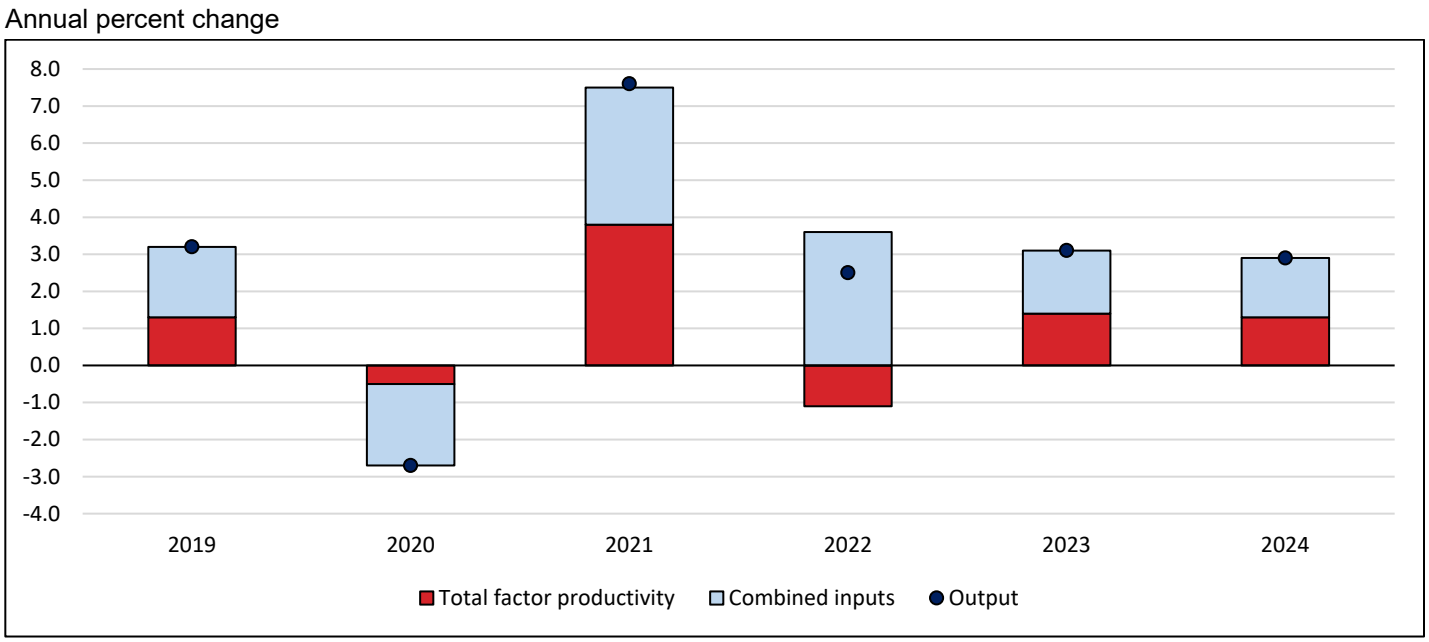
NEWS RELEASE
BUREAU OF LABOR STATISTICS
U. S. DEPARTMENT OF LABOR

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TOTAL FACTOR PRODUCTIVITY – 2024

Total factor productivity (TFP) in the private nonfarm business sector increased 1.3 percent in 2024, the U.S. Bureau of Labor Statistics reported today. (See chart 1, table A.) The 2024 increase in TFP reflects a 2.9-percent increase in output and a 1.6-percent increase in the combined inputs of capital and labor. Capital input grew 2.9 percent and labor input–which is the combined effect of hours worked and labor composition–increased 0.7 percent. The 2024 growth in TFP, output, and combined inputs shows a similar pattern as 2023 and represents 2 years of growth consistent with the pre-COVID-19 year of 2019. (See chart 1.)

Chart 1. Total factor productivity, combined inputs, and output in the private nonfarm business sector, 2019-24



Total factor productivity is calculated by dividing an index of real output by an index of combined units of labor input and capital input. Total factor productivity annual measures differ from BLS quarterly labor productivity (output per hour worked) measures because TFP includes the influences of capital input and shifts in the composition of workers. Measures for the most recent year of this release are preliminary estimates. See the Technical Notes for additional information.

Private business sector total factor productivity also increased 1.3 percent in 2024, as output increased 2.9 percent and combined inputs increased 1.6 percent. (See table A.)

