. Between 1970 and 2007, the real interest rate on 10-year Treasury notes averaged 2.8 percent; the average from 1954 to 2007 was 2.6 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)" (March 28, 2018), www.bls.gov/cpi/cpiurs.htm.

23. CBO calculates real interest rates by subtracting expected rates of inflation from nominal interest rates. In general, 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 uses the actual consumer price index, adjusted to account for changes over time in the way that the index measures inflation, as a proxy for both what expectations of inflation have been in the past and what they will be in the future. One drawback is that if inflation fluctuates 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 is a useful proxy over long periods, on average.

24. 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), https://tinyurl.com/z6zqnb7 (PDF, 1.8 MB).

25. 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.

in the early 2000s, and the demand for low-risk assets was 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 preferences for Treasury securities relative to riskier assets to gradually decline over the next three decades but to remain above their average levels from 1990 to 2007.

At the same time, in CBO's estimates, several factors 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 projected to be much larger as a percentage of GDP than it was before 2007—reaching 96 percent by 2028 and 152 percent by 2048. The latter figure is more than three and a half times the average over the 1990–2007 period. Greater federal borrowing tends to crowd out private investment in the long term, reducing the amount of capital per worker and increasing both interest rates and the return on capital over time.

- CBO anticipates that emerging market economies will attract a greater share of foreign investment in coming decades than they did in the 1990–2007 period. As economic and financial conditions in those economies continue to improve, they will become increasingly attractive destinations for foreign investment. CBO projects that development to put upward pressure on interest rates in the United States.

- 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. The share is projected to decline 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 the rise in income for owners of capital (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 would 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, in CBO's estimates, the total amount of saving available for investment decreases (all else being equal), which tends to reduce the amount of capital per worker and thereby push up interest rates. (CBO estimates that this effect only partially offsets the positive effect of increased income inequality on saving, leaving a net increase in savings available for investment.)

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 but also on information from financial markets to guide its assessments of the effects of various factors on interest rates over the long term. 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—the premium paid to investors for the extra risk associated with holding longer-term bonds—and for investment opportunities in the United States and abroad, and it points to considerably lower interest rates well into the future than those of recent decades.

Projections of Interest Rates. CBO anticipates considerable movement in long-term interest rates over the first 11 years of the projection. For the next few years, CBO

projects interest rates to rise as GDP expands beyond its potential and the Federal Reserve tightens monetary policy. Beginning in late 2021, CBO expects long-term interest rates to decline as GDP growth slows and the economy moves back towards its historical relationship with potential output. Beginning in 2024, long-term interest rates in CBO's projections gradually rise in response to increases in the ratio of debt to GDP.

The nominal interest rate on 10-year Treasury notes is projected to average 4.1 percent over the 2018–2048 period and to reach 4.8 percent in 2048. The real interest rate on 10-year Treasury notes is projected to average about 1.7 percent and, at the end of the period, to be 2.4 percent.

The average interest rate on all federal debt held by the public tends to be 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.[26] CBO projects a 0.4 percentage-point difference between the rate on 10-year Treasury notes and the effective rate on federal debt over the 2029–2048 period. That difference is projected to average 0.6 percentage points over the next decade. The difference is larger over the coming decade than for later years because a significant portion of federal debt that will be outstanding during the next 10 years 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 changes more slowly than the 10-year rate because only a portion of federal debt matures each year.) Thus, in CBO's projections, the average nominal interest rate on all federal debt held by the public is about 3.6 percent for the 2018–2048 period and reaches 4.4 percent in 2048.

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. In CBO's projections, the nominal interest rate on bonds newly issued to the trust funds averages 4.1 percent over the

2018–2048 period and reaches 4.8 percent in 2048. The corresponding real rates are 1.7 percent, on average, over the full period and 2.4 percent in 2048.

Because interest rates have been low for much of the past decade, CBO projects the average interest rate earned by all bonds held (both new and previously issued) by the Social Security trust funds to be slightly lower than the interest rate on newly issued bonds over the next decade. The average interest rate on all bonds, which CBO uses to calculate the present value of future streams of revenues and outlays for those funds, is projected to average 3.8 percent for the 2018–2048 period.[27]

Changes in Projections of Interest Rates Since Last Year. CBO's projections of interest rates this year are higher than last year's. The real rates on 10-year Treasury notes and the Social Security bonds are projected to average 1.7 percent over the 2018–2048 period and to be 2.3 percent in 2047. Last year, CBO projected both rates would average 1.5 percent over the 2017–2047 period and would be 2.3 percent in 2047.

The path of interest rates is higher in this year's projections than in last year's. Long-term interest rates are poised to end the first half of 2018 roughly half a percentage point higher than CBO projected last year. The higher rate probably reflects the expectation of tighter monetary policy (in response to a stronger labor market and greater inflationary pressure) as well as reduced demand for long-term Treasury bonds. Both trends are expected to continue over the next several years. In addition, CBO projects greater federal borrowing to push up interest rates. The upward revision to 10-year Treasury rates is anticipated to peak at 1 percentage point in 2020. The upward revision is predicted to be smaller in later years, as economic growth returns to its historical relationship with potential output growth and downward revisions to projected deficits gradually reduce the upward revision to the stock of debt. From 2023 to 2047, the 10-year Treasury rate is roughly unchanged in this year's report compared to last year's projection.

---

26. In particular, from 2018 to 2028, the difference between the rate on 3-month Treasury bills and the rate on 10-year Treasury notes shrinks from 1.2 percentage points to its longer-run level of 1 percentage point.

27. A present value is a single number that expresses a flow of past and future income or payments in terms of an equivalent lump sum received or paid at a specific time. The value depends on the rate of interest, known as the discount rate, that is used to translate past and future cash flows into current dollars at that time.