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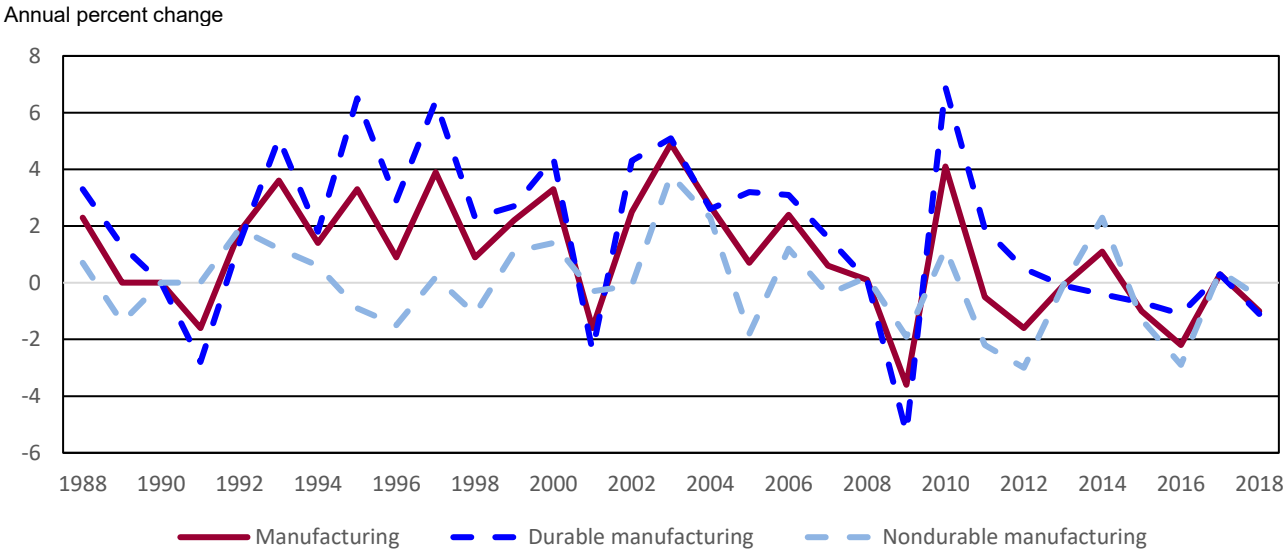
MULTIFACTOR PRODUCTIVITY TRENDS IN MANUFACTURING - 2018

Manufacturing sector multifactor productivity declined 1.0 percent in 2018, the U.S. Bureau of Labor Statistics reported today. (See chart 1, table A.) The multifactor productivity decline in 2018 reflected a 0.6-percent decrease in sectoral output and a 0.3-percent increase in combined inputs. The decrease in multifactor productivity followed a revised 0.3-percent increase in 2017.

Multifactor productivity is calculated by dividing an index of real sectoral output by an index of combined units of labor input, capital services, and intermediate inputs. Multifactor productivity annual measures differ from BLS quarterly labor productivity or output per hour measures because the former also includes information on capital services, shifts in the composition of the workforce, and intermediate inputs.

Durable manufacturing sector multifactor productivity decreased 1.1 percent in 2018. The decline reflected a 0.4-percent decrease in sectoral output and a 0.7-percent increase in combined inputs. **Nondurable manufacturing sector multifactor productivity** decreased 0.5 percent in 2018. The decline reflected a 1.0-percent decrease in sectoral output and a 0.5-percent decrease in combined inputs. (See table C, table 3.)

Chart 1. Multifactor productivity in the manufacturing, durable manufacturing, and nondurable manufacturing sectors, 1987-2018



Among the 18 manufacturing industries, 13 experienced declines in multifactor productivity in 2018. The largest declines in multifactor productivity were in the primary metal products and transportation equipment industries. Printing and related support activities and machinery industries showed the largest gains in multifactor productivity. Sectoral output declined in 13 industries; the fourth year in which at least half of manufacturing industries reported sectoral output declines. (See chart 2, table 3.)

Chart 2. Manufacturing industry trends in multifactor productivity, sectoral output, and combined inputs, 2018