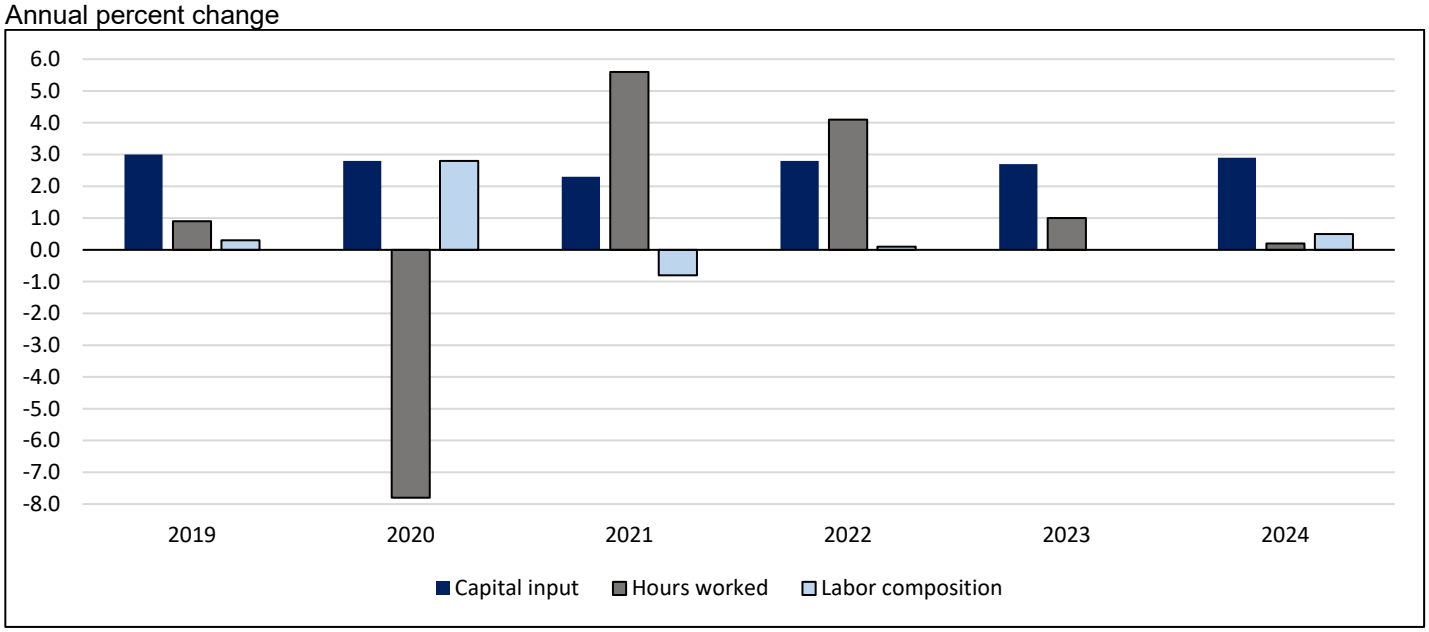
Combined Inputs: 2019-24

Combined input growth is made up of growth in three components: capital input, hours worked, and labor composition. The growth of capital input, which includes equipment, structures, and intellectual property products, decelerated from 3.0 percent in 2019 to 2.3 percent in 2021. Over the past 3 years, capital input has remained relatively consistent, with growth ranging from 2.7 percent to 2.9 percent.

Hours worked has been more volatile over the period, declining 7.8 percent in 2020 and rebounding with 5.6-percent growth in 2021. However, hours growth over the last 3 years has decelerated each year and grew 0.2 percent in 2024.

Labor composition, which estimates the effect of shifts in the age, education, and sex of the workforce, tends to be a relatively stable measure with average annual growth of 0.5 percent over the 1987-2024 period. However, the measure was uncharacteristically volatile during the pandemic and subsequent recovery. Labor composition grew 2.8 percent in 2020 as businesses shed less skilled workers but then declined 0.8 percent the following year as the economy reopened. Over the last 3 years, growth in labor composition has stabilized and grew 0.5 percent in 2024. (See chart 2 and table A.)

Chart 2. Components of combined inputs: capital input, hours worked, and labor composition, 2019-24

