

FEATURED ARTICLE

OCTOBER 2021

Projections overview and highlights, 2020–30

Employment and real output are projected to grow faster during the 2020–30 decade than in previous projection periods. This expectation largely reflects growth associated with the recovery from the 2020 recession, which was caused by the coronavirus disease 2019 (COVID-19) pandemic. About one-fourth of the population will be age 65 or older in 2030, contributing to slow projected growth in the labor force and a continued decline in the labor force participation rate. The aging population is also expected to continue to drive strong demand for a variety of healthcare services, with 3.3 million jobs projected to be added in the healthcare and social assistance sector through 2030.

The U.S. Bureau of Labor Statistics (BLS) projects 0.7-percent annual growth in employment over the 2020–30 decade.¹ This projected growth is faster than the growth in recent projection sets, because the 2020–30 projections reflect both the recovery from the 2020 recession and low base-year employment for 2020 associated with the coronavirus disease 2019 (COVID-19) pandemic. This recovery growth, which occurs as the economy returns to full employment, comes in addition to long-term structural growth,² and compares with 1.3-percent annual growth recorded during the 2009–19 decade, which marked the recovery from the 2007–09 Great Recession. Between 2020 and 2030, the total U.S. economy is projected to add about 11.9 million jobs, with employment reaching a level of 165.4 million in 2030. Various demographic trends, including an aging population and slower growth in the civilian noninstitutional population, are expected to reduce labor force growth and the labor force participation rate over the projections period. These developments will, in turn, affect aggregate demand, industry output and employment, and occupational employment projections.

This article presents an overview of the 2020–30 projections. Highlights include the following:

- Labor force growth is projected to be slower (0.5 percent per year) than the growth in much of recent history, partly because of an aging population and slower population growth among Hispanics.
- The labor force participation rate is projected to continue to trend down, declining from 61.7 percent in 2020 to 60.4 percent in 2030.
- Gross domestic product (GDP) is projected to continue to grow, at 2.3 percent annually. This growth is relatively faster than that in recent history because of recovery growth starting from a low base-year level in 2020.

- Most employment gains over the 2020–30 period are expected to occur in the service-providing sectors and to be led by strong growth in the healthcare and social assistance sector. An aging population will continue to create strong demand for industries and occupations that provide healthcare and related services.
- The recovery from the COVID-19 recession will accelerate growth in many industries and occupations that lost jobs in 2020. In addition, some structural changes induced by the pandemic—such as higher demand for information technology (IT) services to support expanded telework—are expected, although the pandemic’s long-term structural impact remains uncertain.

Compared with the prior decade, the 2020–30 decade is expected to see slower population growth.³ The median age of the population will continue to rise, with all baby boomers reaching ages 66 and older by 2030. (See publication [table 3.4](#).) This increase in the share of people of traditional retirement age is expected to contribute to a decline in the labor force participation rate through 2030.

Real output is projected to increase by \$7.9 trillion from 2020 to 2030, and most of this growth is expected to occur in the service-providing sectors. The 2.2-percent annual output growth projected for the total economy is faster than the 1.6-percent annual growth from 2010 to 2020.

Total employment is projected to grow 0.7 percent annually from 2020 to 2030.⁴ Because of a low employment level in 2020, the projected 10-year employment growth is faster than that which would be expected in a period starting with a full-employment year. Service-providing sectors are expected to account for most of the jobs added from 2020 to 2030.

Of the 11.9 million jobs projected to be added to the economy, over one-quarter (3.3 million) will be in the healthcare and social assistance sector. Employment increases in this sector are expected to stem from greater demand for a variety of healthcare services—demand driven by continued population aging and increasing rates of chronic disease. Among all sectors, the leisure and hospitality sector is projected to see the fastest annual employment growth—2.2 percent. This rapid growth is driven primarily by recovery growth expected for the decade following the sector’s employment losses in 2020. Professional and business services are projected to add 2.0 million jobs over the projections period, an increase including strong growth in computer systems design and related services; employment services; and management, scientific, and technical consulting services.

Slower employment growth is projected in the goods-producing sectors, with the manufacturing sector seeing the slowest growth among them. Increasing automation, combined with international competition, is expected to limit employment demand in the manufacturing sector and in many of the production occupations concentrated in this sector. Changing consumer preferences and increases in the use of technology are expected to lead to declines in employment in the postal service and retail trade industries, as well as in several information-related industries.

Effects of the COVID-19 pandemic on the 2020–30 projections

The COVID-19 pandemic caused a short but severe economic recession. The recession, which lasted from February to April 2020,⁵ led to substantial declines in output and employment. Because 2020 serves as the base year for the 2020–30 projections, these impacts translate into base-year employment and output values that are lower than those seen in previous projection sets. This fact, coupled with the assumption that the economy will reach full employment in the target year of 2030 (see methodology section below),

suggests that the projected average growth rates for output and employment in the 2020–30 projections are relatively high. These faster rates reflect recovery growth from the macroeconomic trough of 2020 to the assumed full-employment economy of 2030.

Many industries are expected to experience cyclical recoveries early in the projections decade, with industry output and employment normalizing and returning to their long-term growth patterns. Because of pandemic-related lockdowns and hampered economic activity, some industries saw substantial employment declines in 2020. These industries, and the occupations within them, are expected to experience robust growth over the projections period.

In addition, structural demand in some industries and occupations is expected to shift as a result of economic changes driven by the pandemic. For instance, many computer-related occupations are expected to see elevated long-term demand, partly because of rising demand for telework computing infrastructure and IT security. Conversely, retail trade is expected to see a greater long-term employment decline, with brick-and-mortar retail losing further market share to e-commerce as a result of long-term changes to spending habits driven by the pandemic. However, the pandemic’s long-term economic impact remains highly uncertain, and any such impact is only one factor (among many) considered in developing the target-year employment projections for a given industry or occupation.

Therefore, data users should note that the fast growth rates projected for 2020–30 can generally be categorized as predominantly cyclically driven, predominantly structurally driven (in the long term), or driven by a combination of cyclical and structural factors. To distinguish between cyclical and structural factors, readers should consider the uneven labor market impacts of the COVID-19 recession across industries, the low employment base for 2020, and the overall employment size and prerecession employment of a given industry or occupation.

In early 2021, BLS also developed alternate scenarios for the 2019–29 employment projections in order to capture possible impacts from the pandemic.⁶ The projections based on these scenarios, which used alternate assumptions about demand patterns in the target year of 2029, are distinct from the 2020–30 baseline projections in that they aimed to estimate relative levels of uncertainty for occupations and industries in the 2019–29 projections set. The 2020–30 baseline figures, however, use the standard BLS projections methodology (discussed below). In an upcoming article slated for publication in fall 2021, BLS will provide a followup analysis comparing the alternate projections with the 2020–30 baseline projections.

Preparing the projections—a methodological overview

BLS prepares projections in four areas: population and labor force, aggregate demand, industry output and employment, and occupational employment. Each step in the projections process affects subsequent steps. The projections for the population affect those for the labor force, which in turn affect those for productivity and GDP growth. These projections further affect industry output and employment, which then feed into the occupational employment projections.

In the BLS labor force model, population growth and changes in participation rates are the main factors driving labor force growth. However, most changes in labor force growth are due to changes in the population. The labor force projections incorporate mortality rates of the U.S. population and assumptions about immigration, an important but uncertain factor affecting the size of the future labor force (projections about immigration and future mortality rates are from the U.S. Census Bureau).

Because labor force growth is one of the major determinants of long-term economic growth, the labor force projections describe the future path of the economy and its capacity to create goods and services. The long-term gradual slowdown in labor force growth continues to be key in determining the growth of the economy and of employment.

BLS develops macroeconomic projections with a model licensed from Macroeconomic Advisers (MA) by IHS Markit.⁷ The MA model assumes full employment in the target year. Data for energy prices come from the U.S. Energy Information Administration, and BLS determines other critical variables and supplies them to the MA model exogenously.⁸ The MA model then projects economic aggregates, including total employment, output, productivity, prices, interest rates, and many other variables for the U.S. economy. These variables—most importantly nonfarm payroll employment, labor productivity, and GDP—serve as constraints for the industry output and employment projections.

BLS produces model-based projections for hundreds of detailed industries, and these projections are then summed to arrive at aggregate values for subsectors and sectors. Macroeconomic factors, such as the labor force, GDP and its components, and labor productivity, affect the growth in total employment. These factors, along with the projection models for individual industries, determine the final projections of industry employment and output.

BLS produces occupational employment projections by analyzing current and projected future staffing patterns (the distribution of occupations within an industry) in an industry–occupation matrix. Changes in the staffing pattern for each industry are projected and applied to the final industry projections, yielding detailed occupational projections by industry. This projected employment matrix includes estimates for 790 occupations across 295 industries.⁹

Population and labor force

In 2020, the COVID-19 pandemic affected nearly every aspect of the U.S. economy, including the labor force. While the U.S. population grew by 1.2 million from 2019 to 2020, the labor force fell by a considerable 2.8 million over the same period, with many restaurant, retail, and other establishments providing in-person services being forced to shut down. As a result, Congress provided individual stimulus checks, increased unemployment insurance benefits, and took a historic step by authorizing unemployment compensation to individuals not in the labor force.¹⁰

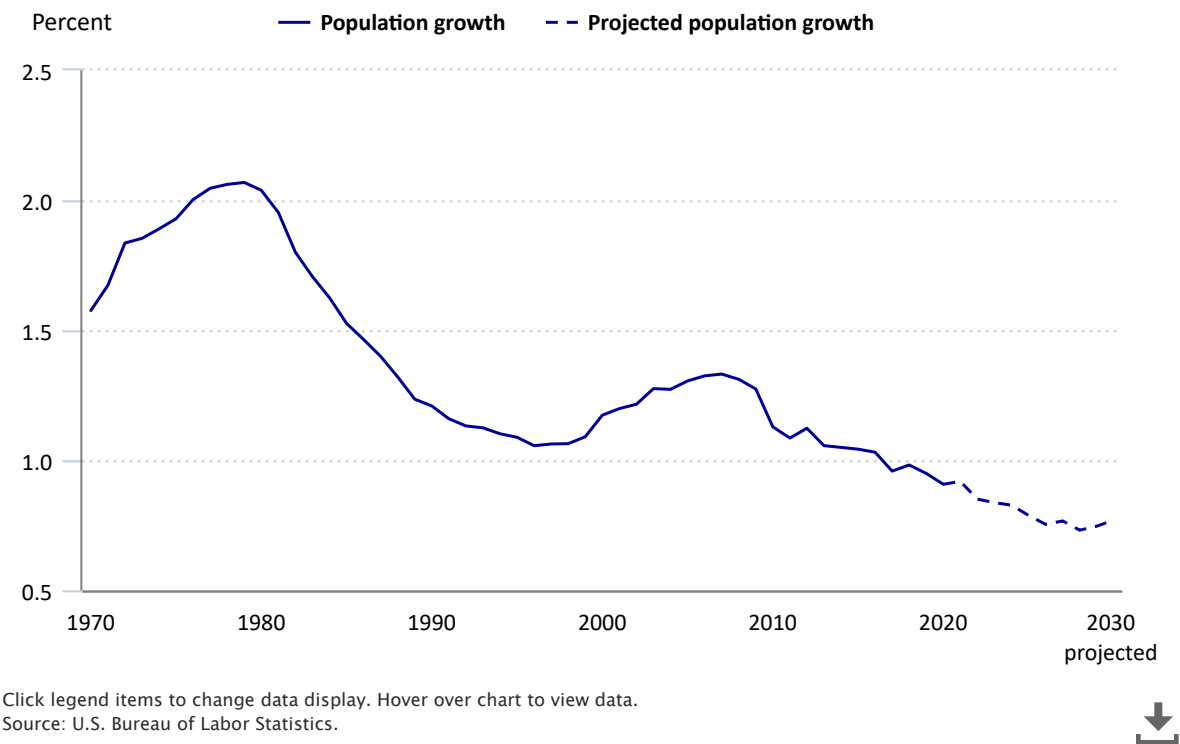
Despite a depressed labor force level in 2020, labor force growth is projected to continue to trail population growth over the projections period. In recent decades, the U.S. population has grown faster than the labor force, primarily because of population aging. Over the next 10 years, this trend is projected to continue. The labor force is projected to grow 0.5 percent annually, slower than the 0.8-percent annual growth projected for the population. This difference in rates results in a declining labor force participation rate, which is projected to fall from 61.7 percent in 2020 to 60.4 percent in 2030.

Population

Apart from experiencing a short-lived reversal in the 2000s, population growth has been slowing since 1980. (See chart 1.) Over the next 10 years, this trend is projected to continue: the population is expected to grow at an annual rate of 0.8 percent, slower than the rate for any other 10-year period over the past 50 years. Population growth is largely affected by historical fertility rates and immigration. Fertility rates,

which had been stagnant for decades, declined over the past decade.¹¹ Moreover, COVID-19, along with the uncertainty associated with it, appears to have lowered fertility rates further.¹² This pandemic-induced “baby bust” is expected to continue to negatively influence population growth, but the impact will be realized outside the timeframe of the 2020–30 projections. BLS develops projections for the civilian noninstitutional population, which includes only people ages 16 and older. Therefore, current changes in the fertility rate will not influence population trends before the end of the 10-year projections period.

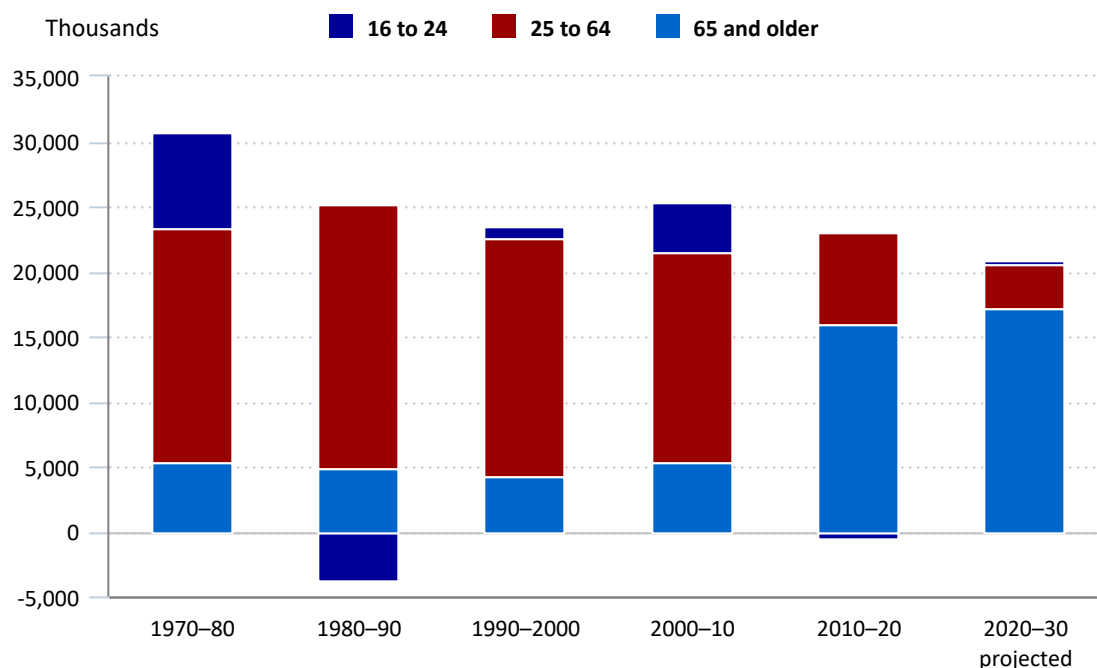
Chart 1. Population growth rates, 10-year compound annual average, 1970–2020 and 2020–30 projected



[View Chart Data](#)

The last time the fertility rate considerably exceeded 2.0 percent was in the 1970s.¹³ For this reason, most population growth during the projections period is expected to be driven by the oldest age groups. While the population is projected to grow by 20.8 million over the 2020–30 decade, more than 80 percent of that growth (17.1 million) is accounted for by people ages 65 and older. (See chart 2.) For those ages 65 and older, most growth (11.2 million) is projected to occur among those ages 75 and older. (See publication [table 3.2.](#))

Chart 2. Population change, by age group, for selected periods and 2020–30 projected



Click legend items to change data display. Hover over chart to view data.
Source: U.S. Bureau of Labor Statistics.



[View Chart Data](#)

Unlike fertility rates, whose contribution to population growth can be predicted accurately after a set period (16 years), net immigration inflows are more uncertain over the long term. Legislation can have large, abrupt impacts on immigration inflows. Net international immigration to the United States has been averaging around 1 million annually since 2000, slightly over half of the 1.8 million it averaged annually in the mid-1990s.¹⁴ Immigrants tend to be of prime working age, which offsets some of the labor force effects of an aging domestic population.¹⁵

Labor force and participation rate

The labor force is the subset of the population that is working or actively seeking work. The labor force participation rate (hereafter referred to as “participation rate”) is the percentage of the population that is in the labor force. Labor force growth stems from both population growth and changes to the participation rate.

BLS focuses on long-term structural trends rather than short-term cyclical fluctuations. However, it is worth noting that the participation rate fell 1.4 percentage points in a single year, from 63.1 percent in 2019 to 61.7 percent in 2020. This compares with an average annual decline of 0.3 percentage point since 2000, when the participation rate stood at 67.1 percent. Much of the 1.4-percentage-point decline for 2019–20 should be considered cyclical, because the size of the labor force during that time was lower than it would have been under full employment.¹⁶

The participation rate is projected to continue its downward trend, but relatively slowly. This is because the rate’s starting point in 2020 was lower than it would have been in the absence of the COVID-19 pandemic. From 2020 to 2030, the participation rate is projected to decline by 1.4 percentage points, to

60.4 percent. This decline is roughly the same as the single-year decline that took place from 2019 to 2020 (1.4 percentage points).

The participation rates of older age groups (55 to 59, 60 to 64, 65 to 69, 70 to 74, and 75 and older) have been trending upward for the past two decades and are projected to continue to do so. (See table 1 and publication [table 3.3](#).) This is due, in part, to substantial changes to Social Security and private pensions.¹⁷ The upward trend for older age groups contrasts with that for the rest of the population, whose participation rate has been declining and is projected to continue to decline through 2030.

Table 1. Labor force participation rates of people ages 55 and older, 2000, 2010, 2020, and 2030 projected

Age group	Labor force participation rate				Difference		
	2000	2010	2020	2030 projected	2000–10	2010–20	2020–30
55 and older	32.4	40.2	39.2	38.6	7.8	-1.0	-0.6
55 to 59	68.9	73.3	72.1	74.9	4.4	-1.2	2.8
60 to 64	47.2	55.2	57.1	62.5	8.0	1.9	5.4
65 to 69	24.5	31.5	33.0	39.6	6.9	1.6	6.6
70 to 74	13.5	18.0	18.9	23.8	4.5	0.9	4.9
75 and older	5.3	7.4	8.9	11.7	2.1	1.5	2.8
Note: Because of rounding, historical data may not match U.S. Bureau of Labor Statistics Current Population Survey data. Source: U.S. Bureau of Labor Statistics.							