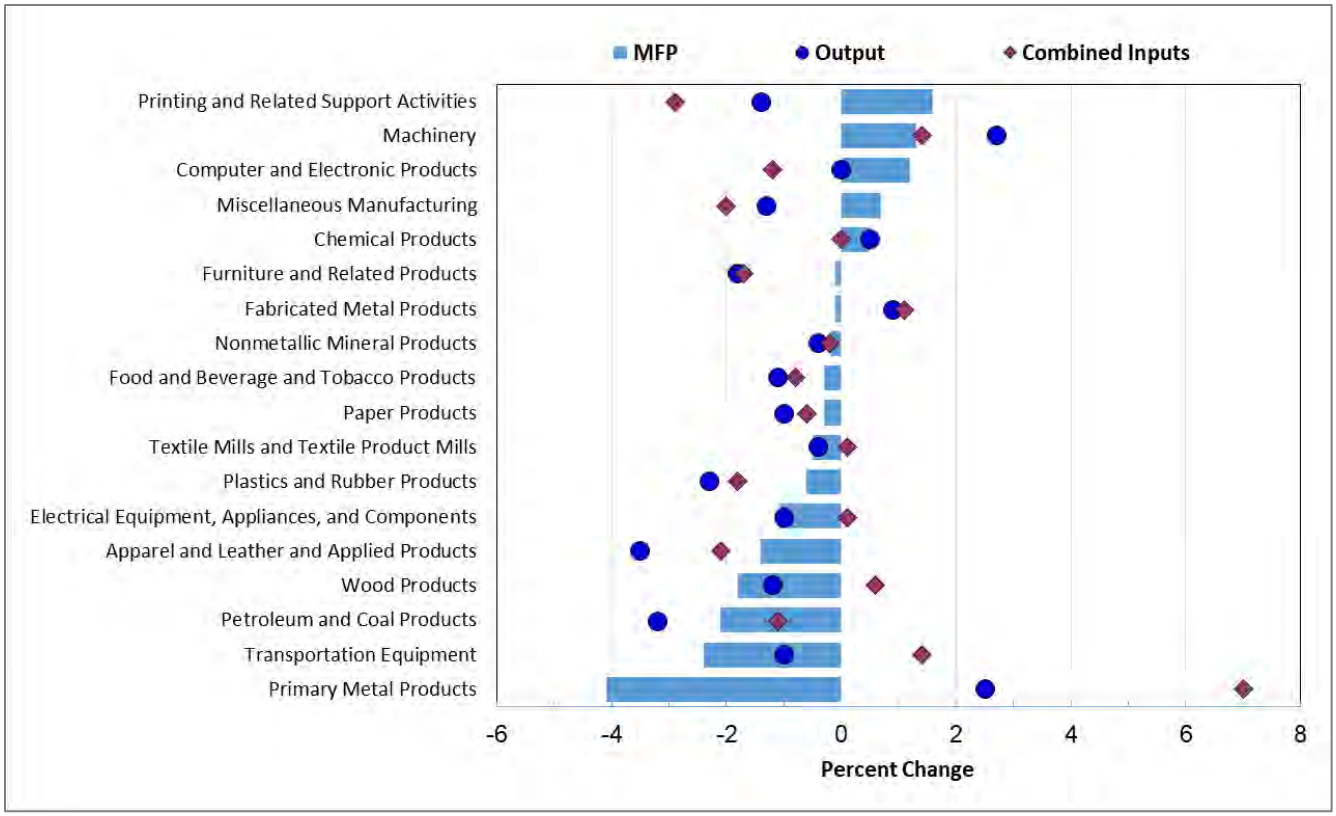
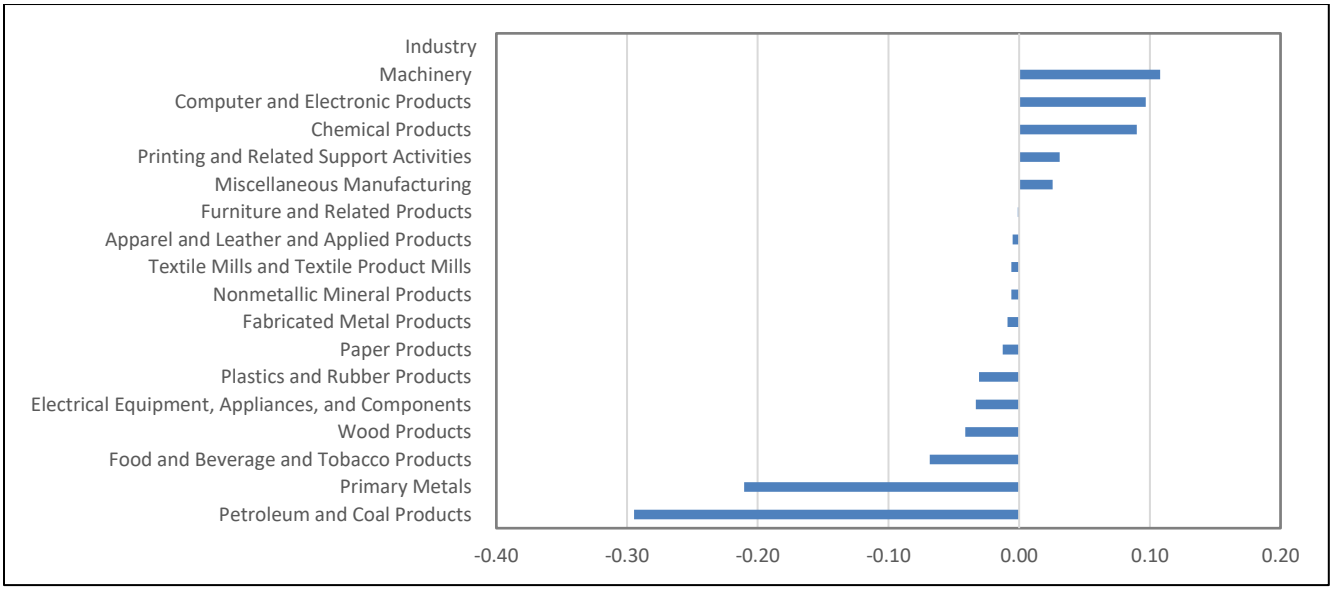


Chart 3 displays the contributions of three-digit manufacturing industries to manufacturing sector multifactor productivity. Contributions take into account the relative importance of each industry to the manufacturing sector multifactor productivity. Transportation equipment made the largest negative contribution to manufacturing multifactor productivity. Machinery made the largest positive contribution to manufacturing multifactor productivity in 2018, partially offsetting the overall productivity decline.