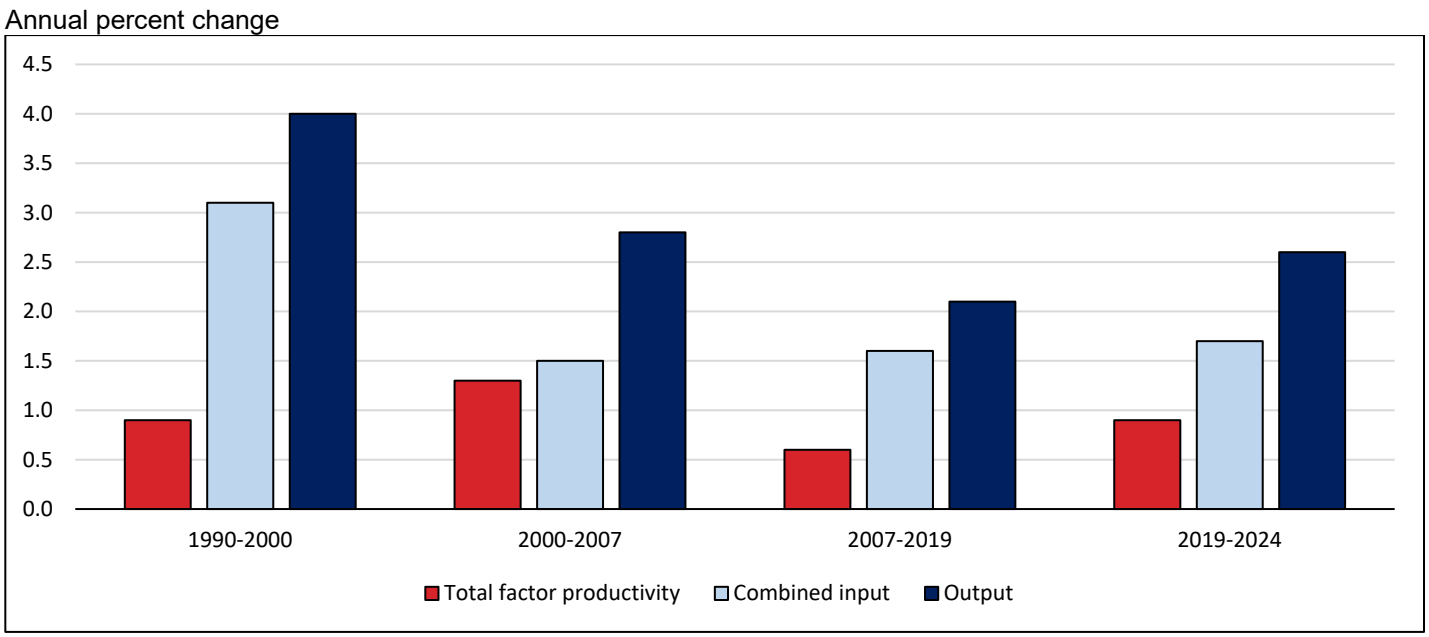


Total Factor Productivity Trends – 1990-2024

Productivity is often viewed as a long-run measure as changes in the production process that lead to productivity growth take time to implement. TFP grew 0.9 percent per year in the private nonfarm business sector in the current 2019-24 business cycle. This growth outpaced the 0.6-percent TFP growth in the previous business cycle which spanned from 2007-19. The growth in output and combined inputs in the 2019-24 period

are also higher than the previous business cycle. (See chart 3 and table A). Although TFP growth in the 1990-2000 period is the same as the current period, output and combined inputs grew significantly faster in the earlier period. TFP grew the fastest during the 2000-07 business cycle, as a 2.8-percent growth in output outpaced a 1.5-percent growth in combined inputs.

Chart 3. Total factor productivity, combined inputs, and output in the private nonfarm business sector, selected time periods



Labor Productivity Trends

Changes in the use of capital and worker skills impact output per hour worked, also known as labor productivity. Labor productivity growth can be approximated as the sum of three components: the contribution of capital intensity, the contribution of labor composition, and the remaining gains that are attributed to total factor productivity. In 2024, private nonfarm business labor productivity increased 2.7 percent, the largest annual growth since 2004 that did not immediately follow an economic recession. (See chart 4 and table B.)

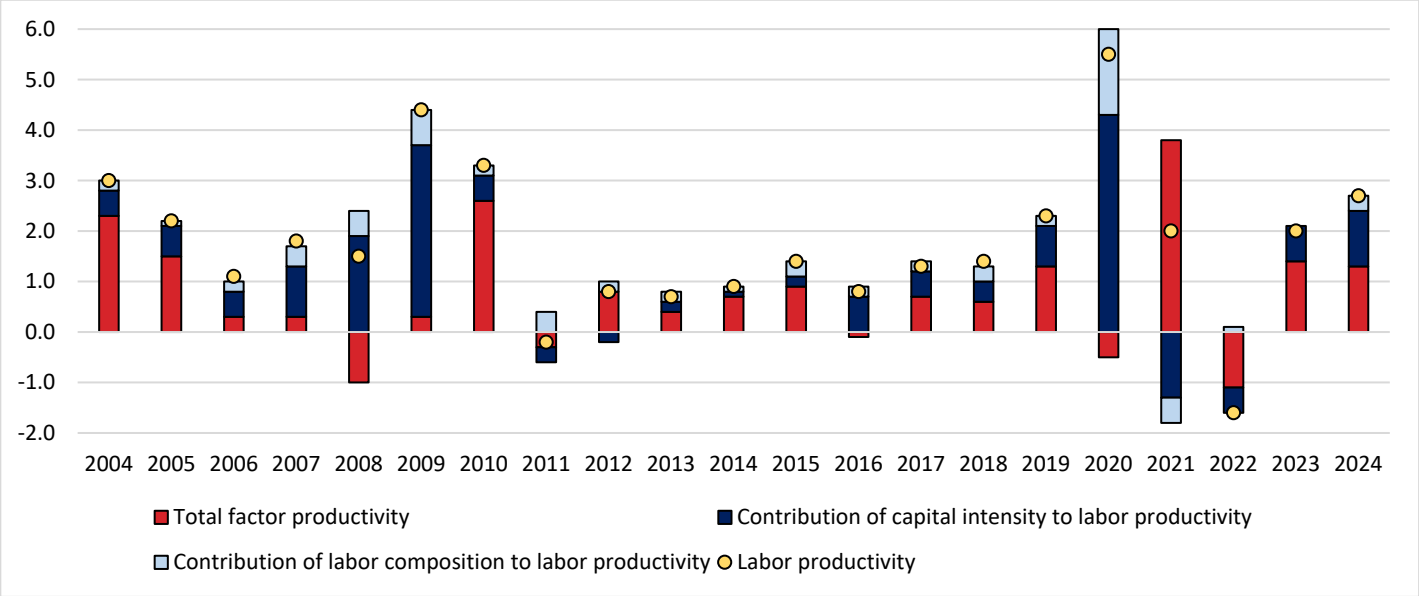
The 2024 private nonfarm business sector growth of labor productivity was a result of positive contributions from all 3 components, led by the 1.3-percent increase in total factor productivity.

