



Updated January 3, 2023

# Introduction to U.S. Economy: Productivity

## What Is Productivity?

Productivity is broadly defined as the ratio of output to inputs. With respect to the economy, productivity measures how efficiently goods and services can be produced by comparing the amount of economic output with the amount of inputs (labor, capital, etc.) used to produce those goods. Policymakers are interested in productivity because productivity growth is generally the most consequential determinant of long-term economic growth and substantive improvements in individual living standards.

## Productivity Measures

There are two prominent measures of economic productivity: labor productivity (also known as output per hour) and multifactor productivity (also known as total factor productivity), both of which are produced by the Bureau of Labor Statistics (BLS).

Labor productivity is defined as the ratio of real (inflation-adjusted) output per labor hour. The most commonly cited measure of labor productivity is for the nonfarm business sector. Nonfarm business sector output is defined as gross domestic product excluding outputs from farms, general government, nonprofit institutions, paid employees of private households, and rental value of owner-occupied dwellings. Estimates of labor productivity, across several sectors and industries, are released quarterly by BLS. Growth in labor productivity depends upon how real output and hours worked change in relation to each other and is an important factor in the overall economy.

Multifactor productivity (MFP) is an alternative measure of productivity that compares real private business sector output to the level of combined inputs (labor and capital) used to produce goods and services. BLS releases estimates of MFP annually.

MFP, unlike labor productivity, differentiates among workers with respect to educational attainment and work experience. Therefore, changes in labor force composition that increase the workers' efficiency (e.g., increased work experience) would not be registered as an increase in MFP, but would be registered as an increase in labor productivity. Likewise, increases in the capital stock would boost labor productivity but not MFP.

## Measurement Complications

Measuring outputs and inputs, and thus productivity, involve challenges. Adjusting nominal output figures for inflation can be complicated, especially during periods of rapid technological progress when the introduction of new products and services and improvements in their quality complicate measuring inflation. Depending on the construction of the price index, estimates of real output may understate or overstate actual real output.

Gaps in the data available to BLS also complicate the measurement of labor inputs. The primary source of labor data only includes figures for total number of employees and average weekly hours of production and nonsupervisory workers. BLS has to estimate the number of hours worked by nonproduction and supervisory workers. Additionally, labor hour data for the self-employed and unpaid family workers must be forecasted from IRS data that lags by about three years.

BLS faces additional challenges when determining the value of capital inputs for MFP. To calculate MFP, BLS uses the total value of the services provided by productive capital in the economy, rather than the amount of physical capital. BLS uses a number of assumptions to first determine the level of productive capital in the economy by applying depreciation schedules to physical capital based on its age. Then BLS must determine the value of the services provided by that level of capital. Estimates of MFP are likely less precise than estimates of labor productivity due to the additional assumptions incorporated into estimating MFP.

## Importance of Productivity Growth

Productivity growth is a primary driver of long-term economic growth and improvements in living standards. As productivity increases, society can produce more goods and services with the same level of resources, which, all else equal, increases incomes and access to goods and services, including additional leisure time.

Policymakers are also interested because government policies, institutions, and the regulatory environment can impact productivity growth. For example, strong and enforceable patent laws likely encourage companies to invest more in research and development, which contributes to productivity growth, because the laws enable companies to profit from their new technologies and products.

## Sources of Productivity Growth

Growth in output per hour of labor can be achieved through three different sources: improvements in the quality of workers (i.e., human capital), increases in the level of physical capital, and technological progress.

### Human Capital

Improvements in the abilities and efficiency of individual workers, often referred to as increases in human capital, allow each individual worker to produce more goods and services per hour, and therefore increase labor productivity. Increases in human capital generally result from increased education, work experience, on-the-job training, and so on.

## Physical Capital

Increases in the level of physical capital (machines, factories, etc.) available to workers also result in productivity growth. Physical capital complements labor, allowing it to produce goods and services faster. The level of physical capital in the economy depends on investment spending on new physical capital and how quickly physical capital is worn out. When investment spending on new capital exceeds the depreciation of old capital, the total amount of physical capital in the economy increases.