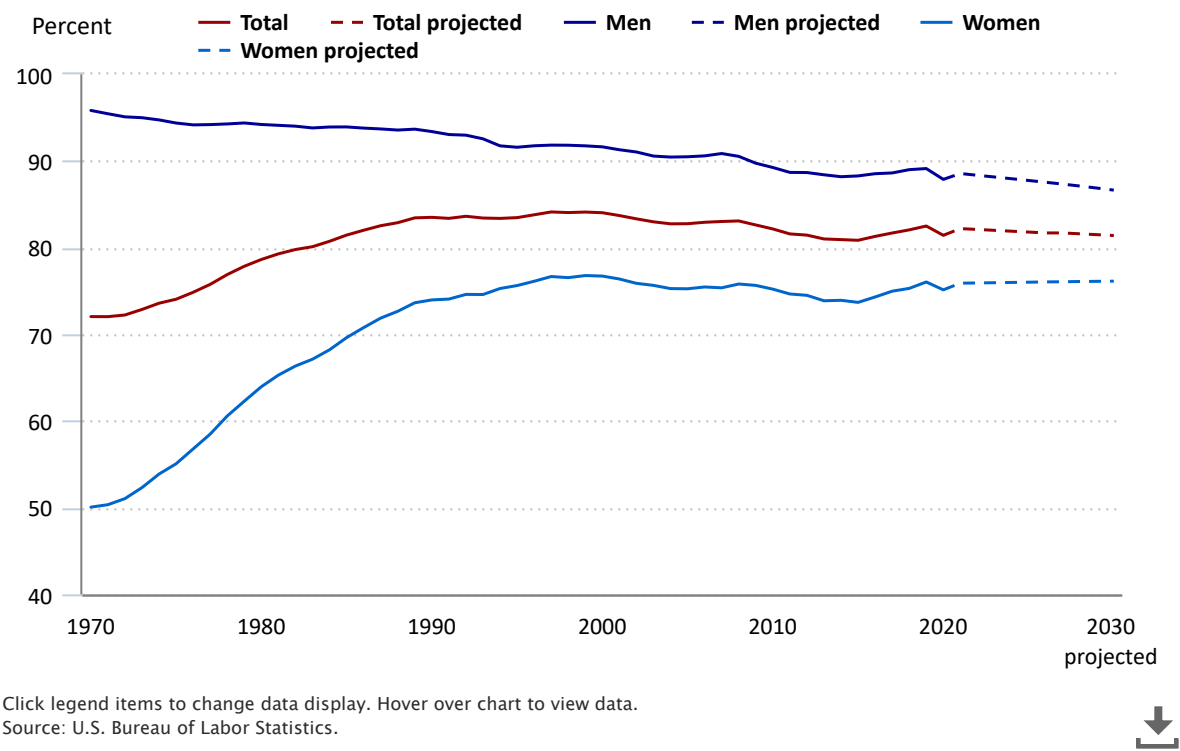
The overall participation rate is a composition of each individual demographic group’s participation rate. The effect of each detailed group is weighted by the relative size of the group’s population. As the size of one group increases, so does its contribution to the overall participation rate. This results in an interesting dynamic: although the participation rates of all older detailed age groups are projected to increase, the rate for the aggregate 55-and-older group is projected to decrease. This projection is based on the expectation that, as the baby-boom generation ages, the population of people ages 75 and older will grow the fastest. This group has a much lower participation rate than the rate of people ages 55 to 74. (See table 1 and publication [table 3.3](#).)

While the participation rates of older age groups have been increasing, those of younger and middle-age groups have been declining or staying flat. The rates of younger age groups have been steadily declining over the past couple of decades and are projected to continue to do so from 2020 to 2030. (See publication [table 3.3](#).) Much of this decline is due to increased college attendance, which delays entry into the workforce.¹⁸ However, people who have a high school diploma but do not attend college are also increasingly more likely to remain out of the labor force.¹⁹

The participation rate of the prime-age population, which is composed of people ages 25 to 54, has been slowly trending down, declining from a high of 84.1 percent in the late 1990s to 81.4 percent in 2020. This rate increased rapidly until the 1990s, as more women entered the workforce. Throughout the 1990s,

the participation rate remained relatively flat, but it started to decline in 2000. Over the past decade, the decline in the participation rate of the overall prime-age population flattened; the rate increased from 80.9 in 2015 to 82.5 in 2019, before falling in 2020 as a result of the COVID-19 pandemic. (See chart 3.) The participation rate of the prime-age population is projected to hold steady, at 81.4 percent, through 2030.

Chart 3. Labor force participation rate of prime-age population (ages 25 to 54), total, men, and women, 1980–2020 and 2020–30 projected



The participation rate of the prime-age population can be further examined by looking at the rates of men and women separately. Although the overall participation rate for this group is projected to remain flat, the men’s rate is projected to decline while the women’s rate is projected to increase. The men’s rate declined by 1.4 percentage points between 2010 and 2020 (from 89.3 percent to 87.9 percent) and is projected to decline by an additional 1.2 percentage points over the next decade, down to 86.6 percent in 2030. The women’s participation rate remained flat over the 2010–20 period (75.2 percent in 2010 and 75.1 percent in 2020) and is projected to increase by 1.0 percentage point over the projections period, reaching 76.1 percent in 2030.

A decreasing fertility rate over the past decade is one possible explanation for the flattening of the labor force participation rate of women.²⁰ Among women of prime working age, the youngest age groups (25 to 29, 30 to 34, and 35 to 39) saw increases in their participation rate over the last decade. (See table 2.) Compared with women in older age groups, women in the youngest groups are more likely to have children needing care.²¹ Having fewer children means fewer parents leaving the labor force to care for a child, and the leavers are more likely to be women than men.

Table 2. Labor force participation rates of prime-age women, 2000, 2010, 2020, and 2030 projected

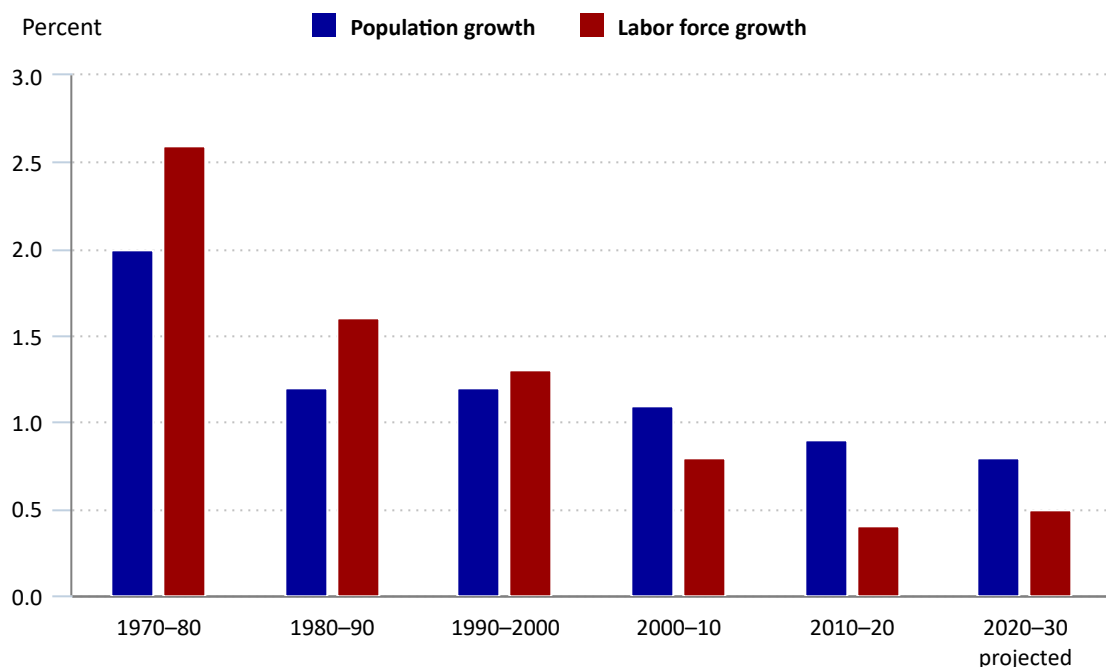
Age group	Labor force participation rate, prime-age women				Difference		
	2000	2010	2020	2030 projected	2000–10	2010–20	2020–30
25 to 54	76.7	75.2	75.1	76.1	-1.5	-0.1	1.0
25 to 29	76.7	75.6	76.8	78.1	-1.1	1.2	1.3
30 to 34	75.5	73.7	74.6	75.6	-1.8	0.9	1.0
35 to 39	75.7	74.1	74.3	74.6	-1.6	0.2	0.3
40 to 44	78.7	76.2	75.7	75.5	-2.5	-0.5	-0.2
45 to 49	79.1	76.8	76.0	76.9	-2.3	-0.8	0.9
50 to 54	74.1	74.6	73.4	76.3	0.5	-1.2	2.9

Note: Because of rounding, historical data may not match U.S. Bureau of Labor Statistics Current Population Survey data.

Source: U.S. Bureau of Labor Statistics.

The labor force is an important source of economic growth. A larger labor force translates into more hours worked, and more hours worked mean higher GDP. Over the projections period, labor force growth is expected to be constrained by slower population growth and a declining participation rate. Although the labor force is expected to grow more slowly in the 2020s than in the 1980s, 1990s, and early 2000s, it is projected to grow slightly faster than in the preceding 10 years. (See chart 4.) The labor force grew 0.4 percent annually from 2010 to 2020, which compares with 0.5-percent projected annual growth for the 2020–30 decade. When the first year of a projections period is a recession year (in this case, 2020), the labor force (and GDP) has a low starting point and, hence, is expected to grow faster.

Chart 4. Population and labor force growth, 10-year compound annual average rates, for selected periods and 2020–30 projected



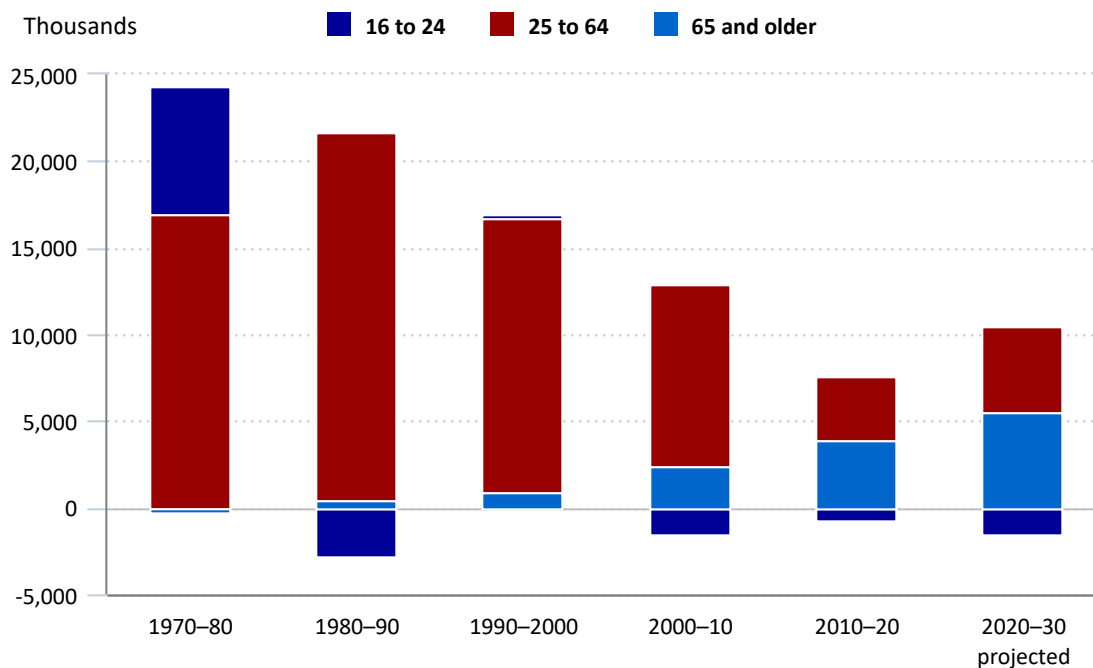
Click legend items to change data display. Hover over chart to view data.
Source: U.S. Bureau of Labor Statistics.



Generally, the labor force is considered mildly cyclical, although cyclical fluctuations have become more pronounced recently.²² Individuals who lose their jobs tend to stay in the labor force, searching for a new job. However, the COVID-19 recession differed from past recessions, because much of government policy associated with it encouraged social distancing, thereby hindering access to many prepandemic work arrangements. In some cases, Congress authorized unemployment compensation for people not in the labor force.²³

Despite starting from a lower point in 2020, the labor force is projected to grow more slowly than the population. (See chart 4.) As noted previously, over 80 percent of population growth will be driven by people ages 65 and older, and this group has a lower propensity to work than does the prime-age group. Despite this lower propensity, the 65-and-older group's population growth is sizable enough to account for more than 60 percent of the projected labor force growth over the 2020–30 decade. This is a substantial change in growth trends. Before 2010, almost all labor force growth was driven by those ages 25 to 64. (See chart 5.)

Chart 5. Labor force growth, by age group, for selected periods and 2020–30 projected



Click legend items to change data display. Hover over chart to view data.
Source: U.S. Bureau of Labor Statistics.

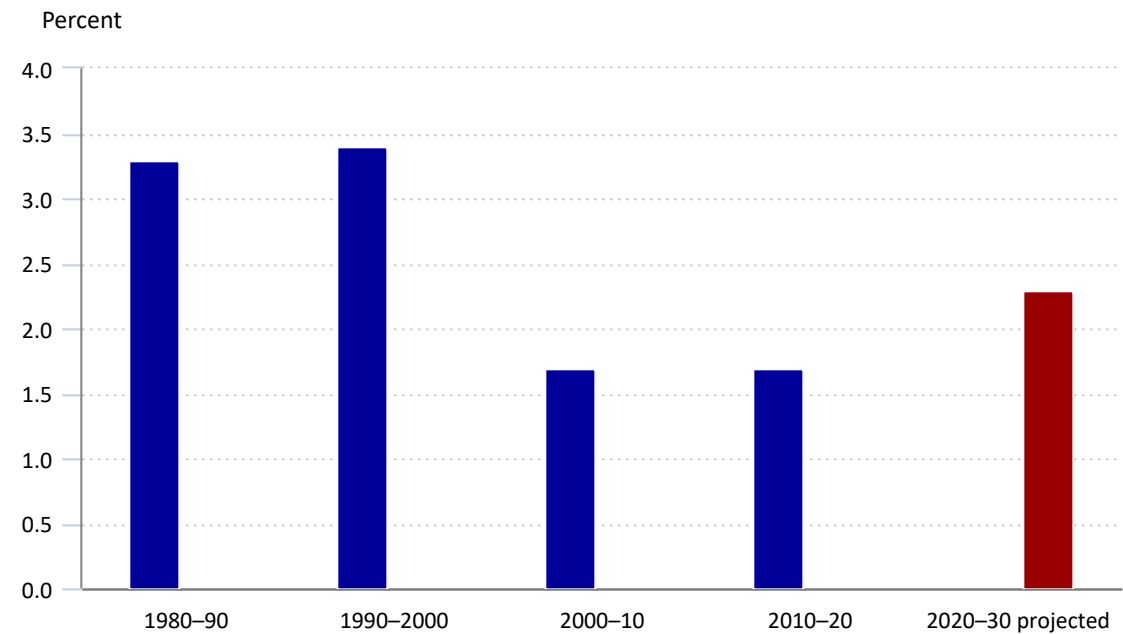


The three primary trends highlighted previously—an aging population, a declining participation rate, and slow labor force growth—are interrelated and influence one another. These trends are projected to continue over the next 10 years.

Macroeconomic projections

Over the next 10 years, GDP is projected to grow by 2.3 percent annually, relatively fast compared with the 1.7-percent annual growth recorded in the previous two decades. (See chart 6.) This faster growth is largely due to a low starting GDP in 2020. Because of the COVID-19 pandemic, GDP fell 3.5 percent in 2020. In July 2021, the National Bureau of Economic Research declared that a recession began in February and ended in April 2020,²⁴ and this recession followed the longest expansion in the history of U.S. business cycles dating back to 1854.²⁵ BLS assumes that, in the target year of 2030, the economy is at full employment, which means that the economy is operating at a high rate of resource utilization while GDP growth is sustainable (this condition tends to coincide with the latter part of an economic expansion). While the economy is assumed to be at full employment in 2030, it was well below full employment in 2020. Therefore, the projected growth rate for 2020–30 includes some cyclical recovery growth.

Chart 6. Gross domestic product, 10-year compound annual growth rates, for selected periods and 2020–30 projected



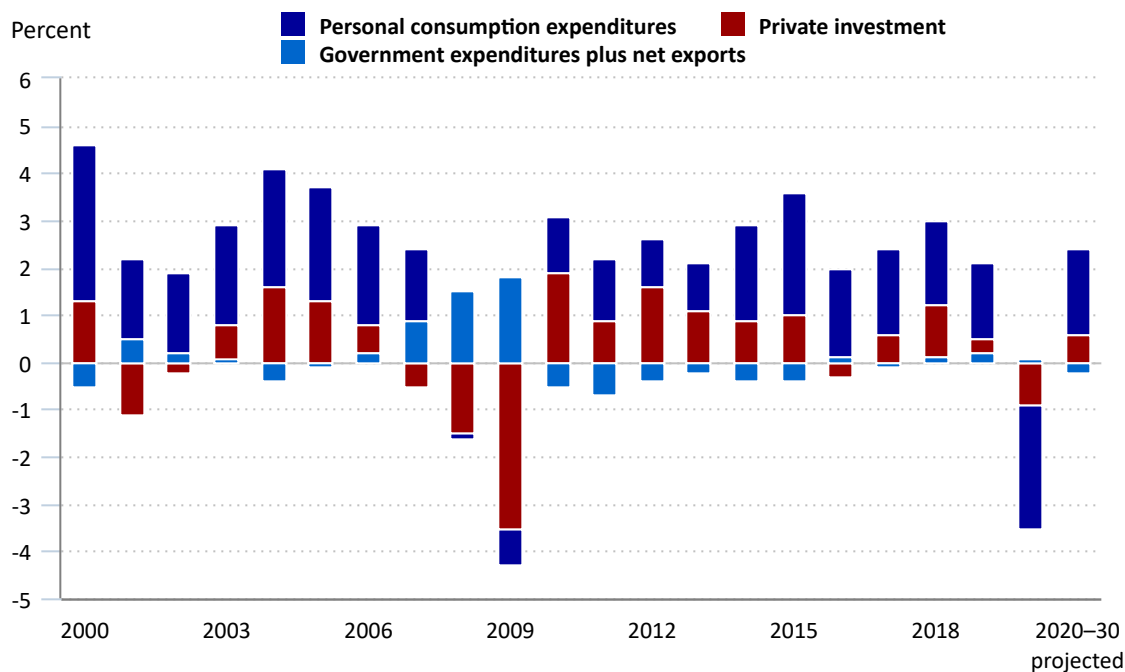
Hover over chart to view data.
Source: U.S. Bureau of Labor Statistics.



[View Chart Data](#)

GDP can be examined by its components—consumption, investment, net exports, and government spending. Personal consumption expenditures are projected to be the primary driver of GDP, contributing 1.8 percentage points to GDP growth. Private investment is projected to account for another 0.6 percentage point. Over the next 10 years, net exports are projected to reduce GDP growth by 0.3 percentage point, with imports outpacing exports. This can partly be attributed to net exports of oil (and its byproducts) flattening over the next decade after growing substantially in the previous 10 years.²⁶ Government expenditures, which include spending by federal, state, and local governments, are projected to play a minimal role in GDP growth over the projections period, contributing only 0.1 percentage point to that growth. (See chart 7 and publication [table 4.2.](#))

Chart 7. Contributions to growth in gross domestic product, 2000–20 and 2020–30 projected



Click legend items to change data display. Hover over chart to view data.

Source: Historical data are from the U.S. Bureau of Economic Analysis. Projected data are from the U.S. Bureau of Labor Statistics.

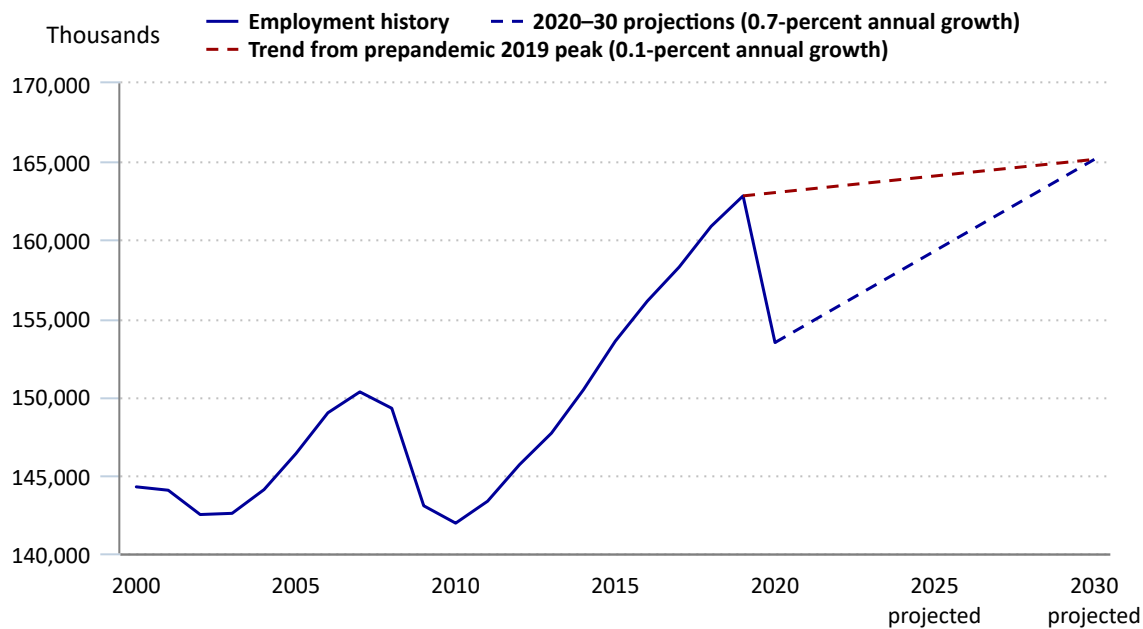


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Employment, unemployment, and nonaccelerating inflation rate of unemployment

Employment, one of the major inputs into GDP, declined by almost 10 million in 2020, as the COVID-19 recession took hold. As a result, employment is projected to grow rapidly (faster than it does typically) over the next 10 years, at an annual rate of 0.7 percent. Chart 8 shows that this rate would have been only 0.1 percent if the projections period started in 2019, before the pandemic hit.