The contribution of capital intensity grew 1.1 percent in 2024, the largest growth in the last 15 years outside the COVID-19 year of 2020. Capital intensity is the ratio of capital input growth to labor hours growth. The 2024 increase in capital intensity was driven by the growth in capital input of 2.9 percent outpacing hours worked growth of 0.2 percent. (See tables A and B.)

The contribution of labor composition to labor productivity for private nonfarm business increased 0.3 percent in 2024 and represents a shift toward hours worked of higher skill labor compared to the previous year. (See chart 4.)

Chart 4. Contributions to labor productivity growth, private nonfarm business sector, 2004-24

Annual percent change and percentage point contribution



Note: The sum of rates of change of total factor productivity, contribution of capital intensity, and contribution of labor composition may differ from the rate of change in labor productivity.

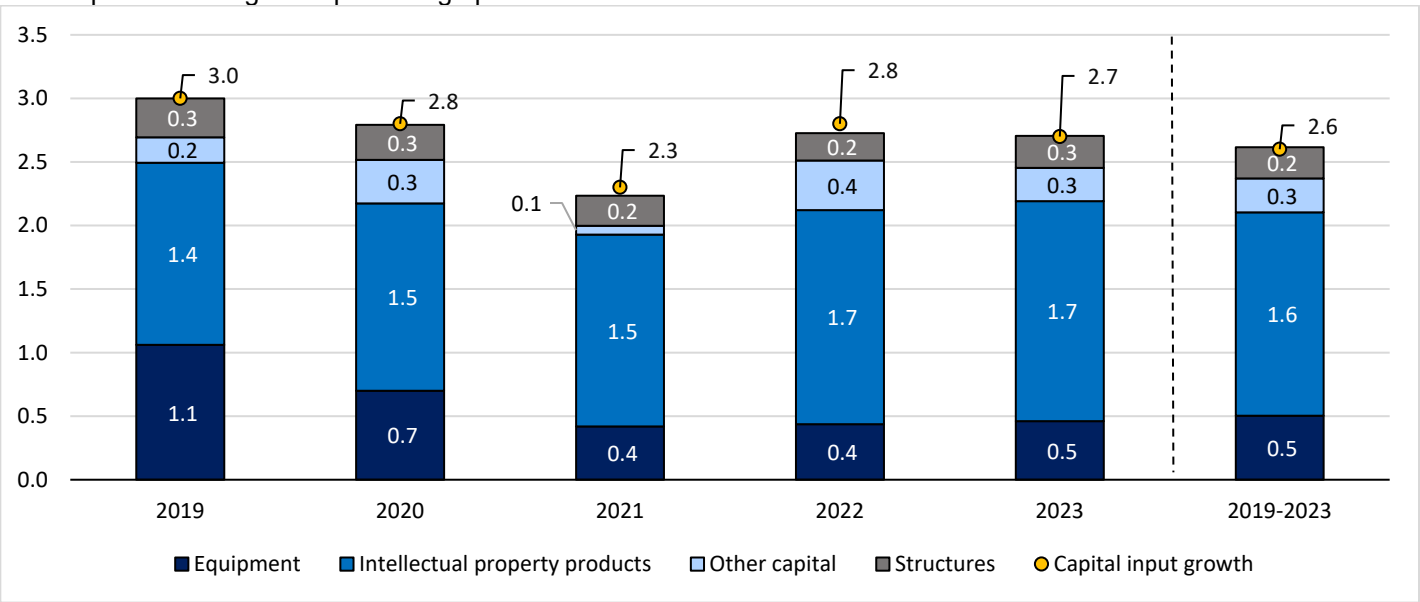
Detailed Capital Input Trends 2019-23

Capital input in the private nonfarm business sector increased at an annual rate of 2.7 percent in 2023, the latest year of detailed capital data, and is consistent with the 2.8-percent growth of 2022. The capital input growth of 2.6 percent in the 2019-23 business cycle is 0.2-percentage point higher than the previous 2007-19 period. (See table C.)

Capital input is made up of different types of capital assets, including equipment, structures, and intellectual property products. In 2023, intellectual property products contributed 1.7 percentage points to the 2.7 percent growth in capital input in the private nonfarm business sector. This asset category's influence on capital input growth has increased since 2019 when its 1.4-percentage-point contribution represented nearly half of the 3.0 percent growth in capital input. In 2023, the 1.7-percent growth in intellectual property products accounted for almost two-thirds of the 2.7-percent capital input growth. Equipment's contribution, however, has declined since 2019, when its 1.1-percentage-point contribution was over a third of private nonfarm business capital input growth. By 2023, this asset category's contribution was less than half its 2019 value at 0.5 percentage point and accounted for less than a fifth of capital input growth. (See chart 5.)