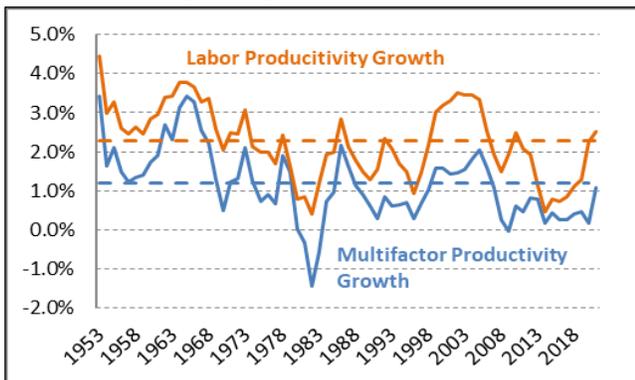
## Technological Progress

Technological progress is potentially the most important and hardest to measure source of productivity growth. Technological progress in this sense is a broad term that includes not only new and more efficient technologies, but also new production processes and organizational structures for companies. The underlying drivers and policies that fuel technological progress can be less obvious than those that fuel improvements in human and physical capital. One source of technological progress is research and development, which economists understand to be one of the main drivers of technological breakthroughs.

## Productivity Slowdown

**Figure 1. Private Business Sector Labor Productivity and Multifactor Productivity Growth**

(Four-Year Moving Average)



**Source:** CRS calculations using data from Bureau of Labor Statistics.

**Notes:** The value for each year represents the four-year average centered on the final year of that period. For example, the value for 2015 represents the average growth rate for the January 2011 to January 2015 period. Orange and Blue dashed lines represent average growth between 1949 and 2021 for output per hour and multifactor productivity, respectively.

In recent years, measures of productivity growth have slowed significantly compared to previous periods in history. As shown in **Figure 1**, average growth rates for both labor productivity and MFP have generally been in decline since the mid-2000s, although average labor productivity has increased somewhat since 2017 and rose above its long-term average in 2021 (although it fell in the first three quarters of 2022). Productivity growth has been fairly volatile in the wake of the COVID-19 pandemic, and it may take several years to parse what effects the crisis had on productivity trends. Output per hour since the end of the Great Recession has grown at an average pace of 1.5% per year (2010-2021). Additionally, MFP has grown at an

average annual rate of 0.53% since the end of the Great Recession (2010-2021). For comparison, the average annual growth rates of labor productivity and multifactor productivity between 1949 and 2021 were 2.3% and 1.2%, respectively, as shown in **Figure 1**.

## Potential Causes

A number of hypotheses have been proposed to explain the recent downturn in productivity growth. Some have argued that the current slowdown is simply a return to 1974-1995 productivity growth rates after significant gains in productivity as a result of the information technology revolution of the 1990s. According to this view, firms reorganized and incorporated these new technologies, resulting in a spike in productivity growth, but now that these technologies have been fully incorporated productivity growth has returned to a slower pace.

Another possible explanation suggests a decline in new technologies and innovations that substantively improve productivity, compared to previous discoveries. For example, the advent of smartphones allows individuals to carry a computer with them at all times, but the productivity gains achieved through this technology are likely smaller than the productivity gains from the widespread availability of the first computers in the workplace. Some observers disagree that innovation is providing smaller gains and instead argue that innovative firms have not been able to scale up to take advantage of their innovations, resulting in lower productivity growth within these firms' sectors. A new wave of discoveries with more direct impacts on productivity could reverse the slowdown; however, the likelihood of this occurring is unknown.

Other observers are more optimistic, suggesting that the current slowdown is a temporary phenomenon resulting from lingering after effects of the financial crisis or the tendency of innovation to come in waves. Still others suggest that there is no productivity slowdown, and rather the changing nature of the economy has rendered productivity measures less accurate. This view contends that the current productivity measures are less able to capture productivity gains from advances in digital goods and services. Issues arise because many goods and services that individuals once paid for are now provided for free through the internet, which affects estimates of total output. For example, free calls through videoconferencing applications may replace long-distance phone service. If a larger share of goods and services is now being provided for free through the internet, output growth may understate gains in wellbeing.

Other explanations for the slowdown in productivity growth include barriers to competition and unequal educational and work opportunities. The slowdown is likely a result of several factors in combination. However, these factors only partially explain some of the concentrated productivity growth slowdown at the industry level.

(Note: This In Focus was originally authored by Jeffrey Stupak, former CRS Analyst in Macroeconomic Policy.)

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