Chart 8. Industry employment, all jobs, 2000–20 and 2020–30 projected (in thousands)



Click legend items to change data display. Hover over chart to view data.

Note: Industry employment is the sum of the employment figures for nonagricultural wage and salary workers; agricultural, forestry, fishing, and hunting workers; and self-employed workers. Dashed lines represent a flat growth rate between a starting point and a 2030 projected value, not actual projections. The U.S. Bureau of Labor Statistics does not publish inter-year employment data. Annual growth refers to a compound average annual growth rate.

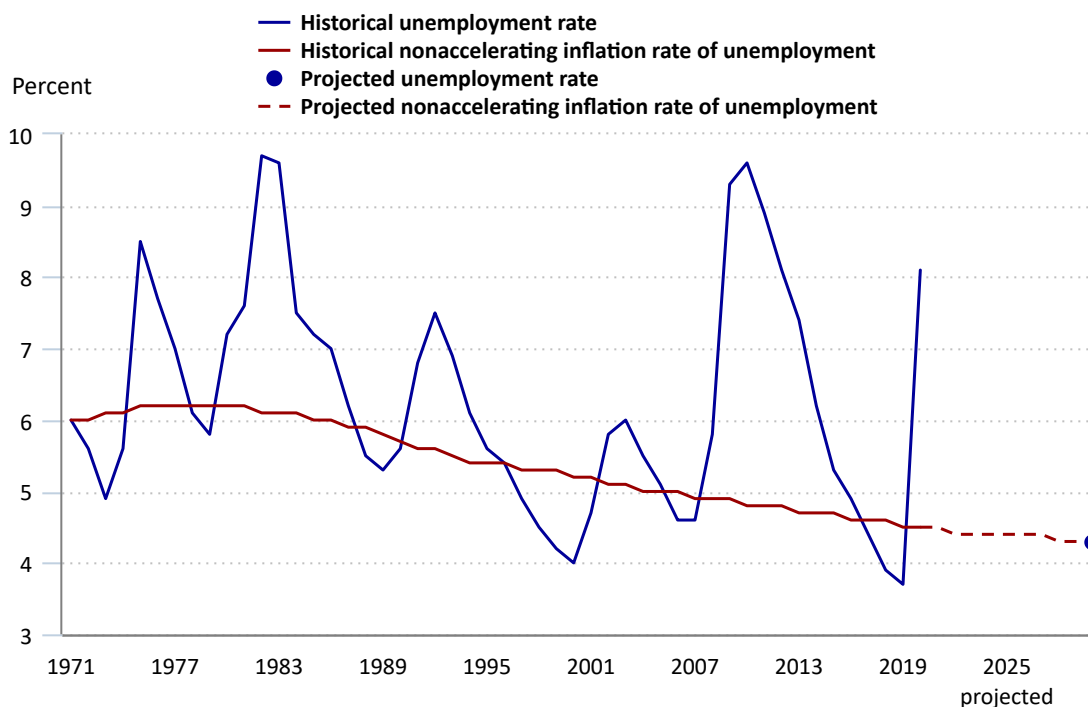
Source: U.S. Bureau of Labor Statistics.



[View Chart Data](#)

The labor force includes both the employed and the unemployed. Unemployment, often expressed as a percentage of the total labor force, is highly cyclical, often increasing during a recession. This happened in 2020, with the unemployment rate jumping to 8.1 percent.²⁷ Although the unemployment rate had surpassed 8.0 percent in previous recessions, its 2020 value was high by historical standards. (See chart 9.)

Chart 9. Unemployment rate and estimated nonaccelerating inflation rate of unemployment, 1971–2020 and 2030 projected



Click legend items to change data display. Hover over chart to view data.

Source: Historical and projected data for the unemployment rate are from the U.S. Bureau of Labor Statistics. Historical and projected data for the nonaccelerating inflation rate of unemployment are from the Congressional Budget Office.



[View Chart Data](#)

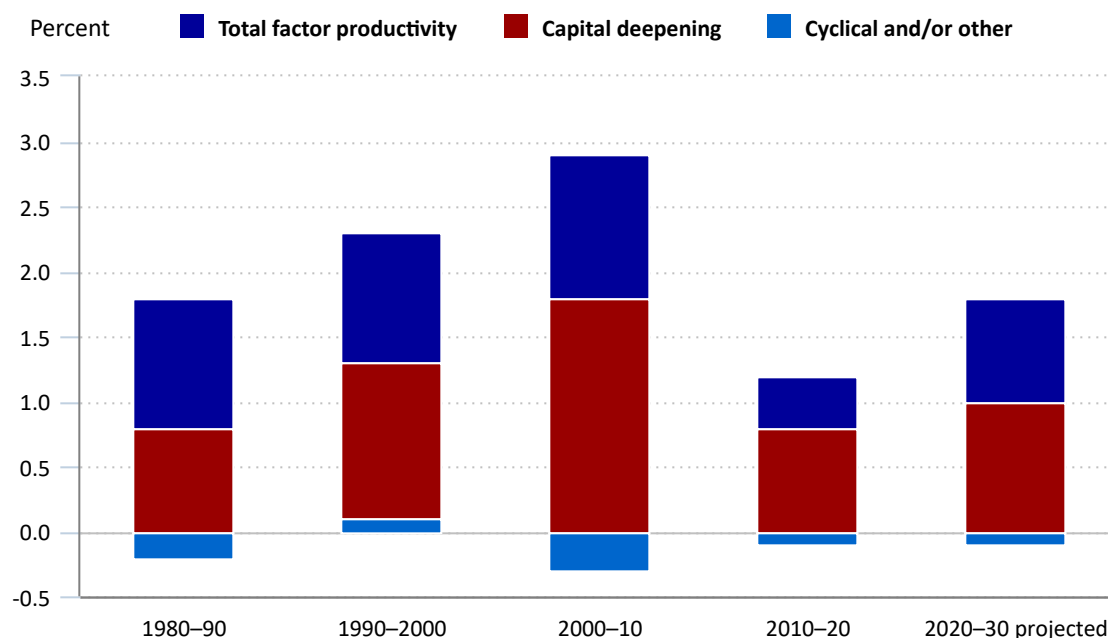
As noted previously, the BLS projections assume full employment in the target year of 2030. The unemployment rate at full employment is referred to as the nonaccelerating inflation rate of unemployment (NAIRU). Currently, NAIRU is 4.5 percent, and it is expected to fall to 4.3 percent by 2030. (See chart 9.) Over the last few decades, NAIRU has been trending down. This trend, as well as NAIRU's expected decline over the projections period, reflects both the continuing aging of the labor force (older workers tend to have lower rates of unemployment when they participate in the labor force) and the labor force's shift away from less educated and less experienced workers (who tend to have higher unemployment rates).²⁸

Productivity

Productivity, measured as total output divided by employment,²⁹ is influenced by capital deepening and total factor productivity (TFP). Capital deepening is an increase in the ratio of capital to labor. Greater investment increases this ratio, although capital depreciates over time in the absence of further investment. TFP is often associated with technological improvements, increases in the education or quality of the workforce, improvements in management practices, and economies of scale.

Productivity is projected to grow at an annual rate of 1.7 percent over the next 10 years. This rate is greater than the 1.1-percent annual growth rate seen in the preceding decade. Productivity growth between 2010 and 2020 was more subdued than in earlier decades. (See chart 10.) Capital deepening traditionally accounts for most of productivity growth, and the next 10 years are no exception. Capital deepening and TFP are projected to account for, respectively, 1.0 and 0.8 percentage points of productivity growth.

Chart 10. Growth in labor productivity and its components, 10-year compound annual average rate, for selected periods and 2020–30 projected



Click legend items to change data display. Hover over chart to view data.
Source: U.S. Bureau of Labor Statistics.



[View Chart Data](#)

Fiscal and monetary policy

To alleviate the economic downturn in 2020, Congress authorized multiple rounds of fiscal stimulus. In addition, the Federal Reserve (hereafter, the Fed) pursued an “easy money” policy by slashing its target federal funds rate from a range of 1.50–1.75 percent to a range of 0.00–0.25 percent.³⁰ The Fed also resumed, among other actions, purchasing massive amounts of securities—a policy known as quantitative easing—and direct lending to businesses and state and municipal governments.³¹

The low federal funds rate has contributed to low interest rates within the bond market. For most of 2020, 10-year treasury yields were under 1.00 percent while 3-month treasury yields were under 0.25 percent.³² While there are some concerns that this “easy money” policy may lead to rising inflation,³³ the Fed has noted that it can tighten monetary policy if inflation exceeds its target rate.³⁴

The COVID-19 recession produced large decreases in output and employment. Prior recessions have resulted in hysteresis that structurally lowered the economy’s long-term growth trend.³⁵ However, the 2020–30 projections assume that the potential output of the economy remains intact. The fast and sizeable fiscal and monetary responses by Congress and the Fed appear to be partly responsible for maintaining the economy’s long-term growth potential. Therefore, the pandemic’s main impact on the 2020–30 output projections is the low output in the base year, which results in a higher growth rate.

Assumptions about fiscal policy, including tax policy and government spending, substantially affect expectations for government revenue, national debt, and economic growth. BLS generally assumes no major changes to current tax laws or other major legislation over the projections decade. Effective marginal tax rates also are held constant at their current levels.

Industry output and employment projections to 2030

BLS projects that, from 2020 to 2030, output will grow faster than it did during the previous decade, whereas employment growth will be slightly slower. Industry output and employment projections were prepared by using the 2017 North American Industry Classification System (NAICS). Major sectors (hereafter referred to as “sectors”) are aggregations of NAICS industries.

Industry output projections

BLS projects that real output will increase from nearly \$33.0 trillion in 2020 to roughly \$40.9 trillion in 2030.³⁶ This increase of just under \$8.0 trillion over the projections period is larger than the increase of \$4.9 trillion during the previous decade. Most of the increase in real output (76.2 percent) is projected to come from nonagricultural sectors, specifically service-providing sectors.

Sector output

Real output in the service-providing sectors is projected to grow at an annual rate of 2.4 percent from 2020 to 2030, faster than the 1.7-percent growth experienced from 2010 to 2020. This projected growth in output for service-providing sectors is slightly faster than the 2.2-percent projected growth for the entire U.S. economy. All service-providing sectors are projected to experience real output growth over the projections period, including the federal government sector, whose output is expected to increase slightly, at an annual rate of 0.3 percent. Unlike the past two projection periods, the leisure and hospitality sector is projected to see the fastest output growth among service-providing sectors in 2020–30, with its output increasing at an annual rate of 4.5 percent. This growth is largely recovery driven.

Real output in the goods-producing sectors (excluding agriculture) is projected to grow at an annual rate of 1.7 percent from 2020 to 2030, slower than the expected growth rate of 2.2 percent for the overall economy. However, the projected 1.7-percent growth rate is faster than the 1.4-percent rate experienced by the nonagricultural goods-producing sectors from 2010 to 2020. The mining sector is expected to have the fastest output growth (2.6 percent annually) among these sectors over the next decade.

Real output in the agriculture, forestry, fishing, and hunting sector is projected to grow at an annual rate of 2.3 percent from 2020 to 2030, slightly faster than the annual rate of 2.0 percent experienced during the 2010–20 decade. (See table 3.)

Table 3. Output by major industry sector, 2010, 2020, and 2030 projected

Industry sector	Output (billions of chained 2012 dollars)			Compound annual rate of change (percent)		Output (billions of dollars)			Percent distribution		
	2010	2020	2030	2010–20	2020–30	2010	2020	2030	2010	2020	2030

[1] Consists of nonproducing accounting categories to reconcile the input–output system with National Income and Product Accounts.

[2] Residual is shown for the first level only. Subcategories do not necessarily add to higher categories as a byproduct of chain-weighting.

Source: U.S. Bureau of Labor Statistics.

Industry sector	Output (billions of chained 2012 dollars)			Compound annual rate of change (percent)		Output (billions of dollars)			Percent distribution		
	2010	2020	2030	2010–20	2020–30	2010	2020	2030	2010	2020	2030
Total	28,101.0	32,971.1	40,902.6	1.6	2.2	26,485.0	36,715.1	47,872.2	100.0	100.0	100.0
Goods producing, excluding agriculture	7,113.3	8,184.8	9,686.0	1.4	1.7	6,548.7	8,185.1	10,466.6	24.7	22.3	21.9
Mining	514.5	651.9	844.6	2.4	2.6	499.3	474.8	860.1	1.9	1.3	1.8
Construction	1,075.4	1,425.4	1,578.8	2.9	1.0	1,016.7	1,736.5	2,007.1	3.8	4.7	4.2
Manufacturing	5,525.9	6,063.8	7,236.0	0.9	1.8	5,032.7	5,973.8	7,599.4	19.0	16.3	15.9
Service providing, excluding special industries	19,242.6	22,772.3	28,813.6	1.7	2.4	18,323.5	26,240.3	34,551.5	69.2	71.5	72.2
Utilities	502.9	447.3	491.7	-1.2	1.0	494.5	495.1	572.1	1.9	1.3	1.2
Wholesale trade	1,430.4	1,874.9	2,522.7	2.7	3.0	1,359.2	2,039.8	2,770.3	5.1	5.6	5.8
Retail trade	1,357.8	1,855.2	2,491.2	3.2	3.0	1,299.7	1,964.6	2,797.5	4.9	5.4	5.8
Transportation and warehousing	975.1	1,080.5	1,420.7	1.0	2.8	856.3	1,211.5	1,641.1	3.2	3.3	3.4
Information	1,277.7	1,998.9	2,713.7	4.6	3.1	1,268.9	1,935.6	2,700.6	4.8	5.3	5.6
Financial activities	3,578.9	4,205.8	4,908.6	1.6	1.6	3,405.4	5,548.7	6,777.4	12.9	15.1	14.2
Professional and business services	2,829.7	3,606.9	4,550.8	2.5	2.4	2,722.0	4,155.7	5,370.4	10.3	11.3	11.2
Educational services	321.2	283.5	336.2	-1.2	1.7	292.9	353.6	442.4	1.1	1.0	0.9
Healthcare and social assistance	1,865.8	2,292.0	3,183.1	2.1	3.3	1,799.6	2,552.8	3,694.5	6.8	7.0	7.7
Leisure and hospitality	1,028.8	1,055.2	1,643.9	0.3	4.5	979.2	1,242.2	2,023.3	3.7	3.4	4.2
Other services	561.2	565.4	716.7	0.1	2.4	535.4	680.5	883.4	2.0	1.9	1.8
Federal government	1,161.9	1,160.7	1,198.8	0.0	0.3	1,118.7	1,313.6	1,395.1	4.2	3.6	2.9
State and local government	2,350.3	2,402.9	2,815.0	0.2	1.6	2,191.7	2,746.7	3,483.5	8.3	7.5	7.3

[1] Consists of nonproducing accounting categories to reconcile the input–output system with National Income and Product Accounts.

[2] Residual is shown for the first level only. Subcategories do not necessarily add to higher categories as a byproduct of chain-weighting.

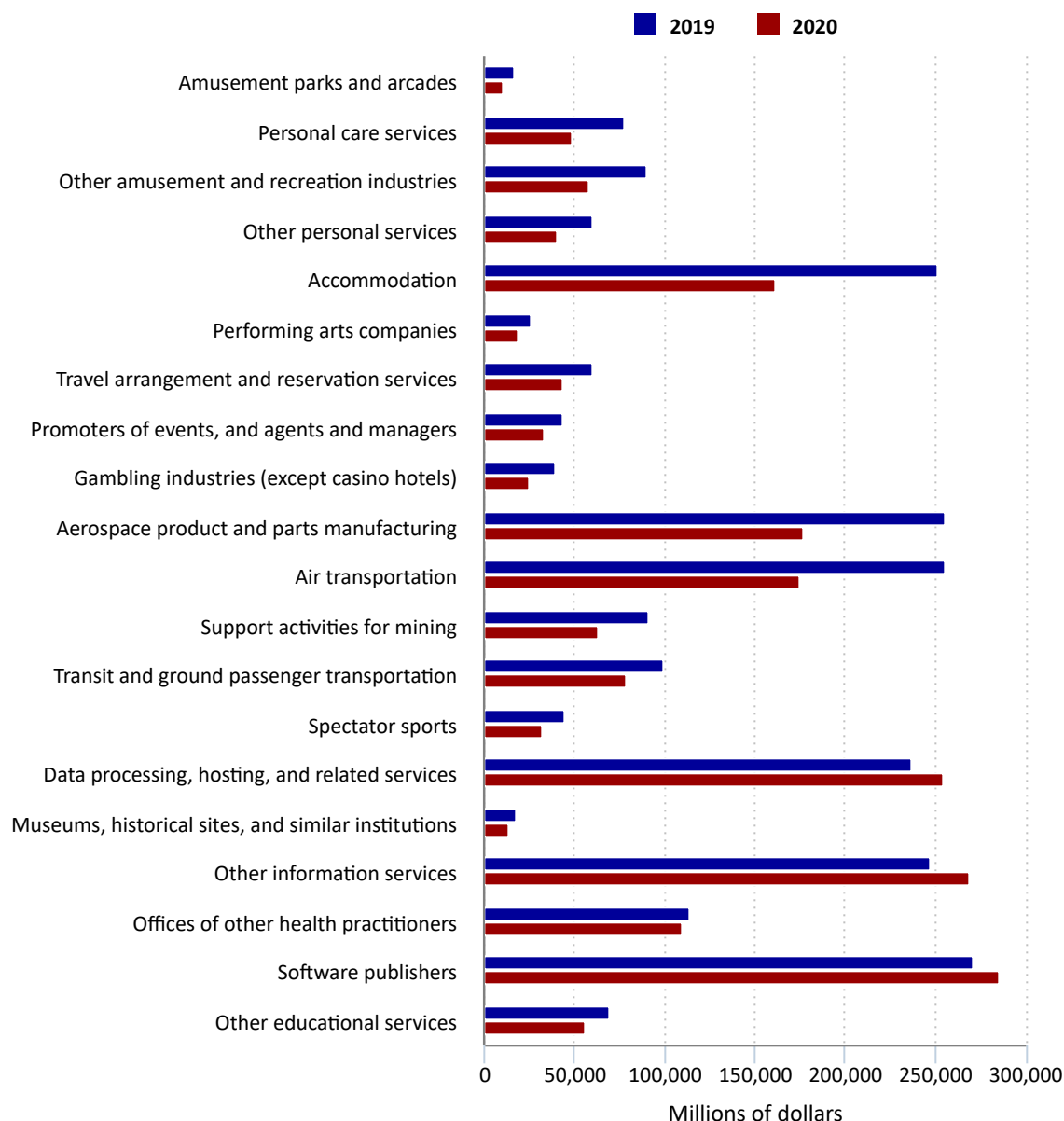
Source: U.S. Bureau of Labor Statistics.

Industry sector	Output (billions of chained 2012 dollars)			Compound annual rate of change (percent)		Output (billions of dollars)			Percent distribution		
	2010	2020	2030	2010–20	2020–30	2010	2020	2030	2010	2020	2030
Agriculture, forestry, fishing, and hunting	467.2	570.0	715.9	2.0	2.3	375.7	474.0	683.2	1.4	1.3	1.4
Special industries ^[1]	1,278.6	1,439.1	1,648.8	1.2	1.4	1,237.1	1,815.7	2,170.9	4.7	4.9	4.5
Residual ^[2]	-0.7	4.9	38.3	—	—	—	—	—	—	—	—
^[1] Consists of nonproducing accounting categories to reconcile the input–output system with National Income and Product Accounts. ^[2] Residual is shown for the first level only. Subcategories do not necessarily add to higher categories as a byproduct of chain-weighting. Source: U.S. Bureau of Labor Statistics.											

Industries with fastest growing output

Of the 20 industries expected to have the fastest growing real output over the 2020–30 projections period, 8 industries are in the leisure and hospitality sector. (See publication [table 2.7.](#)) Output in the amusement parks and arcades industry and in the other amusement and recreation industries is projected to grow by, respectively, 7.1 and 7.0 percent annually, and output in the accommodation industry is expected to grow at an annual rate of 6.1 percent. (See chart 11.) In the last three sets of projections, most of the fastest growing industries in terms of output were in the information sector and in the healthcare and social assistance sector. Leisure and hospitality industries are among those with the fastest growing output because of their expected recovery from pandemic lows.