Chart 5. Asset type contributions to capital input growth in the private nonfarm business sector for 2019-23

Annual percent change and percentage point contribution



Note: The sum of contributions of the rates of change of the asset types may differ from the rate of change in capital growth. Other capital consists of inventories, land, and residential structures.

Underlying assets within intellectual property products and equipment capital allow for examination of intellectual property products' strong contribution to capital growth and the decline in equipment's contribution over the 2019-23 period. Within intellectual property products, research and development (R&D) was the main contributing asset for all years in the period, closely followed by pre-packaged software. A year-by-year increase of 0.1-percentage-point contribution from 2021 to 2023 shows steady growth within research and development. (See chart 6a.)

The equipment asset type can be further broken down into information processing equipment; motor vehicles including autos, light trucks and other vehicles; and all other equipment. Information processing equipment is the main driver of equipment capital, as it contributed 0.4 or 0.5 percentage point each year from 2019 to 2023. The other detailed assets within equipment saw declines in contributions, with autos, light trucks, and other vehicles having partially offsetting contributions to private nonfarm business capital growth in 2021, 2022, and 2023. (See chart 6b.)

Chart 6a. Select intellectual property product asset type contributions to capital input growth in the private nonfarm business sector for 2019-23

Percentage point

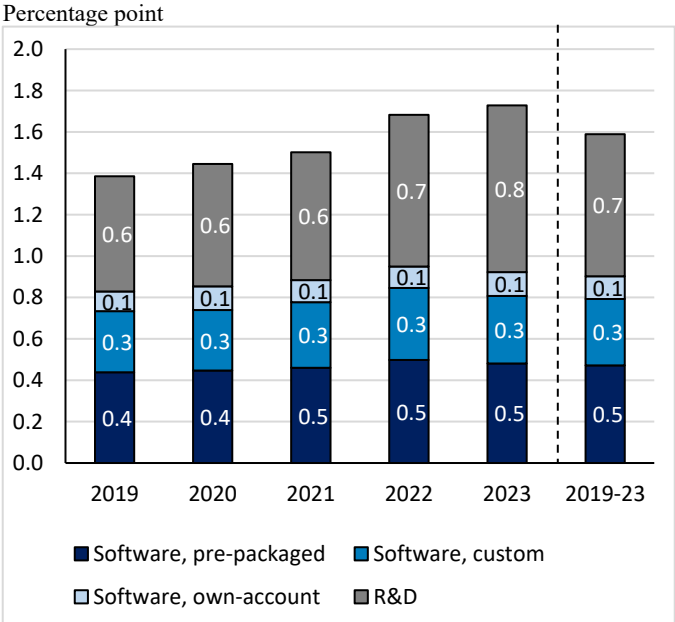
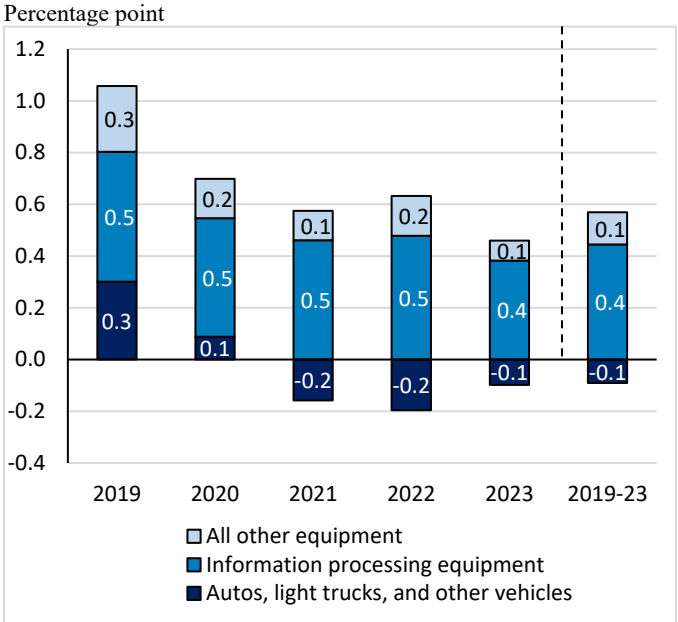


Chart 6b. Equipment asset type contributions to capital input growth in the private nonfarm business sector for 2019-23

Percentage point



Technical Notes

Capital Input

Capital input is the services derived from the stock of physical assets and intellectual property assets. There are 90 asset types for fixed business equipment, structures, inventories, land, and intellectual property products. Data on investment for fixed assets are obtained from the Bureau of Economic Analysis (BEA). Data on inventories are estimated using information from BEA and the Internal Revenue Service (IRS) Corporation Income Returns. Data for land in the farm sector are obtained from the U.S. Department of Agriculture (USDA). Nonfarm industry detail for land is based on IRS book value data. Current-dollar value-added data, obtained from BEA, are used in estimating capital rental prices.

Additional detail on information processing equipment and intellectual property products are available in table C. Information processing equipment is composed of three broad classes of assets: computers and related equipment, communications equipment, and other information processing equipment. Computers and related equipment include mainframe computers, personal computers, printers, terminals, tape drives, storage devices, and integrated systems. Communications equipment is not further differentiated. Other information processing equipment includes medical equipment and related instruments, electromedical instruments, nonmedical instruments, photocopying and related equipment, and office and accounting machinery. Intellectual property products are composed of three broad classes of assets: software, research and development, and artistic originals. Software is comprised of pre-packaged and custom. Research and development is creative work undertaken to increase the stock of knowledge for the purpose of discovering or developing new products or improving existing ones. Research and Development also includes own-account R&D for software which had previously been classified in software. Artistic originals include theatrical movies, long-lived television programs, books, music, and other forms of entertainment. Structures include nonresidential structures and residential capital that are rented out by profit-making firms or persons. Financial assets are excluded from capital input measures, as are owner-occupied residential structures. The aggregate capital input measures are obtained by Tornqvist aggregation of the capital stocks for each asset type within each of 61 NAICS industry groupings using estimated rental prices for each asset type. Each rental price reflects the nominal rate of return to all assets within the industry and rates of economic depreciation and revaluation for the specific asset; rental prices are adjusted for the effects of taxes. Current-dollar capital costs can be defined as each asset's rental price multiplied by its constant-dollar stock, adjusting for capital composition effects.

Capital input measures constructed for the most recent year are preliminary and are based on less detail than the rest of the series. These measures consist of 6 asset types as opposed to the 90 asset types for fixed business equipment, structures, inventories, land, and intellectual property products included in estimates for all previous years. The assets included in the most recent year are structures, fixed business equipment, intellectual property products, inventories, rental residences, and land. Investments, depreciation, and capital income are estimated for each of these six aggregates. Capital input is calculated by a chained superlative Tornqvist index combining stocks of the six asset categories, weighted by capital income shares. See the June 2005 Monthly Labor Review article, "Preliminary estimates of multifactor productivity growth" located at http://www.bls.gov/opub/mlr/2005/06/art3full.pdf.

Labor Input

Labor input in private business and private nonfarm business is obtained by a chained superlative Tornqvist aggregation of the hours worked, classified by age, education, and sex with weights determined by each group's share of the total wage bill. Hours worked data for the measures this news release include hours worked for all persons working in the sector—wage and salary workers, the self-employed and unpaid family workers. The primary source of hours data is the BLS Current Employment Statistics (CES) program, which provides monthly survey data on the number of jobs held by and hours paid to wage and salary workers in nonfarm establishments, counting a person who is employed by two or more establishments at each place of employment. Hours of paid time off are excluded from hours paid using data from the National Compensation Survey (NCS) for 1996 forward and data from the BLS Hours at Work survey, conducted for this purpose, prior to 1990. Between 1990 and 1995, hours of paid time off are excluded using a combination of NCS and Hours at Work survey data. Off-the-clock hours are added, yielding hours worked, using data from the Current Population Survey (CPS). To estimate the hours of farm labor, nonfarm proprietors, and nonfarm unpaid family workers the CPS data are used. The hours worked of proprietors, unpaid family workers, and farm employees are derived from the CPS. Hours worked data reflect estimates in the March 6, 2025 "Productivity and Costs" news release (www.bls.gov/news.release/archives/prod2_03062025.pdf).

The estimates of 2024 hours worked for the private nonfarm business and private business sectors are extrapolated from the hours worked reported in the nonfarm business and business sectors, respectively, in the March 6, 2025 "Productivity and Costs" news release (www.bls.gov/news.release/archives/prod2_03062025.pdf). The growth rate of labor composition is defined as the difference between the growth rate of weighted labor input and the growth rate of the hours of all persons. The index of hours worked of all persons including employees, proprietors, and unpaid family workers, classified by age, education, and sex are weighted together using median wages to compute the labor composition estimates reflecting the different skillset of the work force. These cell estimates are smoothed using a three-year moving average to address missing observations and reduce volatility.

Combined Inputs

Labor input and capital input are combined using chained superlative Tornqvist aggregation, applying weights that represent each component's average share of total costs. The chained superlative Tornqvist index uses changing weights; the share in each year is averaged with the preceding year's share. Total costs are defined as the value of output less a portion of taxes on production and imports. Most taxes on production and imports, such as excise taxes, are excluded from costs; however, property and motor vehicle taxes remain in total costs.

Capital Intensity

Capital intensity is the ratio of capital input to hours worked in the production process. The higher the capital to hours ratio, the more capital intensive the production process becomes.

In a production process, profit-maximizing/cost-minimizing firms adjust the factor proportions of capital and labor when the price of one factor is less than the other factor; there is a tendency for the firms to substitute the less expensive factor for the more expensive one. In the short run, changes in hours worked are more variable than changes in capital input. Changes in hours worked in business cycles can result in volatility of the capital intensity ratio over short periods of time. In the long run an increase in wages relative to the price of capital will induce the firm to substitute capital for labor, resulting in an increase in capital intensity.