Chart 11. Output for 20 industries with fastest projected output growth for 2020–30, 2019 (prepandemic) and 2020



Click legend items to change data display. Hover over chart to view data.
Source: U.S. Bureau of Labor Statistics.



[View Chart Data](#)

Within healthcare, offices of other health practitioners are projected to have the fastest output growth, at an annual rate of 4.3 percent. Personal care services and other personal services industries also are projected to be among the industries with the fastest output growth over the next decade, with respective growth rates of 7.0 percent and 6.5 percent.

Industries with most rapidly declining output

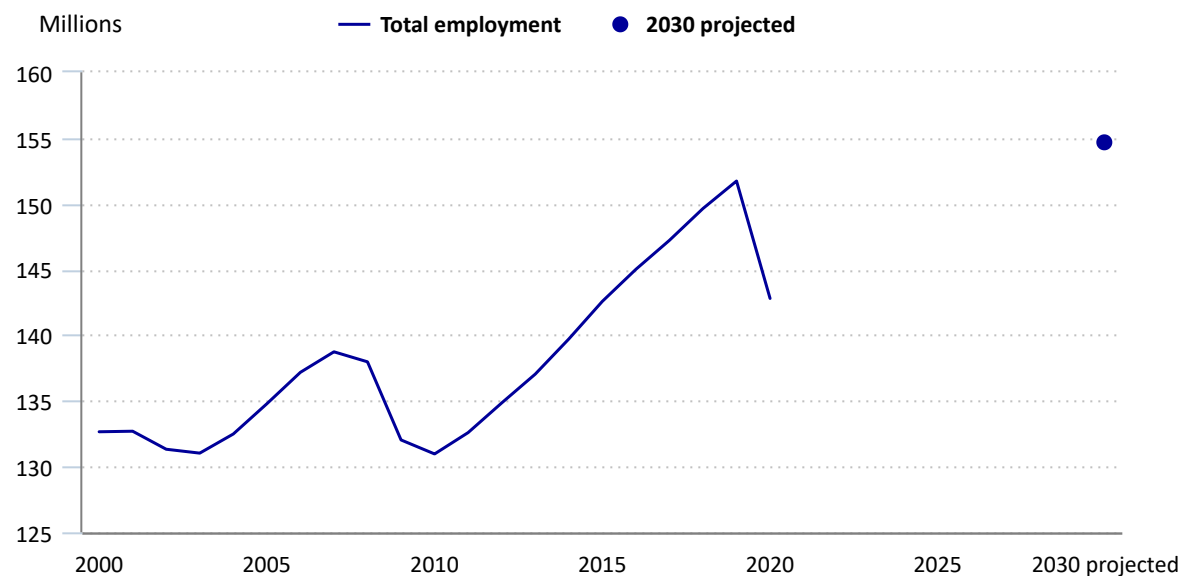
Of the seven industries projected to decline in real output over the 2020–30 projections period, five are in manufacturing. (See publication [table 2.8](#).) Within manufacturing, the tobacco manufacturing industry is projected to have the fastest annual rate of output decline, 3.8 percent. This expectation is due to a decades-long trend of continued decline in the number of people who use tobacco products.³⁷ Apparel,

leather, and allied product manufacturing, whose output is projected to decline at an annual rate of 2.7 percent, is the second fastest declining industry, followed by coal mining, whose output is projected to decline at an annual rate of 2.0 percent.

Industry employment projections

BLS projects that total employment will reach 165.4 million in 2030, an increase of about 11.9 million from 2020. This increase represents an annual growth rate of 0.7 percent, slightly lower than the 0.8-percent growth rate experienced from 2010 to 2020. Most of the increase in employment, 93.5 percent, stems from nonagricultural wage and salary workers. The number of nonagricultural wage and salary jobs is projected to rise from 142.8 million in 2020 to 154.7 million in 2030, an increase of 11.9 million jobs. (See chart 12.) This increase is about the same as that recorded from 2010 to 2020. The 2020–30 employment increase for nonagricultural wage and salary workers (0.8 percent per year) is projected to be slightly slower than the increase experienced from 2010 to 2020 (0.9 percent per year).³⁸

Chart 12. Total nonagricultural wage and salary employment, 2000–20 and 2030 projected



Click legend items to change data display. Hover over chart to view data.
Note: Total nonagricultural wage and salary employment is the sum of private household employment data from the Current Population Survey and nonagricultural wage and salary employment data, excluding data for logging, from the Current Employment Statistics survey.
Source: U.S. Bureau of Labor Statistics.

[View Chart Data](#)



Sector employment

Employment in the service-providing sectors is projected to reach about 134.1 million in 2030, an increase of roughly 11.3 million jobs. This increase represents just over 95 percent of all jobs added from 2020 to 2030. Employment in the service-providing sectors is expected to grow by 0.9 percent annually over the next decade, slightly faster than both the rate experienced from 2010 to 2020 (0.8 percent) and the rate projected for the overall economy for 2020–30 (0.7 percent). (See table 4.)

Table 4. Employment by major industry sector, 2010, 2020, and 2030 projected

Industry sector	Employment (thousands of jobs)			Employment change (thousands of jobs)		Percent distribution			Compound annual rate of change (percent)	
	2010	2020	2030	2010–20	2020–30	2010	2020	2030	2010–20	2020–30
Total ^[1]	141,926.7	153,533.8	165,413.7	11,607.1	11,879.9	100.0	100.0	100.0	0.8	0.7
Nonagriculture wage and salary ^[2]	130,964.0	142,795.2	154,693.1	11,831.2	11,897.9	92.3	93.0	93.5	0.9	0.8
Goods producing, excluding agriculture	17,702.2	20,021.6	20,578.5	2,319.4	556.9	12.5	13.0	12.4	1.2	0.3
Mining	654.8	573.1	671.3	-81.7	98.2	0.5	0.4	0.4	-1.3	1.6
Construction	5,518.3	7,269.4	7,584.4	1,751.1	315.0	3.9	4.7	4.6	2.8	0.4
Manufacturing	11,529.1	12,179.1	12,322.8	650.0	143.7	8.1	7.9	7.4	0.5	0.1
Services providing, excluding special industries	113,261.8	122,773.6	134,114.6	9,511.8	11,341.0	79.8	80.0	81.1	0.8	0.9
Utilities	552.8	541.9	502.9	-10.9	-39.0	0.4	0.4	0.3	-0.2	-0.7
Wholesale trade	5,386.6	5,639.8	5,780.8	253.2	141.0	3.8	3.7	3.5	0.5	0.2
Retail trade	14,446.3	14,853.1	14,266.3	406.8	-586.8	10.2	9.7	8.6	0.3	-0.4
Transportation and warehousing	4,179.2	5,555.1	6,189.2	1,375.9	634.1	2.9	3.6	3.7	2.9	1.1
Information	2,707.2	2,694.4	2,977.2	-12.8	282.8	1.9	1.8	1.8	0.0	1.0
Financial activities	7,694.8	8,723.7	9,027.1	1,028.9	303.4	5.4	5.7	5.5	1.3	0.3
Professional and business services	16,782.9	20,245.7	22,265.6	3,462.8	2,019.9	11.8	13.2	13.5	1.9	1.0
Educational services	3,155.1	3,459.4	3,983.6	304.3	524.2	2.2	2.3	2.4	0.9	1.4

^[1] Employment data for wage and salary workers are from the U.S. Bureau of Labor Statistics Current Employment Statistics (CES) survey, which counts jobs. Employment data for the self-employed and for agriculture, forestry, fishing, and hunting are from the Current Population Survey (CPS) (household survey), which counts workers.

^[2] Includes wage and salary data from the CES survey, except for private households, whose data are from the CPS. Logging workers are excluded.

^[3] Includes data for agriculture, forestry, fishing, and hunting from the CPS, except for logging, whose data are from the CES survey. Government wage and salary workers are excluded.

Source: U.S. Bureau of Labor Statistics.

Industry sector	Employment (thousands of jobs)			Employment change (thousands of jobs)		Percent distribution			Compound annual rate of change (percent)	
	2010	2020	2030	2010–20	2020–30	2010	2020	2030	2010–20	2020–30
Healthcare and social assistance	16,820.0	19,776.2	23,092.6	2,956.2	3,316.4	11.9	12.9	14.0	1.6	1.6
Leisure and hospitality	13,048.7	13,326.7	16,566.3	278.0	3,239.6	9.2	8.7	10.0	0.2	2.2
Other services	5,997.7	6,048.8	6,804.9	51.1	756.1	4.2	3.9	4.1	0.1	1.2
Federal government	2,977.0	2,929.0	2,860.9	-48.0	-68.1	2.1	1.9	1.7	-0.2	-0.2
State and local government	19,513.5	18,979.8	19,797.1	-533.7	817.3	13.7	12.4	12.0	-0.3	0.4
Agriculture, forestry, fishing, and hunting ^[3]	2,102.9	2,241.3	2,296.3	138.4	55.0	1.5	1.5	1.4	0.6	0.2
Agriculture wage and salary	1,282.3	1,500.8	1,579.1	218.5	78.3	0.9	1.0	1.0	1.6	0.5
Agriculture self-employed	820.6	740.5	717.3	-80.1	-23.2	0.6	0.5	0.4	-1.0	-0.3
Nonagriculture self-employed	8,859.8	8,497.3	8,424.3	-362.5	-73.0	6.2	5.5	5.1	-0.4	-0.1

^[1] Employment data for wage and salary workers are from the U.S. Bureau of Labor Statistics Current Employment Statistics (CES) survey, which counts jobs. Employment data for the self-employed and for agriculture, forestry, fishing, and hunting are from the Current Population Survey (CPS) (household survey), which counts workers.

^[2] Includes wage and salary data from the CES survey, except for private households, whose data are from the CPS. Logging workers are excluded.

^[3] Includes data for agriculture, forestry, fishing, and hunting from the CPS, except for logging, whose data are from the CES survey. Government wage and salary workers are excluded.

Source: U.S. Bureau of Labor Statistics.

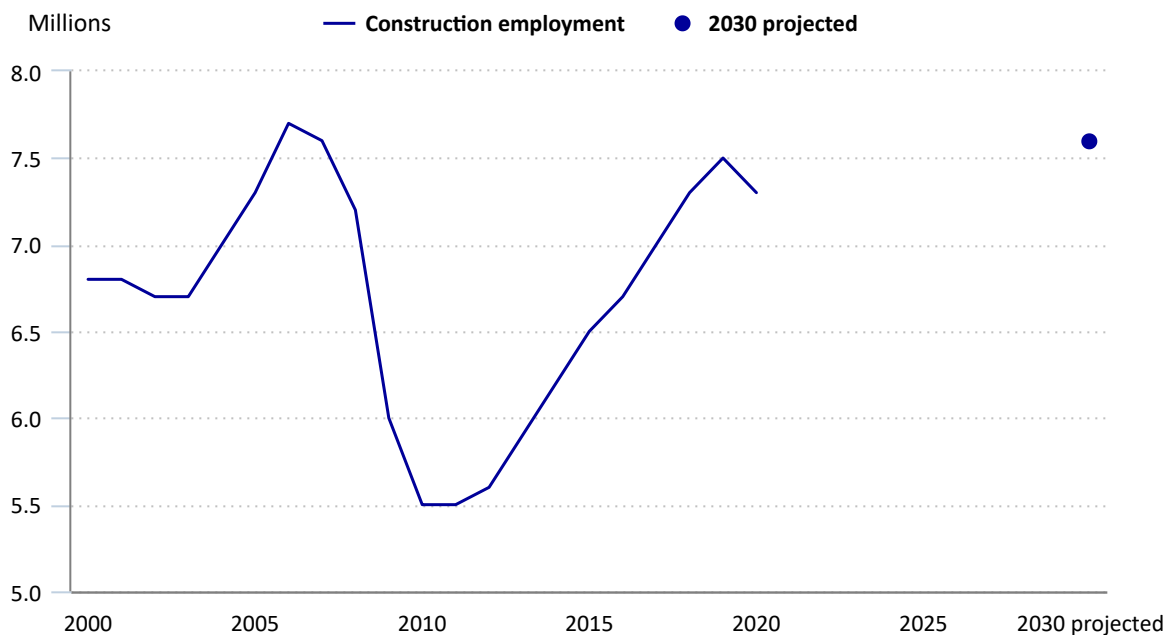
As in the last six projection sets, the healthcare and social assistance sector is projected to add the most jobs over the next 10 years. Employment in healthcare and social assistance is projected to increase by 3.3 million over the projections period, reaching a level of 23.1 million in 2030. This sector is projected to grow at an annual rate of 1.6 percent, the same as in 2010–20 but more than twice as fast as the projected annual growth for the overall economy. An aging population and longer life expectancies are expected to continue to drive strong demand for healthcare services.

Like in the last projections set, the retail trade industry is projected to have the largest employment decline among all service-providing industries. Employment in retail trade is projected to decline by 586,800 from 2020 to 2030, sharply contrasting its increase of 406,800 jobs during the previous decade.

The declining trend in retail trade employment is driven by several factors, including a consumer behavioral shift toward e-commerce that has led to bankruptcy and consolidation of big-box stores.³⁹

Employment in the goods-producing sectors (excluding agriculture) is projected to increase by 556,900 over the projections period, reaching about 20.6 million in 2030. In the previous decade, these sectors experienced much larger employment gains (2.3 million). Of the projected job gains over the next decade, 315,000 jobs are expected to be added in construction, at an annual rate of 0.4 percent. This increase is much smaller than that experienced by the sector during the previous decade, when construction added about 1.8 million jobs. In the previous decade, employment growth in construction was driven by the recovery from the housing market crash of 2008 and the Great Recession of 2007–09, in which the residential construction industry experienced particularly large employment declines. (See chart 13.)

Chart 13. Construction wage and salary employment, 2000–20 and 2030 projected



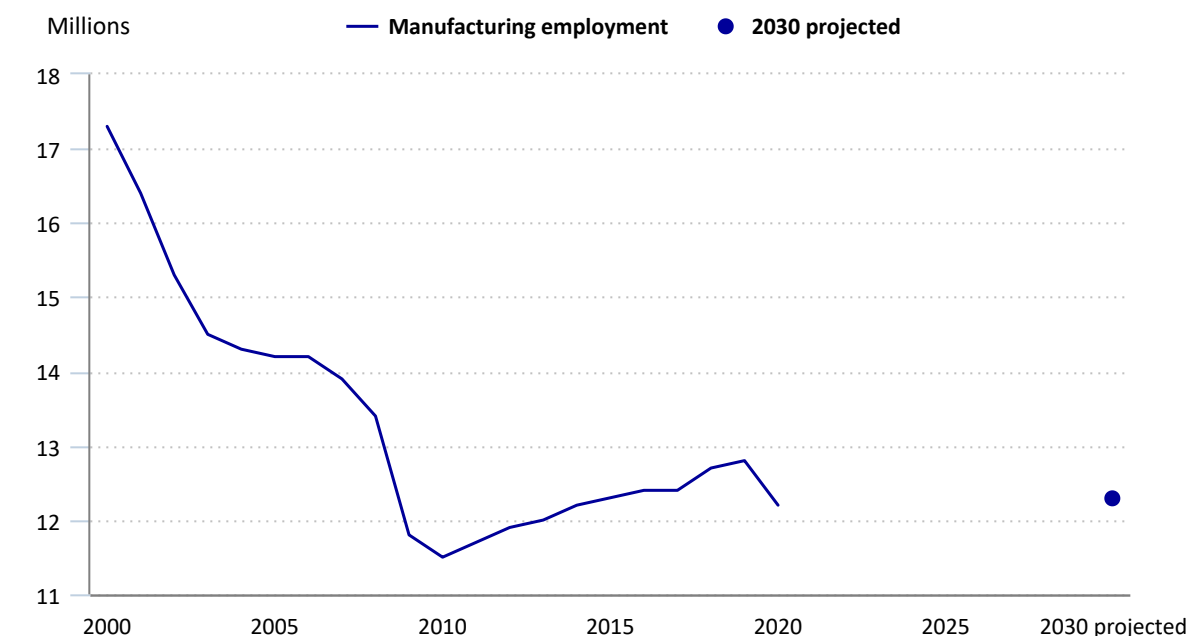
Click legend items to change data display. Hover over chart to view data.
Source: U.S. Bureau of Labor Statistics.



[View Chart Data](#)

Employment in manufacturing—the largest sector among the goods-producing sectors (excluding agriculture), accounting for about 61 percent of total employment in these sectors in 2020—is projected to increase by 143,700 over the next decade. During the previous decade, manufacturing added 650,000 jobs. (See chart 14.) The projected slower employment growth in manufacturing reflects automation-driven productivity gains, which are expected to limit employment demand for low-skilled labor in the sector over the projections period.⁴⁰

Chart 14. Manufacturing wage and salary employment, 2000–20 and 2030 projected



Click legend items to change data display. Hover over chart to view data.
Source: U.S. Bureau of Labor Statistics.



[View Chart Data](#)

Mining is projected to add 98,200 jobs over the next decade, more than offsetting its loss of 81,700 jobs from 2010 to 2020. The projected growth in mining is primarily due to expected recovery growth, particularly in the support activities for mining industry, which saw a large employment drop in 2020.

The agriculture, forestry, fishing, and hunting sector is projected to add 55,000 jobs from 2020 to 2030, less than half the number of jobs it added from 2010 to 2020. Although agriculture wage and salary employment is projected to increase by 78,300 over the next decade, a continued decline in agriculture self-employment (–23,200) is expected to stymie the overall employment recovery from the previous decade. This decline is due, in part, to a declining number of small farms, to the emergence of large farming operations, and to older workers being more likely to be self-employed than any other working-age group in this industry.⁴¹

Industries with fastest growing employment

The COVID-19 pandemic substantially affected industries with the fastest growing and most rapidly declining employment. Because the pandemic lowered employment levels in the base year (2020) relative to 2019, several industries that would not have fallen in any of these two categories under normal (prepandemic) conditions did so in the 2020–30 projections.

Among all sectors, leisure and hospitality is projected to see the fastest employment growth over the next decade, comprising 7 of the 20 fastest growing industries. (See publication [table 2.3](#).) Employment of promoters of events, and agents and managers, is expected to grow the fastest, at an annual rate of 6.4 percent. Following this industry are independent artists, writers, and performers, with an expected annual growth rate of 5.0 percent, and motion picture, video, and sound recording industries in the information

sector, whose employment is projected to grow by 4.9 percent annually. The projected employment increase in the overall leisure and hospitality sector is due, in part, to businesses making up for losses suffered as a result of the pandemic and to the general public's desire to resume recreational activities. The leisure and hospitality sector is projected to return to its prepandemic employment trend over the 2020–30 period.

Within healthcare, the individual and family services industry is projected to grow the fastest, at an annual rate of 3.3 percent, about the same as in the 2019–29 projections. Demand for healthcare services is expected to continue to increase because of an aging baby-boom generation, longer life expectancies, and continued growth in the number of patients with chronic conditions.⁴² Employment in healthcare industries has trended up in the last four projection periods.

Industries with most rapidly declining employment

Although the manufacturing sector is projected to experience employment growth over the next decade, many manufacturing industries are expected to see employment declines. The large manufacturing sector includes 11 of the 20 industries projected to experience the most rapid job declines from 2020 to 2030. (See publication [table 2.4.](#)) These expected declines are due, in part, to growing international competition and continued productivity gains driven by automation.⁴³ Employment in the tobacco manufacturing industry is projected to decline most rapidly, by 5.5 percent annually. A continued decline in tobacco use is one of the primary reasons for this expected drop.

Other industries projected to be among those with the most rapidly declining employment over the next decade include consumer goods rental and general rental centers, an industry within the financial activities sector expected to see an annual employment decline of 2.7 percent, and wired telecommunications carriers, an industry within the information sector projected to experience an annual employment decline of 1.9 percent.