Rising labor costs are, in fact, an incentive for firms to introduce automated production processes. Industry estimates of capital to hours ratios can be obtained at www.bls.gov/productivity/tables/.

Value-Added Output

Private business sector output is a chain-type, current-weighted index constructed after excluding from gross domestic product (GDP) the following outputs: general government, nonprofit institutions, private households (including owner-occupied housing), and government enterprises. This release presents data for the private business and private nonfarm business sectors. Additionally, the private nonfarm business sector excludes farms from the private business sector but includes agricultural services. Total factor productivity measures exclude government enterprises, while the BLS quarterly Productivity and Costs series include them.

The output measures are based on the National Income and Product Accounts (NIPA) data released by BEA on February 27, 2025. The estimates of 2024 output for the private nonfarm business and private business sectors are extrapolated from the output reported in the nonfarm business and business sectors, respectively, in the March 6, 2025 "Productivity and Costs" news release (www.bls.gov/news.release/archives/prod2_03062025.pdf).

Total Factor Productivity

Total factor productivity measures describe the relationship between output in real terms and the inputs involved in its production. They do not measure the specific contributions of labor or capital, or any other factor of production. Rather, total factor productivity is designed to measure the joint influences of technological change, efficiency improvements, returns to scale, reallocation of resources, and other factors on economic growth, allowing for the effects of capital and labor.

The total factor productivity indexes for private business and private nonfarm business are derived by dividing an output index by an index of combined inputs of capital input and labor input. The output indexes are computed as chained superlative indexes (Fisher Ideal indexes) of components of real output.

Research and Development

The stock of research and development in private nonfarm business is derived by aggregating different vintages of constant dollar measures of research and development expenditures and allowing for depreciation. Current dollar expenditures for privately financed research and development are obtained from annual issues of Research and Development in Industry published by the National Science Foundation. BLS develops price deflators and estimates of the rate of depreciation.

The research and development data in the private nonfarm business sector presented here show the effect of spillovers from economic units that conduct research and development. BEA publishes measures of research and development investments in each industry that include estimates of the direct returns to firms

conducting such research and development activities. By combining the direct returns to firms conducting research and development with the spillover effect of other firms, a picture of the total overall effects of research and development can be drawn.

Further description of these data and methods can be found in BLS Bulletin 2331 (September 1989), "The Impact of Research and Development on Productivity Growth" at www.bls.gov/productivity/technical-notes/impact-of-research-and-development-on-productivity-growth-1989.pdf.

BLS measures of year-to-year contributions of research and development to the private nonfarm business sector and measures of the stock of research and development are available at www.bls.gov/productivity/highlights/research-and-development-contribution-to-total-factor-productivity.htm.

Other Information

Detailed information on methods used in this release can be found in the BLS Handbook of Methods. Productivity Measures: Business Sector and Major Sector section at www.bls.gov/opub/hom/msp/home.htm.

Comprehensive tables containing more detailed data than are published in this news release are available upon request at 202-691-5606 or at www.bls.gov/productivity/tables.

Industry specific contributions to output are available at www.bls.gov/productivity/highlights/contributions-of-total-factor-productivity-major-industry-to-output.htm.

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Table A. Productivity, output, and inputs in the private nonfarm business and private business sectors for selected periods, 1987-2024

Average annual growth rates

	1987-2024	1990-2000	2000-07	2007-19	2019-24	2023	2024
Private nonfarm business							
Productivity							
Total factor productivity	0.8	0.9	1.3	0.6	0.9	1.4	1.3
Labor productivity	2.0	2.2	2.7	1.5	2.1	2.0	2.7
Capital productivity	-0.5	-0.7	-0.7	-0.3	-0.1	0.4	0.0
Output	2.9	4.0	2.8	2.1	2.6	3.1	2.9
Combined inputs	2.1	3.1	1.5	1.6	1.7	1.7	1.6
Labor input	1.4	2.2	0.5	1.1	1.0	1.0	0.7
Hours worked	0.9	1.7	0.1	0.6	0.5	1.0	0.2
Labor composition	0.5	0.5	0.4	0.5	0.5	0.0	0.5
Capital input	3.4	4.7	3.5	2.4	2.7	2.7	2.9
Analytic ratio							
Capital intensity	2.5	2.9	3.4	1.8	2.2	1.7	2.7
Private business							
Productivity							
Total factor productivity	0.9	1.0	1.3	0.6	1.0	1.4	1.3
Labor productivity	2.0	2.3	2.7	1.5	2.1	2.1	2.8
Capital productivity	-0.4	-0.5	-0.6	-0.2	-0.1	0.5	0.0
Output	2.9	4.0	2.8	2.1	2.6	3.1	2.9
Combined inputs	2.0	3.0	1.5	1.6	1.7	1.7	1.6
Labor input	1.3	2.2	0.5	1.1	1.0	1.0	0.7
Hours worked	0.9	1.7	0.1	0.6	0.5	1.0	0.2
Labor composition	0.5	0.5	0.4	0.5	0.5	0.0	0.5
Capital input	3.3	4.5	3.4	2.4	2.7	2.6	2.9
Analytic ratio							
Capital intensity	2.4	2.8	3.4	1.8	2.2	1.6	2.8