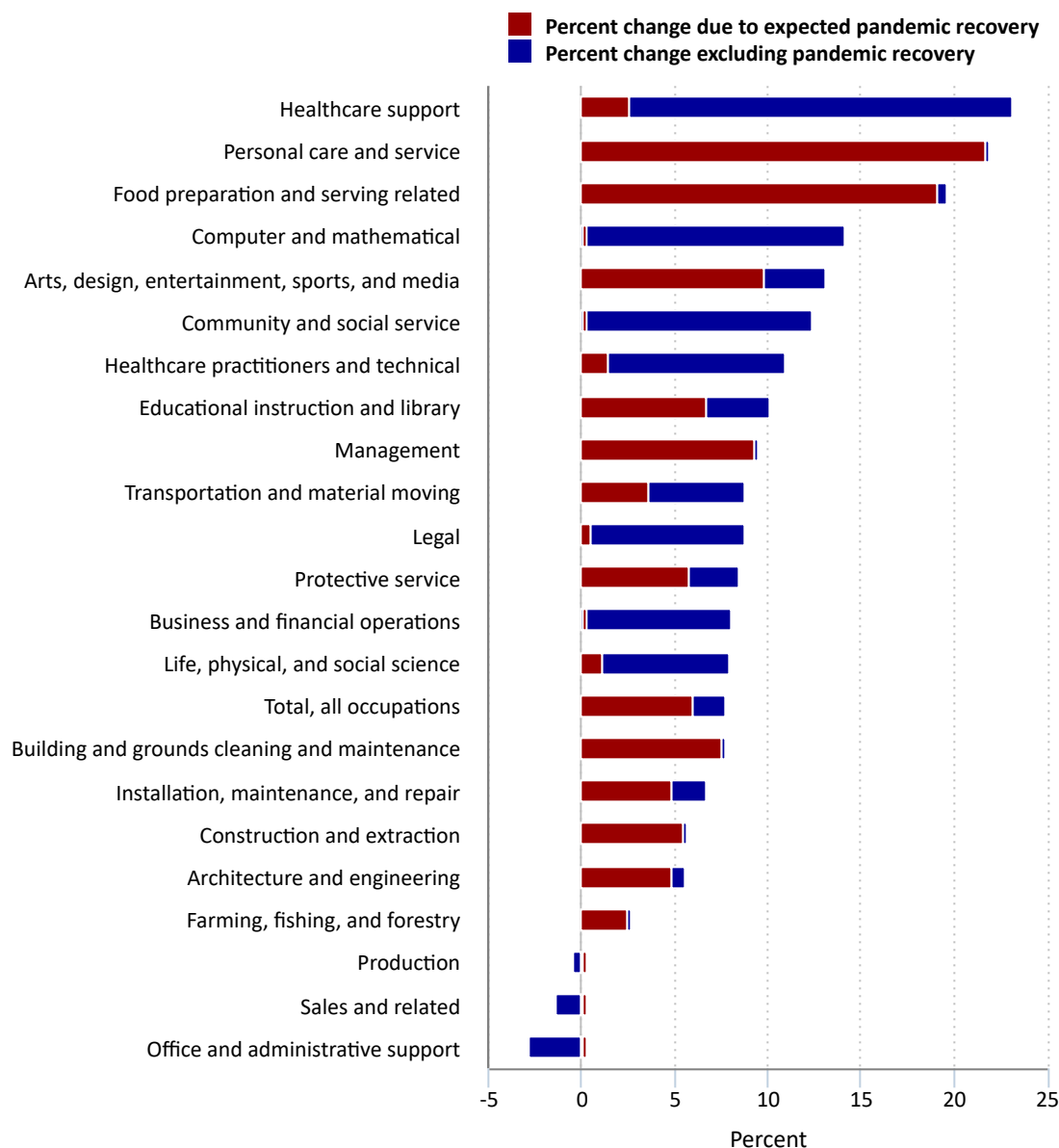
Occupational employment projections to 2030

This section presents BLS occupational employment projections by major occupational group and identifies detailed occupations expected to experience the fastest or most employment growth from 2020 to 2030, as well as occupations whose employment is projected to decline over the period.

Occupational projections of major groups

BLS develops employment projections for 22 major occupational groups.⁴⁴ Chart 15 shows those groups' projected percent changes in employment for 2020–30, including growth due to an expected recovery from the COVID-19 pandemic. Of the 22 major groups, all but 3 are expected to experience employment growth over the next decade.

Chart 15. Projected percent change in employment, by major occupational group, 2020–30



Click legend items to change data display. Hover over chart to view data.

Note: Pandemic recovery is defined as a reversal of declines in employment between 2019 and 2020 for occupational groups that experienced declines during that period.

Source: U.S. Bureau of Labor Statistics.



[View Chart Data](#)

As seen in chart 15, the impact of the COVID-19 recession on occupational employment was uneven. For many occupations, the 2020–30 projections reflect considerable cyclical recovery from the recession, as well as expected long-term structural changes in labor demand. (See publication [table 1.1A](#).)

Nineteen of the 22 major occupational groups experienced a drop in employment between 2019 and 2020. The average employment change for all occupations over this period was about –5.7 percent. The occupational groups with the sharpest employment losses during the COVID-19 recession may have higher projected growth rates for 2020–30 than groups less affected by the pandemic, and these rates may also be higher than those projected for 2019–29. However, most of the occupational groups with a long-term trend of declining employment are projected to remain on a downward trajectory over the 2020–30

decade. These include the production, sales and related, and office and administrative support occupational groups, which were also projected to see employment declines in the 2019–29 projections.⁴⁵

Three occupational groups—business and financial operations occupations, computer and mathematical occupations, and community and social service occupations—grew from 2019 to 2020 and thus have no projected growth attributable to the expected recovery of jobs lost between 2019 and 2020.

Occupations with fastest growing employment

Over the projections period, the healthcare support occupational group is expected to see the fastest employment growth, 23.1 percent. (See chart 15.) This group includes home health and personal care aides, nursing assistants, and various other healthcare support workers. Healthcare support occupations are poised to benefit from expected stronger demand for healthcare services—demand due largely to an aging population.⁴⁶

Personal care and service occupations and food preparation and serving-related occupations are the second- and third-fastest-growing occupational groups, with projected employment growth of 21.7 percent and 19.6 percent, respectively. However, these figures reflect mainly a recovery of pandemic-related job losses incurred in 2020. By comparison, in the last set of projections, these two occupational groups were projected to be the fifth and sixth fastest growing.

On the other hand, expected strong employment growth for computer and mathematical occupations is due mostly to long-term economic changes driving up demand for workers in those occupations. A growing digital economy, partly accelerated by a continued deployment of Internet of Things (IoT) in consumer products and industrial applications, is a driving force behind this projected growth.⁴⁷ In addition, as the volume of sensitive data collected and stored by businesses expands with increasing online traffic and IoT applications, so does the need for cybersecurity. Big data also underpins expected demand for mathematical occupations, which will play an important role in the analysis and interpretation of large datasets.⁴⁸

In about two-thirds of the top 30 fastest growing detailed occupations, employment growth can largely be attributed to cyclical recovery effects rather than expected long-term structural changes in labor demand. (See publication [table 1.3](#).) Workers in these occupations are employed in industries that were hit the hardest by pandemic mitigation measures. As noted previously, these industries, which include leisure and hospitality, personal care services, and entertainment-related industries, are projected to experience strong cyclical recoveries over the projections period, and so are the occupations within them.

For example, employment of motion picture projectionists is expected to grow by 70.5 percent from 2020 to 2030, the fastest growth among all 790 detailed occupations. (See publication [table 1.3](#).) This growth is expected to be entirely driven by an employment recovery in motion picture and video industries, which employ 69.9 percent of all motion picture projectionists. The motion picture and video exhibition industry lost just over 60 percent of its workforce in 2020, as movie theaters nationwide shut down because of pandemic-related lockdown mandates.⁴⁹ The projected employment growth for motion picture projectionists, then, is expected to be driven by a cyclical recovery and does not entail a long-term structural increase in demand for this occupation. In fact, the occupation's employment has been projected to decrease in the previous four projection sets, reflecting a decline in long-term structural demand that is

expected to result from digital film projectors requiring less manual operation and routine monitoring than traditional film projectors.⁵⁰

However, some occupations are expected to see higher long-term structural growth because of pandemic-driven economic changes. For example, employment of epidemiologists is projected to grow 29.6 percent from 2020 to 2030, reflecting rising demand for infectious disease research.⁵¹ In addition, because of expected increases in the use of telework, hybrid work arrangements, and telehealth medical services, many computer occupations may benefit from greater demand for IT services.⁵²

The BLS employment projections identify structural changes in the labor market and do not predict business cycle fluctuations. Consequently, one of the fundamental assumptions of the employment projections is a full-employment economy in the target year of 2030. To provide information on the structural labor market changes expected over the next decade, the BLS Employment Projections program has created an alternate list of fastest growing occupations that excludes occupations largely expected to experience cyclical growth.⁵³ The top 10 occupations composing this list are shown in table 5. Nine of these occupations were also featured in the top 10 list in the 2019–29 projections.⁵⁴

Table 5. Ten occupations with fastest projected employment growth for 2020–30, excluding occupations with above-average cyclical recovery

Occupation	Employment (thousands)		Change (2020–30)	
	2020	2030	Percent	Level
All occupations	153,533.8	165,413.7	7.7	11,879.9
Wind turbine service technicians	6.9	11.7	68.2	4.7
Nurse practitioners	220.3	335.2	52.2	114.9
Solar photovoltaic installers	11.8	17.9	52.1	6.1
Statisticians	42.0	56.9	35.4	14.9
Physical therapist assistants	93.8	126.9	35.4	33.2
Information security analysts	141.2	188.3	33.3	47.1
Home health and personal care aides	3,470.7	4,600.6	32.6	1,129.9
Medical and health services managers	429.8	569.4	32.5	139.6
Data scientists and mathematical science occupations, all other	63.2	83.0	31.4	19.8
Physician assistants	129.4	169.5	31.0	40.1
Note: Occupations whose decline in wage and salary employment from 2019 to 2020 was greater than that for all occupations (approximately 6 percent) are excluded. These excluded occupations may have fast growth rates that are predominantly driven by cyclical recovery rather than structural growth. Source: U.S. Bureau of Labor Statistics.				

Five of the 10 occupations listed in table 5 are in the healthcare sector. An increasing use of team-based healthcare models, an aging baby-boom population, and a rise in the number of individuals with chronic

health conditions are expected to continue to drive demand for these healthcare occupations.⁵⁵ In addition, swelling demand for primary care services, paired with a shortage of physicians, has led to increased delegation of physician responsibilities to nurse practitioners and physician assistants.⁵⁶ Employment of nurse practitioners is projected to increase by 52.2 percent in the next decade, generating about 114,900 new positions. Employment of physician assistants is expected to grow 31.0 percent, adding roughly 40,100 new jobs. Similarly, physical therapy service providers will likely continue to hire more assistants as a cost-saving measure and to meet growing demand from aging baby boomers for these services.⁵⁷ As a result, employment of physical therapist assistants is expected to grow 35.4 percent.

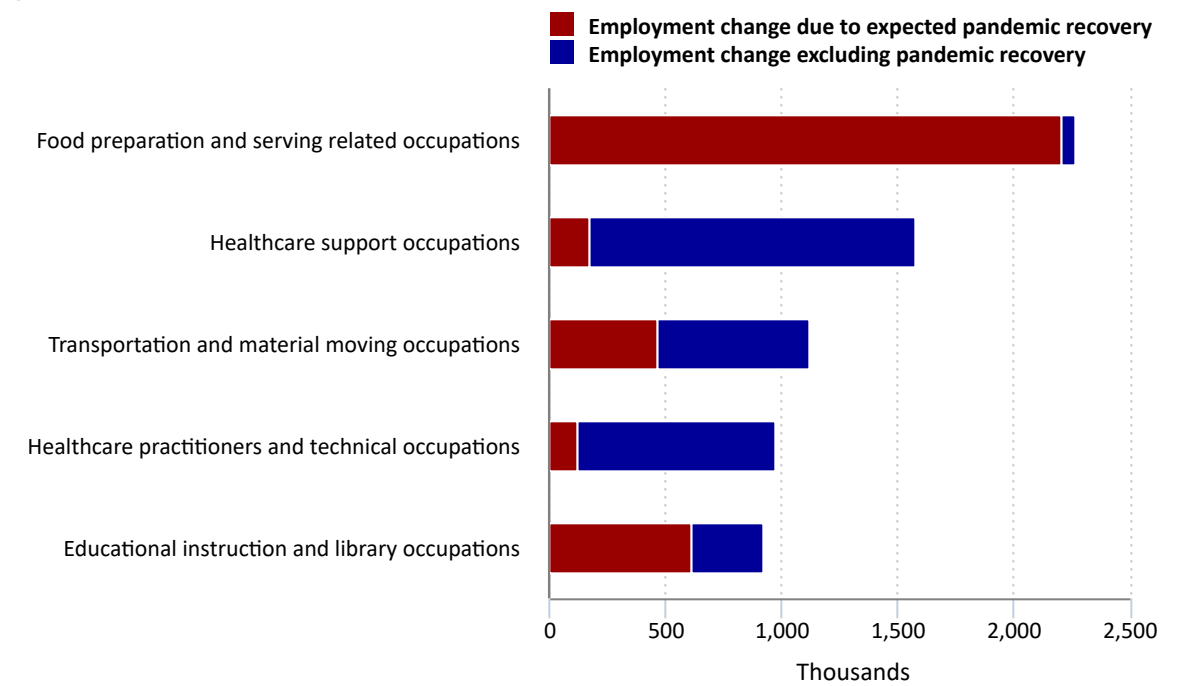
The occupation of home health and personal care aides, already among the top 10 fastest growing occupations (excluding those with above-average cyclical recovery), is expected to add the most jobs over the next decade. (See publication [table 1.3A](#) and [table 1.4](#).) Employment in this occupation is projected to grow by about 1.1 million from 2020 to 2030, an increase of 32.6 percent. Home health and personal care aides assist the elderly or those with disabilities with daily living activities, provide nonmedical care services, and, in some cases, deliver basic medical care services.⁵⁸ An aging population is expected to drive stronger demand for elderly care and social assistance services, including in-home assistance or care in retirement communities, assisted living facilities, nursing homes, and other facilities.

Two of the top three occupations—wind turbine service technicians and solar photovoltaic (PV) installers—are related to renewable energy. (See publication [table 1.3A](#).) The main driver of employment growth in these occupations is the expected continued expansion and adoption of alternative energy sources such as wind and solar energy over the next decade.⁵⁹ These sources are becoming more cost competitive with traditional energy sources such as coal, and their expansion should create new jobs in the installation and maintenance of the infrastructure required to harness them. Employment of wind turbine service technicians is projected to grow 68.2 percent from 2020 to 2030. However, this occupation is relatively small, having a 2020 employment level of approximately 6,900, and its fast growth will account for only about 4,700 new jobs over the next 10 years. Similarly, PV installers are expected to see rapid job growth over the next decade (52.1 percent), but because of the occupation's relatively small size, this growth will translate into only about 6,100 new jobs.

Occupations with largest job creation

Rapid employment growth does not necessarily result in many new jobs. Three occupational groups—food preparation and serving-related occupations, healthcare support occupations, and transportation and material-moving occupations—are each projected to add more than 1.0 million new jobs over the next decade. (See chart 16.) Together, these groups are expected to add roughly 4 out of every 10 new jobs by 2030. The food preparation and serving-related occupational group is expected to add the most jobs—approximately 2.3 million; however, as mentioned previously, most of these jobs will offset pandemic-related job losses in the leisure and hospitality sector. Three detailed occupations within this group are among the top 10 occupations with the largest expected job increases: restaurant cooks, fast food counter workers, and waiters and waitresses. (See publication [table 1.4](#).)

Chart 16. Projected change in employment levels, by selected occupational groups, 2020–30



Click legend items to change data display. Hover over chart to view data.
 Note: Pandemic recovery is defined as a reversal of declines in employment between 2019 and 2020 for occupational groups that experienced declines during that period.
 Source: U.S. Bureau of Labor Statistics.

[View Chart Data](#)

Healthcare-related occupations are expected to experience not only rapid employment growth but also notable gains in employment levels. Healthcare support occupations are expected to add about 1.6 million new jobs over the next decade, while healthcare practitioners and technical occupations are projected to add about 974,600 new jobs. Four of the top 10 largest job increases that exclude the effects of the pandemic recovery are projected to occur in healthcare-related occupations, including home health and personal care aides and registered nurses. (See table 6.)

Table 6. Ten occupations with largest projected employment growth for 2020–30, excluding occupations with above-average cyclical recovery

Occupation	Employment (thousands)		Change (2020–30)	
	2020	2030	Percent	Level
All occupations	153,533.8	165,413.7	7.7	11,879.9
Home health and personal care aides	3,470.7	4,600.6	32.6	1,129.9
Software developers and software quality assurance analysts and testers	1,847.9	2,257.4	22.2	409.5

Note: Occupations whose decline in wage and salary employment from 2019 to 2020 was greater than that for all occupations (approximately 6 percent) are excluded. These excluded occupations may have fast growth rates that are predominantly driven by cyclical recovery rather than structural growth.

Source: U.S. Bureau of Labor Statistics.

Occupation	Employment (thousands)		Change (2020–30)	
	2020	2030	Percent	Level
Registered nurses	3,080.1	3,356.8	9.0	276.8
Laborers and freight, stock, and material movers, hand	2,821.7	3,077.5	9.1	255.8
General and operations managers	2,411.9	2,638.2	9.4	226.3
Market research analysts and marketing specialists	740.9	904.5	22.1	163.6
Medical and health services managers	429.8	569.4	32.5	139.6
Medical assistants	720.9	853.5	18.4	132.6
Management analysts	907.6	1,032.0	13.7	124.4
Heavy and tractor-trailer truck drivers	1,951.6	2,073.6	6.3	122.1
Note: Occupations whose decline in wage and salary employment from 2019 to 2020 was greater than that for all occupations (approximately 6 percent) are excluded. These excluded occupations may have fast growth rates that are predominantly driven by cyclical recovery rather than structural growth. Source: U.S. Bureau of Labor Statistics.				

Transportation and material-moving occupations are projected to add roughly 1.1 million new jobs by 2030, at a rate about as fast as the average rate for the total economy. A little less than half of these additions are expected to represent a recovery of jobs lost during the COVID-19 pandemic. (See publication [table 1.1A](#).) The projected job gains are largely concentrated in various motor vehicle operator occupations and in material-moving occupations. An expected increase in online shopping, app-based ordering, and the use of delivery services is expected to create more opportunities for light truck drivers, driver/sales workers, and stockers and order fillers.⁶⁰

Finally, educational instruction and library occupations are projected to add roughly 920,500 jobs by 2030. However, about two-thirds of these gains are expected to represent a recovery of jobs lost because of school closures during the pandemic. (See publication [table 1.1A](#).) The pandemic led to the temporary closure of 120,000 schools nationwide in 2020.⁶¹

Occupations with declining employment

Three occupational groups—office and administrative support occupations, sales and related occupations, and production occupations—are projected to lose jobs over the next decade. (See table 7.) Between 2019 and 2020, these groups experienced notable declines in employment because of the COVID-19 recession.

Table 7. Occupational groups with projected declines in employment, 2020–30

Occupational group	Change (2020–30)	
	Percent	Level (thousands)
Office and administrative support	-2.8	-539.2

Source: U.S. Bureau of Labor Statistics.

Occupational group	Change (2020–30)	
	Percent	Level (thousands)
Sales and related	-1.4	-202.9
Production	-0.4	-39.0
Source: U.S. Bureau of Labor Statistics.		

Employment in the office and administrative support occupational group is expected to fall by 2.8 percent from 2020 to 2030. This group is also projected to shed the most jobs over the next decade, losing about 539,200 positions. Automation of administrative and clerical tasks through software programs and systems is expected to reduce demand for office and administrative support occupations.⁶² For example, software tools for scheduling meetings and appointments reduce the need for secretaries and administrative assistants, and digital data collection and handwriting recognition software can now perform work previously done by data entry keyers.⁶³ Of the 30 occupations with the steepest projected declines in employment, 9 are office and administrative support occupations. (See publication [table 1.5](#).) Job declines in these nine occupations constitute over half of all projected job losses in the office and administrative support occupational group.

The continued displacement of brick-and-mortar retail by e-commerce,⁶⁴ paired with the automation of checkout positions,⁶⁵ is expected to drive the decline in sales and related occupations; about half of all sales occupations are held by retail salespersons and cashiers. These occupations may see additional downward pressure on employment from the strengthening of online shopping trends caused by behavioral changes during the pandemic—changes that are expected to persist.⁶⁶ Sales and related occupations are projected to lose about 202,900 jobs over the next decade, a 1.4-percent drop in employment. The occupation of cashiers, the fourth largest in 2020, is projected to lose the most jobs of any occupation. (See publication [table 1.6](#).) Employment of cashiers is projected to drop by about 336,400 over the projections period, which would make them the sixth-largest occupation by 2030.

Likewise, manufacturing automation through increased use of robotics and other productivity-enhancing technologies is expected to drive the employment decline in production occupations.⁶⁷ Employment in these occupations is projected to decline 0.4 percent over the next decade, a loss of about 39,000 jobs. Of the 30 occupations with the sharpest employment declines, 12 are in the production occupational group and include various machine and tool setters, assemblers, and operators. (See publication [table 1.5](#).)

Conclusions

Because of an aging population and slower population growth, labor force growth is expected to be slower in 2020–30 than in previous decades. Older people participate in the labor force less than younger people do, so an aging population shrinks the pool of workers available for employment. However, because the base year of the projections (2020) is a recession year, economic growth rates over the next decade are expected to be higher than those in previous projection periods. Total employment is projected to grow 7.7 percent from 2020 to 2030.

Over the projections period, employment is projected to grow faster in the service-providing sector than in the goods-producing sector. Occupations that provide healthcare or services related to healthcare are projected to be among those with the fastest employment growth. An aging population is projected to drive demand for more healthcare and related services. In addition, the number of people with chronic health conditions is expected to continue to grow, adding to the demand for services provided by healthcare-related occupations. Other occupations projected to grow rapidly include those involving computers, math, and alternative energy. Fast growth is also projected for many occupations concentrated in industries expected to recover from pandemic-induced declines, namely those in the hospitality and entertainment sectors.

Although the extent of structural economic change arising from the COVID-19 pandemic remains uncertain, some industries and occupations are expected to see altered long-term growth trajectories because of pandemic impacts. These include computer-related industries and occupations, which are expected to see higher demand due to expanded telework, and retail trade, which is expected to decline faster as a result of an accelerated shift from brick-and-mortar retail to e-commerce.

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Notes

¹ Annual growth refers to a compound annual growth rate.

² In this discussion, cyclical change refers to short-term business cycle fluctuations around a trend. For example, employment may decline in a particular industry during a recession (cyclical decline) and grow during the recovery immediately following the recession (cyclical growth), eventually returning to the long-term trend. Structural change refers to the long-term trend and, in the case of employment, reflects changes in the allocation of employment by industry and occupation. Structural changes in industry or occupational employment are based on factors such as changes in consumer preferences that affect the demand for goods and services or new technology that affects production practices.

³ Population refers to the civilian noninstitutional population ages 16 and older, excluding “active duty members of the U.S. Armed Forces, people confined to, or living in, institutions or facilities such as prisons, jails, and other correctional institutions and detention centers, and residential care facilities such as skilled nursing homes” (<https://www.bls.gov/cps/definitions.htm#population>).

⁴ Total employment is the sum of the employment figures for nonagricultural wage and salary workers; agricultural, forestry, fishing, and hunting workers; and self-employed workers. Nonagricultural wage and salary employment data are from the U.S. Bureau of Labor Statistics (BLS) Current Employment Statistics (CES) survey, excluding data for logging, and include private household employment data, which are provided by the Current Population Survey (CPS). The CPS also provides data for self-employed workers and agricultural, forestry, fishing, and hunting workers, except data for logging workers, which are provided by the CES survey.

⁵ “U.S. business cycle expansions and contractions” (Cambridge, MA: National Bureau of Economic Research, last updated July 19, 2021), <https://www.nber.org/research/data/us-business-cycle-expansions-and-contractions>.

⁶ Lindsey Ice, Michael J. Rieley, and Samuel Rinde, “Employment projections in a pandemic environment,” *Monthly Labor Review*, February 2021, <https://doi.org/10.21916/mlr.2021.3>.

⁷ BLS develops macroeconomic projections with the Macroeconomic Advisers (MA) model, a structural econometric model of the U.S. economy. The model, licensed from MA by IHS Markit, comprises more than 1,000 variables, behavioral equations, and identities. Central characteristics of the MA model are a life-cycle model of consumption, a neoclassical view of investment, and a vector autoregression for the monetary policy sector of the economy. The full-employment foundation of the model is the most critical characteristic for the BLS outlook. Within MA, a submodel calculates an estimate of potential output from the nonfarm business sector. The calculation is based on full-employment estimates of the sector's hours worked and output per hour. Error-correction models are embedded in the MA model so that the model's solution is aligned with the full-employment submodel. MA does not forecast sharp cyclical movements in the economy over the 10-year projection horizon. "Add-factors" are either left unchanged after the first couple of years of the solution or returned to historical norms. Add-factors represent changes made to the base result of a forecast or projection equation; see "Glossary of statistical terms" (Organisation for Economic Co-operation and Development, September 25, 2001, updated March 28, 2014), <https://stats.oecd.org/glossary/detail.asp?ID=44>. The structure of the model, exogenous assumptions, and MA's view of the Federal Reserve's long-term policy objective largely determine the characteristics of the model's long-term outlook for the economy. For more information, see <http://www.macroadvisers.com/>.

⁸ Energy Information Administration estimates include prices for West Texas Intermediate crude oil, Brent crude oil, and natural gas and assume that current energy regulations will remain unchanged. For more information, see *Annual energy outlook 2020* (U.S. Energy Information Administration, February 3, 2021, released annually), <https://www.eia.gov/outlooks/aeo/>.

⁹ For a detailed description of the projections process, see "Employment projections methods overview," *Employment Projections* (U.S. Bureau of Labor Statistics), <https://www.bls.gov/emp/documentation/projections-methods.htm>.

¹⁰ Families First Coronavirus Response Act, Pub. L. No. 116-127 (2020), <https://www.congress.gov/bill/116th-congress/house-bill/6201/text>.

¹¹ "Fertility rate, total (births per woman)—United States" (The World Bank), <https://data.worldbank.org/indicator/SP.DYN.TFRT.IN?locations=US>.

¹² Stephanie Hegarty, "Covid: from boom to bust—why lockdown hasn't led to more babies," *BBC News*, March 18, 2021, <https://www.bbc.com/news/world-56415248>.

¹³ "Fertility rate, total for the United States" (FRED, Federal Reserve Bank of St. Louis), <https://fred.stlouisfed.org/series/SPDYNTFRTINUSA>.

¹⁴ "Net migration—United States" (The World Bank), <https://data.worldbank.org/indicator/SM.POP.NETM?locations=US>. Data are estimated 5-year inflows, so it is not possible to calculate precise annual averages.

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¹⁶ For an indepth discussion of full employment and how and why it is used in BLS projections, see Kevin S. Dubina, "Full employment: an assumption within BLS projections," *Monthly Labor Review*, November 2017, <https://doi.org/10.21916/mlr.2017.30>.

¹⁷ Courtney Coile, "The evolution of retirement incentive in the U.S.," Working Paper 25281 (Cambridge, MA: National Bureau of Economic Research, November 2018), https://www.nber.org/system/files/working_papers/w25281/w25281.pdf.

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- ²⁶ "Annual Energy Outlook 2021," PowerPoint release presentation (U.S. Energy Information Administration, February 3, 2021), slide 19, https://www.eia.gov/pressroom/presentations/AEO2021_Release_Presentation.pdf.
- ²⁷ Because of misclassification of many workers in the "employed people not at work" category rather than the "unemployed on temporary layoff" category, the unemployment rate in 2020 could have been higher than reported. See question 14 ("Household survey: what would the unemployment rate be if these misclassified workers were included among the unemployed?") in "Frequently asked questions: the impact of the coronavirus (COVID-19) pandemic on the Employment Situation for April 2020" (U.S. Bureau of Labor Statistics), <https://www.bls.gov/covid19/employment-situation-covid19-faq-april-2020.htm>.
- ²⁸ "Additional information about the economic outlook: 2021 to 2031" (Congressional Budget Office, February 2021), <https://www.cbo.gov/publication/57014>. The Congressional Budget Office (CBO) refers to the natural rate of unemployment rather than the nonaccelerating inflation rate of unemployment. The concept of the rate of unemployment that prevails at full employment is the same. However, CBO downplays the link between inflation and unemployment.
- ²⁹ More specifically, productivity is calculated as total output divided by total hours worked. Total hours worked are equivalent to employment multiplied by average hours worked. Employment is noted as it changes from year to year, whereas average hours worked tend to remain consistent.
- ³⁰ For changes to the Federal Open Market Committee's target federal funds rate, see "Policy tools: open market operations" (Board of Governors of the Federal Reserve System), <https://www.federalreserve.gov/monetarypolicy/openmarket.htm>.
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- ³² “10-year treasury constant maturity rate (DGS10)” (FRED, Federal Reserve Bank of St. Louis), <https://fred.stlouisfed.org/series/DGS10>; and “3-month treasury bill: secondary market rate (TB3MS)” (FRED, Federal Reserve Bank of St. Louis), <https://fred.stlouisfed.org/series/TB3MS>.
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- ³⁷ “Overall tobacco trends” (Chicago, IL: American Lung Association), <https://www.lung.org/research/trends-in-lung-disease/tobacco-trends-brief/overall-tobacco-trends>.
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- ⁴⁴ BLS uses the Standard Occupational Classification (SOC) system to categorize occupations into 23 major groups on the basis of the job duties performed in these occupations. The BLS Employment Projections program does not develop projections for SOC group 55-0000, military specific occupations. See “2018 Standard Occupational Classification system” (U.S. Bureau of Labor Statistics), https://www.bls.gov/soc/2018/major_groups.htm.
- ⁴⁵ Kevin S. Dubina, Janie-Lynn Kim, Emily Rolan, and Michael J. Rieley, “Projections overview and highlights, 2019–29,” *Monthly Labor Review*, September 2020, <https://doi.org/10.21916/mlr.2020.21>.
- ⁴⁶ “Appendix A: CBO’s projections of demographic and economic trends” (Congressional Budget Office, March 2021), <https://www.cbo.gov/system/files?file=2021-03/56977-LTBO-2021-AppxA.pdf>.

⁴⁷ Jessica R. Nicholson, “Updated digital economy estimates—June 2021” (U.S. Bureau of Economic Analysis, June 2021), p. 2, <https://www.bea.gov/system/files/2021-06/DE%20June%202021%20update%20for%20web%20v3.pdf>; and Alan Zilberman and Lindsey Ice, “Why computer occupations are behind strong STEM employment growth in the 2019–29 decade,” *Beyond the Numbers*, vol. 10, no. 1 (U.S. Bureau of Labor Statistics, January 2021), <https://www.bls.gov/opub/btn/volume-10/why-computer-occupations-are-behind-strong-stem-employment-growth.htm>. Internet of Things refers to the network of physical objects that are connected to the internet via embedded sensors or software. Internet connectivity allows these objects to connect with other devices or systems and send or receive data.

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⁴⁹ Jake Coyle, “Cinemas across U.S. close for pandemic,” *Associated Press*, March 16, 2020, <https://apnews.com/46d247ad42a1975d18ab2434c3b7976d>.

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⁵³ The first step in creating this list was to remove any occupation whose decline in wage and salary employment (industry code TE1200) for 2019–20 was greater than that for all occupations (5.9 percent). The list was then sorted by the percent changes in projected total employment (industry code TE1000), which includes both wage and salary workers and self-employed workers.

⁵⁴ Dubina et al., “Projections overview and highlights, 2019–29.”

⁵⁵ “Issue brief: team-based care creates value” (Chicago, IL: American Hospital Association, October 14, 2020), <https://www.aha.org/system/files/media/file/2020/09/value-initiative-issue-brief-team-based-care-creates-value.pdf>; and Andrew Meola, “The aging U.S. population is creating many problems—especially regarding elderly healthcare issues,” *Business Insider*, January 19, 2021, <https://www.businessinsider.com/aging-population-healthcare>.

⁵⁶ Patrick Boyle, “U.S. physician shortage growing” (Washington, DC: Association of American Medical Colleges, June 26, 2020), <https://www.aamc.org/news-insights/us-physician-shortage-growing>; Hilary Barnes, Michael R. Richards, Matthew D. McHugh, and Grant Martsoff, “Rural and nonrural primary care physician practices increasingly rely on nurse practitioners,” *Health Affairs*, vol. 37, no. 6, June 2018, pp. 908–914, <https://doi.org/10.1377/hlthaff.2017.1158>; and Perri A. Morgan, Valerie A. Smith, Theodore S. Z. Berkowitz, David Edelman, Courtney H. Van Houtven, Sandra L. Woolson, Cristina C. Hendrix, Christine M. Everett, Brandolyn S. White, and George L. Jackson, “Impact of physicians, nurse practitioners, and physician assistants on utilization and costs for complex patients,” *Health Affairs*, vol. 38, no. 6, June 2019, pp. 1028–1036, <https://doi.org/10.1377/hlthaff.2019.00014>.

⁵⁷ David Y. Lo, David M. Pine, and Nicholas J. Janiga, “2020 outlook: physical therapy clinics & centers” (Boca Raton, FL: Healthcare Appraisers, Inc., April 2020), <https://healthcareappraisers.com/wp->

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⁵⁹ William Lawhorn, “Solar and wind generation occupations: a look at the next decade,” *Beyond the Numbers*, vol. 10, no. 4 (U.S. Bureau of Labor Statistics, February 2021), <https://www.bls.gov/opub/btn/volume-10/solar-and-wind-generation-occupations-a-look-at-the-next-decade.htm>.

⁶⁰ Jennifer Smith, “Logistics providers see e-commerce momentum continuing post-pandemic,” *The Wall Street Journal*, June 9, 2021, <https://www.wsj.com/articles/logistics-providers-see-e-commerce-momentum-continuing-post-pandemic-11623266882>; and David Curry, “Food delivery app revenue and usage statistics (2021),” *Businessofapps.com*, September 2, 2021, <https://www.businessofapps.com/data/food-delivery-app-market/#1>.

⁶¹ “Map: coronavirus and school closures in 2019–2020,” *Education Week*, June 30, 2021, <https://www.edweek.org/leadership/map-coronavirus-and-school-closures-in-2019-2020/2020/03>.

⁶² *The future of jobs report 2018* (Geneva, Switzerland: World Economic Forum, 2018), p. 21–23, http://www3.weforum.org/docs/WEF_Future_of_Jobs_2018.pdf.

⁶³ *Ibid.*, pp. 21–23.

⁶⁴ “Quarterly retail e-commerce sales, 2nd quarter 2021” (U.S. Census Bureau, August 19, 2021), https://www.census.gov/retail/mrts/www/data/pdf/ec_current.pdf.

⁶⁵ John Matarese, “Where are all the human cashiers in stores? Self-checkout lanes added at major retailers,” *KTNV Las Vegas*, May 7, 2019, <https://www.ktnv.com/lifestyle/where-are-all-the-human-cashiers-in-stores-self-checkout-lanes-added-at-major-retailers>.

⁶⁶ Smith, “Logistics providers see e-commerce momentum continuing post-pandemic.”

⁶⁷ Timothy Aepfel, “North American companies buying more robots to keep up with demand,” *Reuters*, May 6, 2021, <https://www.reuters.com/technology/north-american-companies-buying-more-robots-keep-up-with-demand-2021-05-06/>.



ABOUT THE AUTHOR

Kevin S. Dubina

dubina.kevin@bls.gov

Kevin S. Dubina is an economist in the Office of Occupational Statistics and Employment Projections, U.S. Bureau of Labor Statistics.

Lindsey Ice

ice.lindsey@bls.gov

Lindsey Ice is an economist in the Office of Occupational Statistics and Employment Projections, U.S. Bureau of Labor Statistics.

Janie-Lynn Kim

kim.janie-lynn@bls.gov

Janie-Lynn Kim is an economist in the Office of Occupational Statistics and Employment Projections, U.S. Bureau of Labor Statistics.

Michael J. Rieley

rieley.michael@bls.gov

Michael J. Rieley is an economist in the Office of Occupational Statistics and Employment Projections, U.S. Bureau of Labor Statistics.

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To improve pandemic work outcomes for parents, ask when, not where

Cody Parkinson

Efforts to contain the coronavirus disease 2019 (COVID-19) changed where and how people work. For many parents, supervising their children's education occupied at least some portion of their available work time during the day. In "[Parental participation in a pandemic labor market](#)" (*FRBSF Economic Letter*, Federal Reserve Bank of San Francisco, April 5, 2021), Olivia Lofton, Nicolas Petrosky-Nadeau, and Lily Seitelman use differences in when and where someone can work, particularly regarding parents, to examine gender gaps in labor market outcomes.

The authors use Current Population Survey microdata on prime-age workers (ages 25 to 54) from the U.S. Bureau of Labor Statistics (BLS) to assess how much parents contributed to the widening labor market gaps among men and women during COVID-19. By midsummer 2020, both men and women had recovered about half the initial declines in labor force participation caused by COVID-19. From July 2020 through December 2020, the labor force participation rate for men remained about 1.0 percentage point lower than prepandemic levels, versus 2.2 percentage points lower for women. Mothers accounted for nearly three-fourths of the 2.2-percentage-point decline in the labor force participation rate for women, while fathers accounted for one-third of the decline for men. About 700,000 additional prime-age mothers would have participated in the labor force at the end of the year had their recovery been like that of women who are not mothers.

Lofton, Petrosky-Nadeau, and Seitelman then looked at labor force participation for men and women by household income. After they split the households into three groups based on income (less than \$50,000; \$50,000–\$99,999; and \$100,000 or more), the authors found that mothers with an annual household income less than \$50,000 exited the labor force at four times the rate of mothers in households making \$100,000 or more. From February 2020 to December 2020, labor force participation declined nearly 9 percent for mothers with a household income less than \$50,000. Fathers had smaller labor force participation declines than mothers across all three income groups.

Finally, the authors examined BLS occupational data relating to telework and work schedule flexibility. Changes in the ratio of mothers' employment to women's employment for various occupation groups were compared with the share of jobs with flexible hours. The data showed that flexibility in work schedules, rather than the ability to work from home, offset some of the employment decreases caused by the pandemic. For example, the ratio of mothers' to women's employment in management occupations (an occupational group with more flexible hours) did not change substantially during the pandemic. Education occupations, with more fixed schedules, saw the ratio decline.

Lofton, Petrosky-Nadeau, and Seitelman's research shows that during the COVID-19 pandemic, nonparent men and women had similar labor market dynamics through December 2020. Fathers fared better than other groups, while mothers generally experienced a slower labor market recovery. A solution to the disparity may be flexible

work hours rather than flexible work locations. If the slow labor force recovery of mothers persists, there could be long lasting repercussions, such as lower earnings potential, a permanent change in household behavioral adaptations, or changes to future labor force participation decisions made by parents.

OCTOBER 2021

The effects of unemployment insurance benefits on U.S. employment

[Lawrence H. Leith](#)

Ever since the federal–state unemployment insurance (UI) system was created, in 1935, economists have debated the program’s effects on aggregate employment. Because the UI system is administered by the states—with financial support from the federal government—the benefits vary somewhat from state to state. Still, most states provide up to 26 weeks of UI benefits, with qualified workers receiving, on average, about half the amount they earned before they lost their jobs. Do these benefits effectively discourage people from working and thus tend to reduce overall employment? In a recent article entitled, “[Unemployment insurance generosity and aggregate employment](#)” (*American Economic Journal: Economic Policy*, May 2021), economists Christopher Boone, Arindrajit Dube, Lucas Goodman, and Ethan Kaplan examine this question and reach some interesting conclusions.

During the Great Recession of 2007–09 and its aftermath, most states extended UI benefits beyond the standard 26 weeks to 99 weeks. In fact, from November 2009 to March 2012, the maximum duration of benefits averaged more than 90 weeks across all states. By contrast, during the 2001 recession, when the benefits period was also extended, the average was only about 40 weeks. Yet, some states did not extend the period of UI benefits during the Great Recession. These contrasting policies among some neighboring states provide a unique opportunity to compare the two approaches and their respective effects on aggregate employment.

Boone and his coauthors analyze county-level employment data from the U.S. Bureau of Labor Statistics from late 2007 to the end of 2014, a period that includes the Great Recession and the 5.5 years that followed it. Their results show that in the states that implemented them, the UI extensions had negligible effects on employment in those states. The authors’ findings show that, at worst, the extensions reduced employment slightly and, at best, they increased employment in those localities. More specifically, they found that the change in the employment-to-population ratio in the United States ranged from an increase of less than 0.2 percentage points to a decline of less than 0.3 percentage points, neither of which is a statistically significant change. In other words, the UI extensions had virtually no impact on employment, positive or negative.

Although a large body of scholarly work exists that examines the effects of increasing the length of UI benefits on the labor supply, the authors of this study argue that few studies have focused on employment, per se. Yet, as they explain, the effect that extending UI benefits has on employment is an important public policy issue. If the positive effects of extending UI benefits, in terms of increased demand, outweigh the negative effects on employment, then the policy is warranted. This study persuasively argues that employment is little affected, either positively or negatively, and thus UI benefits extensions make good public policy: aggregate demand increases, employment is largely unaffected, and workers who have lost their jobs are better able to endure the effects of economic downturns without major disruptions to their lives and those of their families.