Table B. Labor productivity growth and the contributions of capital intensity, labor composition, and total factor productivity to labor productivity growth, private nonfarm business and private business sectors

Average annual growth rates/percentage point contributions

	1987-2023	1987-2024	1990-2000	2000-07	2007-19	2019-24	2023	2024
Private nonfarm business								
Labor productivity growth	2.0	2.0	2.2	2.7	1.5	2.1	2.0	2.7
Contribution of capital intensity	0.9	0.9	1.0	1.1	0.7	0.8	0.7	1.1
Contribution of information processing equipment (IPE)	0.3	-	0.5	0.4	0.2	-	0.1	-
Contribution of research and development (R&D)	0.1	-	0.1	0.1	0.1	-	0.3	-
Contribution of intellectual property products (IPP) excluding R&D	0.2	-	0.2	0.2	0.2	-	0.4	-
Contribution of capital input excluding IPP & IPE	0.2	-	0.2	0.4	0.2	-	-0.1	-
Contribution of labor composition	0.3	0.3	0.3	0.3	0.3	0.3	0.0	0.3
Total factor productivity growth	0.8	0.8	0.9	1.3	0.6	0.9	1.4	1.3
Contribution of R&D to total factor productivity	0.2	-	0.3	0.3	0.2	-	0.3	-
Private business								
Labor productivity growth	2.0	2.0	2.3	2.7	1.5	2.1	2.1	2.8
Contribution of capital intensity	0.8	0.9	0.9	1.1	0.7	0.9	0.7	1.1
Contribution of information processing equipment (IPE)	0.3	-	0.5	0.4	0.2	-	0.1	-
Contribution of research and development (R&D)	0.1	-	0.1	0.1	0.1	-	0.3	-
Contribution of intellectual property products (IPP) excluding R&D	0.2	-	0.2	0.2	0.2	-	0.4	-
Contribution of capital input excluding IPE & IPP	0.2	-	0.2	0.4	0.1	-	-0.1	-
Contribution of labor composition	0.3	0.3	0.3	0.3	0.3	0.3	0.0	0.3
Total factor productivity growth	0.9	0.9	1.0	1.3	0.6	1.0	1.4	1.3

*- Data for the most recent year not available

Note: Total factor productivity plus contribution of capital intensity and labor composition may not sum to labor productivity due to independent rounding. Contributions of the components of capital intensity may not sum to the total contribution of capital intensity due to independent rounding.

Table C. Real capital input growth by asset type, private nonfarm business and private business sectors

Average annual growth rates

	1987-2023	1990-2000	2000-07	2007-19	2019-23	2023
Private nonfarm business						
All assets	3.4	4.7	3.5	2.4	2.6	2.7
Equipment	4.4	6.7	5.0	3.3	1.7	1.6
Information processing equipment (IPE)	9.3	13.6	9.6	6.9	6.1	5.5
Computers & related equipment	14.6	28.6	14.4	5.8	6.5	5.4
Communication equipment	9.2	7.9	9.8	10.9	8.4	7.8
Other IPE	3.1	3.5	3.3	2.8	3.1	3.1
All other equipment	2.3	3.5	2.9	1.8	0.3	0.4
Structures	1.5	2.1	1.3	0.9	0.9	0.9
Intellectual property products (IPP)	6.1	7.4	5.4	4.8	7.2	7.6
Research and development	4.7	5.5	4.1	3.7	5.7	6.4
Software	10.5	14.0	8.2	7.3	11.0	11.4
Artistic originals	2.8	3.7	3.6	2.0	1.1	1.1
Rental residential capital	1.2	1.4	2.2	0.2	1.1	0.9
Inventories	2.7	3.5	2.2	2.4	2.2	2.8
Land	0.8	0.9	0.7	0.6	1.0	0.5
Private business						
All assets	3.3	4.5	3.4	2.4	2.6	2.6
Equipment	4.3	6.5	4.9	3.3	1.7	1.6
Information processing equipment (IPE)	9.3	13.6	9.6	6.9	6.0	5.4
Computers & related equipment	14.6	28.6	14.4	5.8	6.5	5.4
Communication equipment	9.2	7.9	9.8	10.9	8.4	7.8
Other IPE	3.2	3.6	3.4	3.0	3.1	3.0
All other equipment	2.2	3.3	2.8	1.8	0.3	0.3
Structures	1.4	2.0	1.2	0.9	0.9	0.9
Intellectual property products (IPP)	6.1	7.4	5.4	4.8	7.2	7.6
Research and development	4.7	5.5	4.1	3.7	5.7	6.4
Software	10.5	14.0	8.2	7.3	11.0	11.4
Artistic originals	2.8	3.7	3.6	2.0	1.1	1.1
Rental residential capital	1.2	1.4	2.2	0.2	1.1	0.9
Inventories	2.6	3.4	2.1	2.2	2.1	2.7
Land	0.7	0.5	0.6	0.3	1.4	0.2

Note: Real capital input by asset type is not available for the most recent reference year. For a brief discussion of methods used in preparing these data see the Technical Notes in this release.