BOOK REVIEW

OCTOBER 2021

When Big Brother gets smart

Too Smart: How Digital Capitalism is Extracting Data, Controlling Our Lives, and Taking Over the World. By Jathan Sadowski. Cambridge, MA: The MIT Press, 2020, 194 pp., \$22.95 paperback.

This book by Jathan Sadowski examines the social and economic implications of smart tech and warns that even the most mundane technology in our cities and homes collects private data that can be used to our disadvantage. Sadowski's descriptions dance between reality and potentiality, illustrating how this predicament already affects the most disadvantaged people in our society and alluding to even worse consequences for a wider swath of people going forward. The analysis considers the interactions between certain aspects of smart-tech innovation and the various scales at which it occurs in order to build 10 theses about the design, effects, beginning, and implications of digital capitalism. Sadowski ends the book by recognizing that his stories may seem hyperbolic, but he assures the reader that they occur in our daily lives. He suggests that although the benefits and costs of smart tech are not evenly distributed, its users can help reshape the system by "deconstructing capital, democratizing innovation, and demanding data."

Sadowski breaks the objectives of smart-tech innovation into three aspects: interests, imperatives, and impacts. The architects of any technology have certain objectives in mind, and they build their smart devices to serve their own interests and bottom lines. The traditional market-clearing actions of consumers and producers are too streamlined to accurately describe the relationship between tech companies and the users of their technologies. Instead, argues Sadowski, the secondary market for consumer data must be considered. The interests of tech producers involve not only maximizing profits, but also maximizing the scope and volume of data that they can collect. Consumers are no longer just end users of smart devices, but by using them, they generate data that producers can harvest to increase profits, either by selling those data to a third party or by using them themselves.

A tech producer's interest in maximizing both data and profit leads directly to the imperatives of smart tech. The first imperative is collection, driving tech companies to extract "all data, from all sources, by any means possible." The second is control, whereby tech companies use the information gleaned from their collection activities to "monitor, manage, and manipulate the world and its people." Once again, the one-directional relationship between smart-tech producers and consumers breaks down when the data collected by the former are harnessed for their benefit. The data amassed by producers about consumers can be used to advertise to them, to influence their behavior, to predict their future actions, and to reward them for expected behaviors.

The imperatives of data collection and control dictate a design of smart-tech systems that furthers the interests of producers, while frequently neglecting the impact on the users of such systems. Sadowski

gives many examples of the potentially negative consequences of using smart technology. His examples include the following:

- An electronically controlled entrance gate to a fancy apartment building that regularly malfunctions, leaving tenants stranded in the rain.
- A leased smart vehicle on the highway whose engine suddenly shuts off and steering wheel locks up because the vehicle has been remotely repossessed.
- Handheld scanners that, by calculating the speed with which warehouse pickers complete high-demand tasks, determine a worker's pay and place within the workforce.

The impact of smart tech can be small and easily ignored, as would be the case, for example, when an advertisement for shoes targets people who talked about needing new running shoes in proximity to their cell phones. But the impact can also be significant and beyond the control of the people it affects. One example given in the book is a case in which the city of New Orleans quietly installed Palantir, a smart policing system that monitors people's movements, payments, interactions, and social media presence, drawing connections between their activities. This system makes it possible for the police to access information not just about criminals but also about the everyday lives of law-abiding citizens.

The application of smart tech happens on several scales, which Sadowski terms the smart self, the smart home, and the smart city. Each of these scales involves stated benefits and hidden costs to citizens. For instance, a fitness tracker collects an individual's health statistics and progress toward a health goal, but these data may be used by healthcare providers to determine health insurance premiums and coverage. Likewise, a home's smart thermostat records the living-room or bedroom temperature desired by a family, but it also monitors electric load statistics that a utility company may consider in determining when to charge more for energy use. And finally, a smart city's cameras might record the perpetrator of a crime running from the crime scene, but the city's police force might install cameras more frequently in economically disadvantaged communities, skewing the crime statistics it collects. In each of these cases, a smart system's stated objective is to ostensibly benefit the smart self, the smart home, or the smart city, but it also has the less obvious objective of furthering the interests of the designer or secondary user of the data gleaned from that system.

By considering whose interests are reflected in the collection and control of user data—and what impact that has on society as more people, homes, and cities become “smart”—Sadowski outlines his 10 theses of digital capitalism. The first three theses deal with how society is shaping smart tech while also being shaped by it. The hawkers of interconnected things bring with them all the assumptions and power dynamics that come with their positions in a given society, thereby “maintaining the same essential features of exclusion, extraction, and exploitation” inherent in that society. Sadowski argues that the capitalistic instincts of the tangible world are being programmed into the digital world because the architects of both worlds are essentially the same. He suggests that when we think about smart tech, we should conjure in our minds not just fitness wristbands but also surveillance systems and location trackers. Then we should think not just about the companies creating those technologies and collecting data from them, but also about the people whose information is being collected and how their lives might be affected when they relinquish control of that information.

Sadowski's fourth, fifth, and sixth theses attempt to set a new standard for how we think about the extraction of our data. First, collecting data from consumers whenever they participate in the market should be regulated. Data about an individual should be that person's property rather than the property of a large corporation. Second, the extraction of personal information from its rightful owner for use against him or her should be unacceptable. Distilling a person down to a few statistics nullifies that person and can have adverse individual consequences. Third, digital platforms currently operate like landlords,

leasing access to our own information while profiting from that control in the market for that information. Some companies construct smart objects that are difficult to use without a subscription to the software that controls them, thereby maintaining partial ownership of those objects.

The seventh thesis pinpoints the moment when digital capitalism began supplanting physical capital and financial markets as the drivers of the economy. The Great Recession of 2007–09 redirected investments from real estate and tangible goods toward smart-tech companies and service-based digital platforms, rearranging markets and market power.

In the last three theses, Sadowski outlines how the objectives of smart-tech companies have constricted what we think is possible in the future. This has been achieved by shaping the language of tech to be “solution-based” and by making smart tech the solution to every problem, whether or not that problem previously existed. The companies’ vision of a connected society that uses smart tech to achieve ever greater efficiency becomes deterministic and seemingly inevitable. Sadowski’s last thesis admits that no one person’s actions can confront this digital predicament and widen the possibilities for the future. Only through collective action can citizens regain control of their own digital lives and expand the scope of options for the next era.

Finally, while acknowledging that his chosen examples of digital tech are extreme, Sadowski makes the case for why and how our society should demand better from our smart selves, smart homes, and smart cities. He argues that the problem is not with innovation itself, but with allowing it to negatively affect our welfare. He encourages collective innovation from workers and users of smart tech, rather than top-down production requirements. To make technological development more democratic, workers, who are an “untapped well of novel ideas and possess the skills needed to organize production for socially useful outcomes,” could be involved in the selection, design, production, and distribution of the smart tech brought to market. Lastly, by demanding oversight of how data are collected, stored, and used, governments can regulate large tech companies and the ways in which they use collected data. Sadowski suggests that personal information should be treated and protected as private property, and the ability to opt out of its collection should not preclude smart-tech users from participating in the market.

Too Smart was a difficult read, not because of the prose (Sadowski’s examples are well articulated and breathe life into the topic) but because so much of my life is already enmeshed in the digital wires described in the book. My phone, alarm system, car, computers, and city are all collecting my personal data, and this situation seems far too complex to solve or escape. I recommend this book to anyone who wants a more clear-eyed view of how our interconnected version of modernity might not be as benevolent as it is presumed to be at the annual Consumer Electronics Show.



TOO SMART

HOW DIGITAL CAPITALISM IS
EXTRACTING DATA, CONTROLLING OUR
LIVES, AND TAKING OVER THE WORLD
JATHAN SADOWSKI

ABOUT THE REVIEWER

Victoria Battista

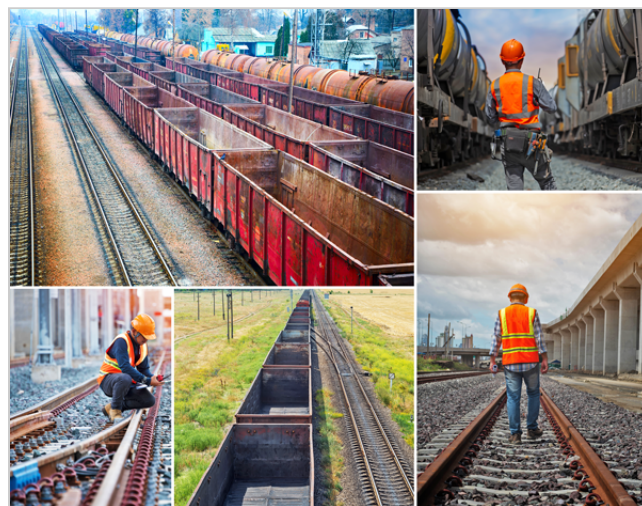
battista.victoria@bls.gov

Victoria Battista is a senior economist in the Office of Employment and Unemployment Statistics, U.S. Bureau of Labor Statistics.

Employment in rail transportation heads downhill between November 2018 and December 2020

This article examines recent employment declines in rail transportation, a small but important component of the transportation and warehousing industry. Although employment in rail transportation remained relatively stable for most of the past 25 years, it declined by 40,000 jobs from November 2018 to December 2020. This article provides an analysis of the recent employment declines in the rail transportation industry.

After remaining stable for over two decades, employment in the rail transportation industry began to decrease in November 2018, according to data from the U.S. Bureau of Labor Statistics Current Employment Statistics (CES) survey.^[1] By December 2020, the industry had lost 40,000 jobs. (See chart 1.) Many sources, including both the public media and rail industry experts, attributed the beginning of the industry's employment losses to three main factors: the decline of the reliance on coal as a natural resource, an uncertain trade environment, and a new method of operations adopted by railroads called Precision Scheduled Railroading (PSR). In addition, a fourth factor, the coronavirus disease 2019 (COVID-19) pandemic, further exacerbated job losses in the industry.

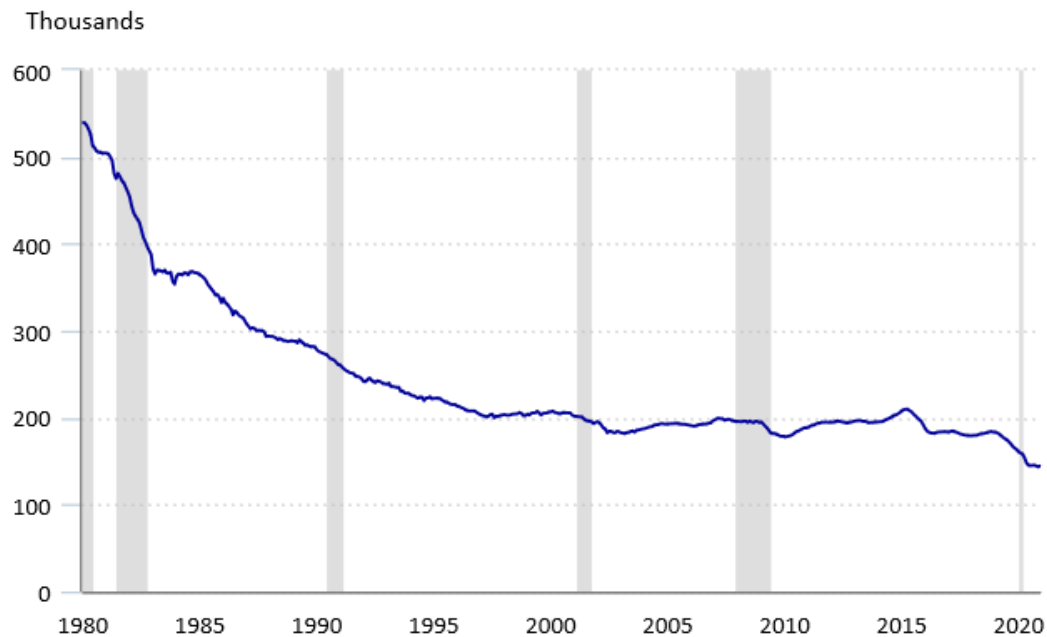


Ryan Ansell

CESinfo@bls.gov

Ryan Ansell is an economist in the Office of Employment and Unemployment Statistics, U.S. Bureau of Labor Statistics.

Chart 1. Employment in rail transportation, January 1980–December 2020, seasonally adjusted



Click legend items to change data display. Hover over chart to view data.
Shaded areas represent recessions as determined by the National Bureau of Economic Research.
Source: U.S. Bureau of Labor Statistics.

Within the transportation and warehousing industry, rail transportation is one of the smallest component industries, in terms of employment. In fact, rail transportation made up only 3 percent of transportation and warehousing employment as of November 2018, but the industry accounted for 33 percent of the 121,000 jobs lost between November 2018 and December 2020. (See table 1 and chart 2.) Employment in rail transportation declined consistently throughout 2019 and into the beginning of 2020, accelerated in April and May of that year, and then leveled off through December.

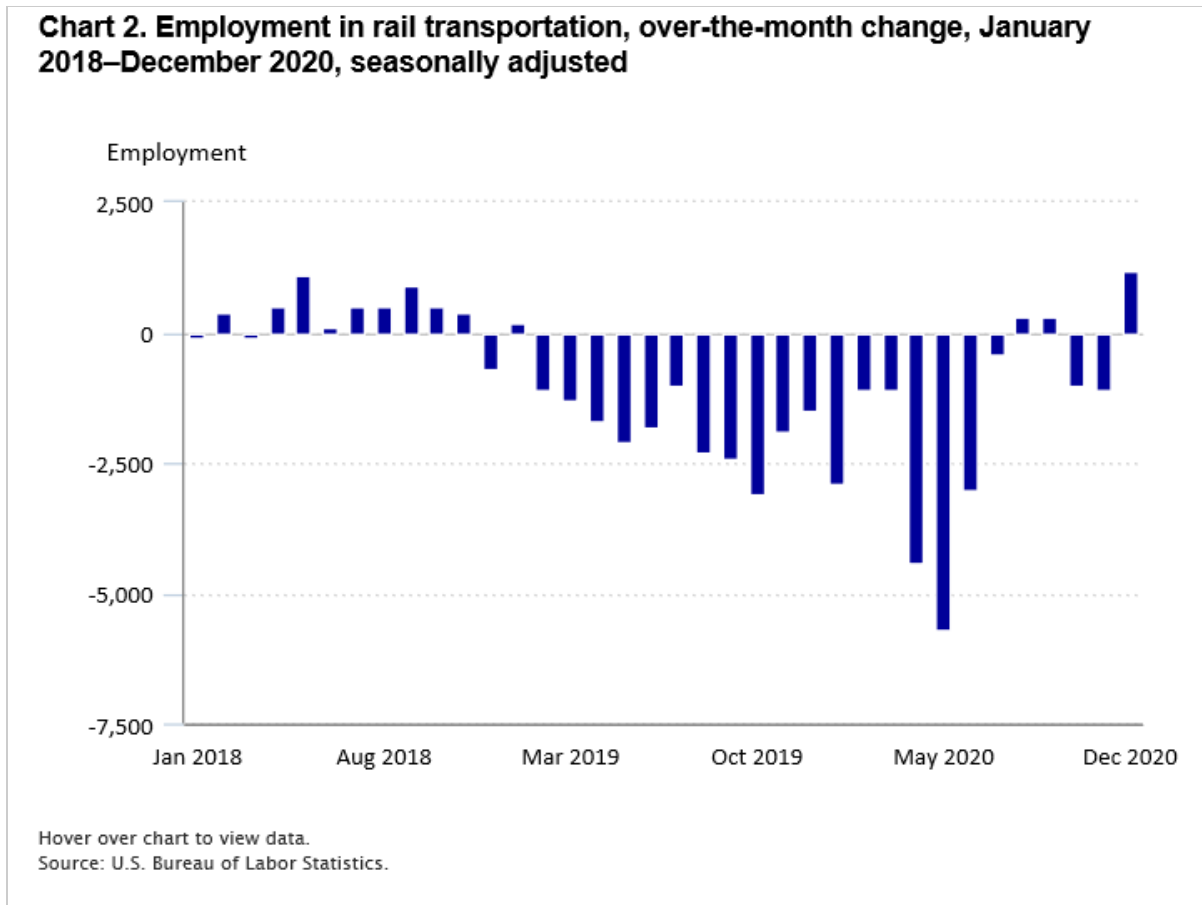
Table 1. Industry composition of transportation and warehousing, November 2018

Section	Percent
Air transportation	8.9
Rail transportation	3.3
Water transportation	1.2
Truck transportation	27.3
Transit and ground passenger transportation	8.9
Pipeline transportation	0.9
Scenic and sightseeing transportation	0.6
Support activities for transportation	13.5
Couriers and messengers	14.1
Warehousing and storage	21.1

Note: Values do not sum to 100 due to rounding.

See footnotes at end of table.

Source: U.S. Bureau of Labor Statistics.



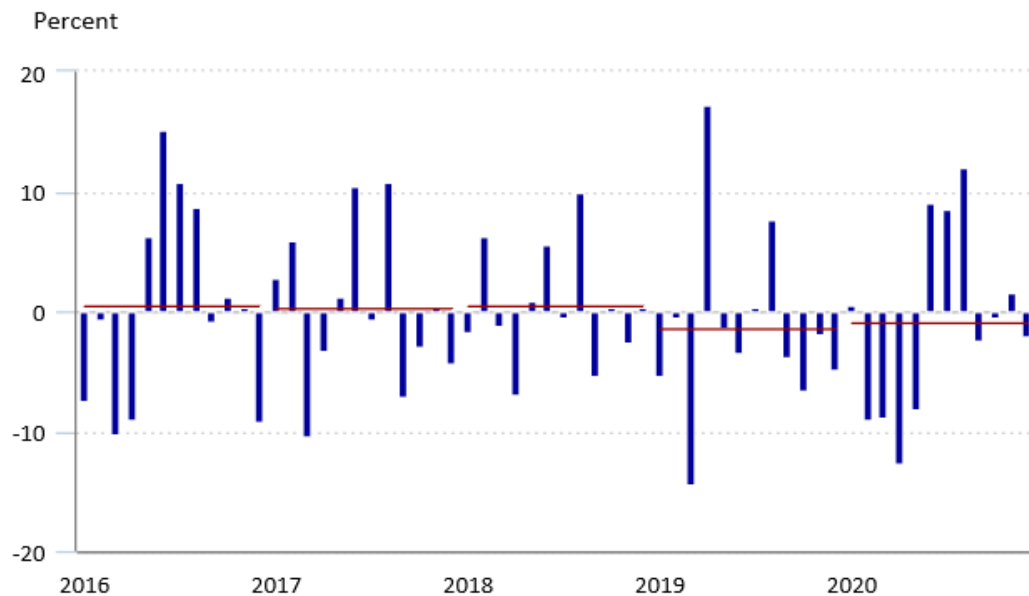
The decline of coal

In 2019, U.S. railroads moved 4 million carloads of coal, with each carrying enough coal to power 19 homes for an entire year. Five states accounted for approximately 71 percent of U.S. coal production in 2019, despite coal being consumed all over the country.^[2] However, because of recent advances in natural gas extraction and the increased use of renewable resources to generate electricity, the United States is becoming less reliant on coal as an energy source.^[3] In fact, the movement of millions of coal carloads in 2019 actually represented a decline of 405,000, or 9.2 percent, over the year. According to Association of American Railroads (AAR) Vice President John T. Gray, the number of coal carloads in 2019 were the lowest they had been in decades.^[4] With the United States relying less on coal, the demand for rail cars that transport coal decreases. In turn, there is a decrease in the need for rail cars overall, as well as the need for employees to work on the railroads.

In 2020, the COVID-19 pandemic added to the decline in the use of coal, as business closures, shelter-in-place mandates, and generally low demand from the public weakened the overall economy. In addition, cheap natural gas prices prompted the increased use of natural gas instead of coal to generate electricity, deepening the decline in the number of coal carloads further. As of April 25, 2020, when the tightest of COVID-19 restrictions across the United States were still in effect, coal was down 21.4 percent over the year.^[5] As shown in chart 3, the decline

accelerated in the beginning of 2020.^[6] In fact, the 2-month period (April and May 2020) in which the largest percentage declines in the number of coal carloads occurred corresponded with the rail industry's largest over-the-month declines in employment. In addition, once the country began to reopen in the summer, the number of coal carloads began to increase and rail employment returned to smaller monthly declines. Although coal carloads do not correlate with rail employment on a month-by-month basis, it is evident that reductions in coal carloads have a negative influence on rail employment.

Chart 3. Over-the-month percent change in number of coal carloads, January 2016–December 2020



Hover over chart to view data.

Note: Over-the-month percent changes were calculated by comparing the weekly average number of coal carloads from one month to the next. March and April 2019 data probably reflect the impacts of historic flooding in the Midwest.
Source: Association of American Railroads.

An uncertain trade environment

Businesses strive to make efficient use of their time, money, and other resources, and changes in the demand for rail transportation and impacts on their revenues as a result of trade uncertainties can impact the industry's employment. Rail freight volumes and movement—how often trains are moving freight from one point to another—have recently been reduced by an uncertain trade environment involving the negotiations of the United States-Mexico-Canada Agreement (USMCA) and trade relations between the United States and China. According to AAR economist Luisa Fernandez-Willey, trade uncertainty and tariffs had a strong negative effect on the rail transportation industry in 2019, as 42 percent of rail carloads and intermodal units (units using two modes of freight, such as truck and rail, to transport goods) and 35 percent of annual rail revenue are associated with international trade.^[7] In addition, about 50,000 jobs, worth over \$5.5 billion in annual wages and benefits, also

depend on international trade.[8] The relationship between rail carloads and international trade is strongly tied to employment, as fewer carloads and lower revenue tied to international trade mean a reduced need for workers.

Even general uncertainty resulting from the United States' trade relationships with other countries can lead to the hesitance of firms to hire, and thus the USMCA and trade relations with China have been widely referenced in analyzing rail employment declines in 2019. Fernandez-Willey noted that clarity on trade would be vital for the rail industry to recover in 2020, stating that the ratification of the USMCA and the resolution of disputes with China would be the key factors to achieving this clarity.[9]

In 2019, uncertainty that is due to the ongoing disputes between the United States and China lowered demand for companies that move freight, especially within the agriculture and manufacturing industries.[10] These disputes included the United States and China imposing tariffs on hundreds of billions of dollars of each other's goods. Tensions ran especially high in 2019, with the two countries spending the last few months of the year threatening to impose new tariffs and increase existing tariffs against one another.[11] Uncertainty appeared to grow out of the USMCA's delayed ratification as well, with the final outcome of the agreement relatively unclear for most of the year. In December 2019, the U.S. House of Representatives passed the USMCA, which established key policy changes.[12]

In January 2020, it appeared trade uncertainty and its negative effect on rail employment may have started to fade once a phase-one trade deal with China was established and the USMCA was signed into law.[13] However, the positive outlook for trade and rail employment did not last long into 2020, once the COVID-19 pandemic began. Global trade and shipment volumes were disrupted throughout the year, as people across the world stayed at home and quarantined in an effort to contain the virus. The Cass Freight Index for April 2020, released at the height of the U.S. stay-at-home orders, is particularly revealing, as it reported that shipment volumes dropped 22.7 percent and freight expenditures fell 18.2 percent year-over-year in North America.[14] The COVID-19 recession appears to have held back improvements to trade uncertainty, as little has changed regarding U.S. trade relations with China since the start of the pandemic.[15] Recessions are also typically characterized by a surge in trade disputes and a slowdown in trade negotiations, as rising unemployment heightens uncertainty.[16]

Precision Scheduled Railroading

Precision Scheduled Railroading (PSR), is a railroad strategy that uses departure schedules and point-to-point delivery methods to achieve low operating ratios (how much a company needs to spend to make a dollar) and consolidate railroad networks (the elimination of shorter, less efficient lanes in favor of high-volume lanes).[17] PSR may be the most widely accredited reason for the decrease in rail transportation employment. Before PSR was implemented, the North American rail model, which includes the United States and Canada, focused on moving long trains with a single good in order to maximize capacity and yield the greatest efficiency. However, this model was actually slowing down the rail network because trains would be late or canceled if they did not meet specific length requirements, thus leaving customers unexpectedly without service. With the implementation of PSR, the focus shifted to moving cars with mixed goods, so that the trains are always moving and cars are picked up on schedule, regardless of train length. Despite lower length requirements, average train length increased because railroad companies were no longer discouraged from transporting multiple types of goods in a single train.

As a result of PSR, there is now more efficient timing and scheduling, as well as an effective allocation of resources, such as crews, cars, and locomotives, in the places where they are needed on the rail network.[\[18\]](#)

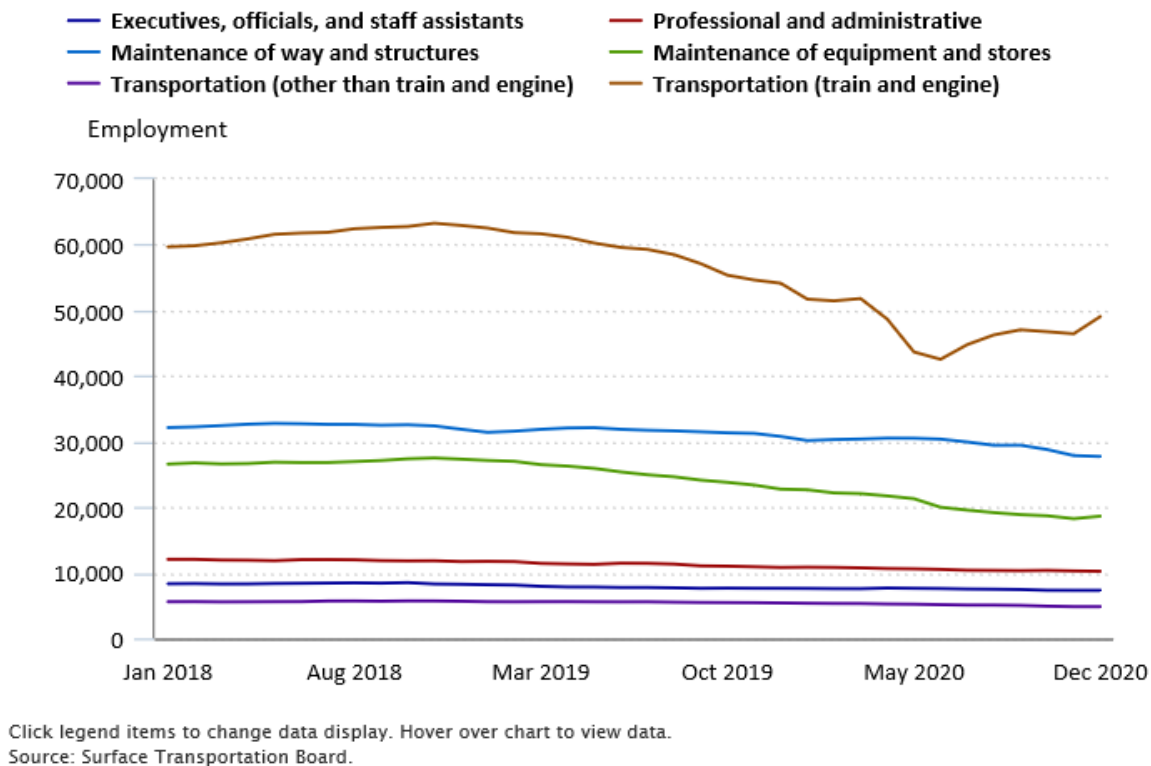
North American railroads are divided by revenue into different classes. Class I railroads are the largest, and have an annual operating revenue of at least \$447,621,226, while Class II railroads are known as regional railroads and Class III railroads are known as short-line railroads.[\[19\]](#) The practice of furloughing employees is rather common within the rail industry and usually depends on the volume of freight at a given point in time. After Class I railroads adopted PSR, furloughs and layoffs in the industry increased. Rail companies, including Norfolk Southern and Union Pacific, have stated explicitly that they have furloughed or closed down certain operations because of PSR.[\[20\]](#) Industry officials seem to hail the new efficiency PSR has brought to the railroads, while union leaders have responded negatively because of its effect on employees. One article noted that reduced staffing is made possible by running longer trains, as hitching two trains together allows one rail work crew to be cut. This coincides with a 25-percent increase in the average train length (1.4 miles) since 2008. In addition, according to rail economist Jim Blaze, seven major freight railroads idled nearly 30 percent of locomotives in 2019 alone, as they aim to run fewer and longer trains.[\[21\]](#)

The North American Class I railroads that have adopted PSR as part of their operations include Canadian National Railway, Canadian Pacific Railway Limited, CSX Corporation, Norfolk Southern Corporation, Union Pacific Corporation, and Kansas City Southern.[\[22\]](#) The Surface Transportation Board (STB) regulates North American Class I railroads inside the United States and collects monthly data on employment and occupational composition. These data can be used to show changes in the occupational composition of some of the railroads that have implemented PSR, while CES rail transportation employment data are not broken down by the specific type of job in which the workers perform. The STB breaks down the employment data into the following occupational classifications:

- Executives, officials, and staff assistants
- Professional and administrative
- Maintenance of way and structures
- Maintenance of equipment and stores
- Transportation (other than train and engine)
- Transportation (train and engine)

Thus, the STB data show where, in terms of types of jobs, losses are occurring in the rail industry in a way that CES data do not. Chart 4 displays each of the STB's occupational classifications and their employment since January 2018, showing little change from January 2018 to November 2018, as well as the changes in trend over the period from November 2018 to December 2020.[\[23\]](#)

Chart 4. Employment in North American Class I rail transportation, by occupational group, January 2018–December 2020



The STB data show that the greatest job losses occurred in the occupational groups most directly involved with the actual operation and maintenance of trains on the railroads. Out of the 31,000 jobs lost estimated by the STB, transportation (train and engine) accounted for 46 percent of the losses from November 2018 to December 2020, despite representing less than 43 percent of all railroad jobs in November 2018. At the same time, maintenance of equipment and stores jobs accounted for more than a quarter of the losses, despite being less than a fifth of all employment in November 2018. In contrast, the other classifications each contributed between 3 and 15 percent of the job losses over the same period. Although PSR appears to have altered the hiring and layoff decisions of rail establishments over the period, employment in rail transportation began to flatten in the second half of 2020, indicating that railroads may have balanced out their employment levels with the new scheduling method.

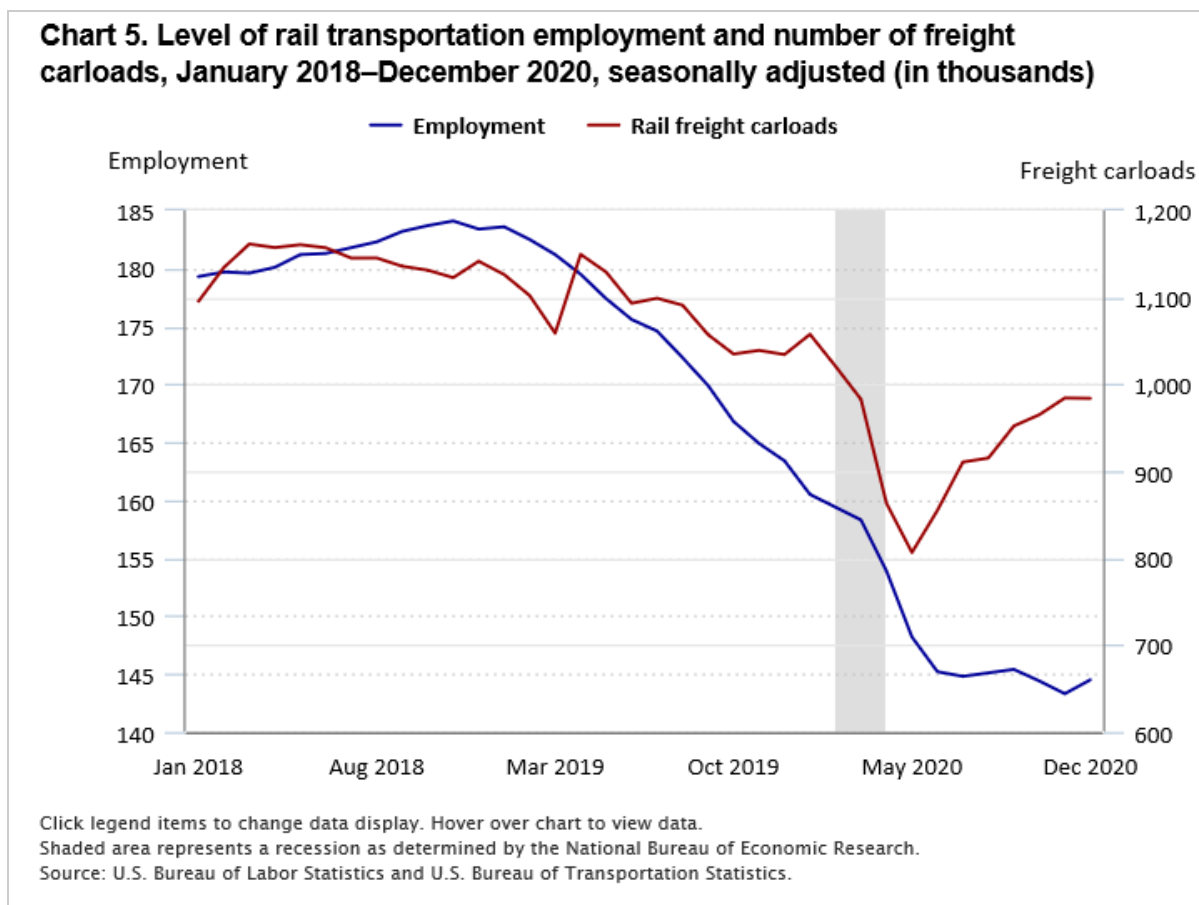
Coronavirus delivers deeper losses

COVID-19 is discussed earlier in this article because the disease coincided and interacted with the other factors associated with the recent decline of employment in rail transportation. However, the COVID-19 pandemic itself can be viewed as a fourth factor contributing to the decline of employment in rail transportation.

A national emergency regarding COVID-19 was declared on March 13, 2020, as the virus began to rapidly spread throughout the United States. On March 15, the Centers for Disease Control and Prevention discouraged gatherings of 50 or more people over the next 8 weeks, prompting many business and school closures in a public health effort to slow the spread of the disease. By March 26, the United States led the world in confirmed coronavirus cases.^[24] As of April 20, over 316 million Americans in at least 42 states were being urged to stay

home.[25] COVID-19-related business closures during this period caused millions of Americans to lose their jobs, and the rail transportation industry was no exception.[26] Employment in rail transportation experienced two large monthly declines during the early months of the pandemic—April and May 2020—for a combined loss of 10,000 jobs. This accounts for a quarter of the 40,000 rail transportation jobs lost from November 2018 to December 2020, suggesting that the effects of the pandemic had a considerable impact on employment.

Chart 5 displays employment in rail transportation and the number of rail freight carloads over the period from January 2018 to December 2020.[27] The two series moved similarly during April and May 2020, at the height of COVID-19 pandemic restrictions and business closures. In fact, both employment in rail transportation and rail freight carloads experienced notable contractions during those 2 months. However, the two series have diverged since May 2020. After declining since January 2020, the number of rail freight carloads began to increase again in May, which may be a result of the easing of state restrictions and businesses reopening in some capacity amid the pandemic. Despite the continuing spread of the virus, every state had begun to at least partially reopen businesses by the end of May.[28] From June to December, employment in rail transportation began to level off, while the volume of rail freight carloads continued to recover.



In addition, news sources also recognized the negative effects of COVID-19 on railroads, stating that the shelter-in-place mandates in April and May caused rail volume to be slashed. The COVID-19 pandemic had been

predicted to result in a reduction in U.S. imports, translating into less volume on the railroads.[29] As a result, Class I railroads had to deal with reduced demand by temporarily shutting down facilities with less rail traffic.[30]

In August, a *FreightWaves* article stated that the STB and the Federal Railroad Administration, who are responsible for enabling safe, reliable, and efficient movement of people and goods, had asked the Class I railroads to resolve service issues that had arisen during the pandemic as a result of crew availability issues. At the same time, labor unions questioned the railroads companies' furlough practices, stating that some recalled furloughed employees were being sidelined for a second time.[31] This information suggests that railroads may have hired back workers earlier than they were needed, which may explain the deceleration of rail transportation employment losses towards the end of 2020. However, the pandemic is not over. New variants of COVID-19 could place further stress on the global economy and could make firms' decisions regarding employment in the near future more uncertain.[32]

Summary

Rail transportation employment may be one of the smallest components of transportation and warehousing, but recent job losses have been substantial, with the industry losing 40,000 jobs from November 2018 to December 2020. Rail industry experts and the public media speculate that the three main reasons for the job losses were the United States' decreased reliance on coal as a resource, an uncertain trade environment, and PSR—a new method of scheduling operations. The COVID-19 pandemic compounded these factors and affected rail transportation employment as a fourth factor. These factors suggest that some of these job losses may be permanent. Although we can acknowledge what led to the large declines in rail transportation employment over this period, the future of the industry's employment remains uncertain.

SUGGESTED CITATION

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NOTES

¹ The CES program, which provides detailed industry data on employment, hours, and earnings of workers on nonfarm payrolls, is a monthly survey of about 144,000 businesses and government agencies representing approximately 697,000 individual worksites. For more information on the program's concepts and methodology, see "Technical notes for the Current Employment Statistics survey," *Current Employment Statistics—CES (national)* (U.S. Bureau of Labor Statistics), <https://www.bls.gov/web/empsit/cestn.htm>. To access CES data, see <https://www.bls.gov/ces/>. The CES data used in this article are seasonally adjusted unless otherwise noted. Employment in the rail industry consists of jobs relating to the transportation of passengers and cargo using railroad rolling stock. The railroads within the industry either operate on networks, over an extensive geographic area, or over a short distance on a local rail line. Scenic and sightseeing rail transportation and street railroads, commuter rail, and rapid transit are not included in the rail transportation industry. See "Sector 48-49—Transportation and Warehousing," *2017 NAICS definition* (U.S. Census Bureau), <https://www.census.gov/naics/?input=482&year=2017&details=482>.

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Can STARs shine without a college degree?

Eleni X. Karageorge

Workers often referred to as “unskilled” (individuals with high school diplomas, but not bachelor’s degrees) experience a fundamentally different wage trajectory than do workers with bachelor’s degrees. In [“Skills, degrees, and labor market inequality”](#) (National Bureau of Economic Research, Working Paper 28991, July 2021), authors Peter Q. Blair, Papia Debroy, and Justin Heck show how differing wage outcomes over a worker’s career can be explained by an opportunity gap between those with and without degrees. This opportunity gap suggests that access to higher paying jobs often depends less on the skills or experience of workers and more on if they attended college. The researchers argue that these so-called unskilled workers are not unskilled but are “skilled through alternative routes” or “STARs” because they may have gained skills through their work experience, such as on-the-job training and military service, or through a certification program.

The authors find that both those with a bachelor’s degree and those who are STARs have little trouble transitioning between jobs in which the skill requirements are alike. Whether you are a construction worker or an attorney, finding a job doing the same work somewhere else is not hard. However, if a worker wants to transition into a job that pays more and requires a different skill, this move upward usually requires a college degree. Workers with bachelor’s degrees are far more likely than STARs to be able to make that kind of upward jump. Although both groups of workers can get new jobs at similar skill levels as their previous jobs, STARs experience more difficulty transitioning to higher paid work.

The authors say that this opportunity gap in obtaining higher paying jobs may explain income inequality by degree status. This gap does not appear to be driven by differences in knowledge, experience, or skills acquired in college. Instead, this gap is driven by the lack of access experienced by STARs, which slows their movement to higher wage jobs.

In order to find evidence of the financial ramifications of the opportunity gap, the researchers looked at wages among STARs and college graduates for a group of Americans who were 25 years old in 1989. Workers with only high school diplomas were 55 years old before they earned as much as the college graduates did at age 25, when they were beginning their careers. In other words, STARs needed 30 years of work experience to earn as much as their peers with 4-year degrees earned just out of college.

The authors suggest that the wage and upward mobility opportunities that come with a 4-year degree are not tied to what someone learns in college. Instead, those rewards appear to be tied to having earned the degree. This result shows that employers who hire people for better jobs simply prefer hiring people with college degrees. The college degree versus no college degree opportunity gap appears to be the result of an inherent preference for employers to hire workers who have a bachelor’s degree.

According to the authors, degree requirements have become a convenient way for employers to sort through job applicants, since employers view college education as a sign of a worker's potential. A majority of employers surveyed from various industries acknowledge that they ignore applications from people without college degrees even if they have the skills and work experience to perform well in the job.

The researchers suggest that a more equitable and practical solution to counteract this college degree bias would be for employers to stop placing so much emphasis on bachelor's degrees as a prerequisite. Instead, employers should open more opportunities, specifically in jobs that pay higher wages, for less-educated workers to learn on the job. Company policy changes may help make these opportunities a reality. The authors suggest possible options such as removing degree requirements and intentionally recruiting and hiring STARs from lower paying jobs both within a company and outside of an organization.