Chart 3. Contributions of manufacturing industries to manufacturing sector multifactor productivity, 2018



Trends in the manufacturing sector

Manufacturing sectoral output declined in 2018 with an annual decrease of 0.6 percent compared to the 0.6-percent increase in 2017. Combined inputs increased 0.3 percent, the same increase as 2017. (See table 1.)

Over the longer term, multifactor productivity in the manufacturing sector grew at an average annual rate of 0.9 percent from 1987 to 2018 with sectoral output increasing at an average annual rate of 1.5 percent, faster than the 0.5-percent average annual rate of increase in combined inputs. During the same period, labor productivity grew at an average annual rate of 2.5 percent. (See table A.) Of the 2.5-percent average annual increase in labor productivity, multifactor productivity contributed 0.9 percentage points which represents about 40 percent of the growth in the 1987-2018 period. Capital intensity contributed 0.7 percentage points, intermediate inputs intensity contributed 0.6 percentage points, and labor composition contributed 0.2 percentage points to the increase in labor productivity. (See table B.)

For the more recent 2007-18 period, multifactor productivity declined at a 0.4-percent average annual rate compared to an increase of 1.7 percent during the 2000-07 period. (See table A.) Sectoral output decreased 0.5-percent (average annual rate) and combined inputs decreased 0.1-percent (average annual rate) over the 2007-18 period.

Revised measures

Annual rates of multifactor productivity and related series were revised historically for all three sectors. (See table D.) The revisions were a result of newly released historical series for energy, materials, and business services from the Bureau of Economic Analysis for the 1987-1997 period, and incorporation of the 2017 Economic Census First Look data.

Over the 1987-2017 period, multifactor productivity in the manufacturing sector was revised up 0.4 percentage points to 1.0 percent. The upward revision was due to a 0.4-percentage point downward revision to intermediate inputs stemming from the newly incorporated historical detail. The revisions to the longer term reflect mostly revisions to the 1987-2000 period and the more recent 2012-2017 period. Revisions over the 1987-2017 period resulted in a 0.1-percentage point upward revision to multifactor productivity in nondurable manufacturing (0.0 percent), with a 0.5-percentage point upward revision to multifactor productivity growth (1.8 percent) in durable manufacturing.

In 2017, multifactor productivity in the manufacturing sector was revised upward 1.7 percentage points to 0.3 percent. The upward revision was primarily due to a 1.6-percentage point downward revision to combined inputs. Multifactor productivity was revised upward 3.5 percentage points in the durable manufacturing sector and downward 0.2 percentage point in the nondurable manufacturing sector. Materials were revised downward 8.7 percentage points in manufacturing, 11.2 percentage points in durable manufacturing, and 3.9 percentage points in nondurable manufacturing. (See table D.)

Table A. Productivity, sectoral output, and inputs in the manufacturing sector for selected periods, 1987-2018

Average annual growth

	1987-2018	1987-1990	1990-1995	1995-2000	2000-2007	2007-2018	2017-2018
Productivity							
Multifactor Productivity[1]	0.9	0.8	1.7	2.2	1.7	-0.4	-1.0
Labor Productivity[2]	2.5	1.7	3.2	4.5	4.3	0.2	-2.6
Output per unit of capital services	-0.8	-0.9	0.5	0.2	-0.3	-2.2	-2.1
Sectoral Output	1.5	1.8	3.1	4.4	1.2	-0.5	-0.6
Inputs							
Combined Inputs[3]	0.5	1.0	1.5	2.1	-0.6	-0.1	0.3
Labor input[4]	-0.4	0.5	0.7	0.5	-2.4	-0.3	1.9
Hours	-1.0	0.1	-0.1	-0.1	-3.1	-0.7	2.0
Labor composition[5]	0.6	0.4	0.7	0.6	0.7	0.4	-0.1
Capital services	2.3	2.7	2.7	4.3	1.5	1.8	1.5
Energy	-2.1	-0.8	-2.6	10.9	-5.5	-5.4	-3.9
Materials	0.5	-0.9	3.1	1.5	0.5	-0.7	-0.9
Purchased business services	0.4	3.9	-0.2	2.2	-0.4	-0.7	-2.0

1 Output per combined units of labor input, capital services, energy, materials, and purchased business services.

2 Output per hour worked.

3 The growth rate of each input is weighted by its share of current dollar costs.

4 Hours at work by age, education, and gender group are weighted by each group's share of total wages.

5 Ratio of labor input to hours.

Table B. Labor productivity and contributions of capital intensity, intermediate inputs intensity, labor composition, and multifactor productivity to labor productivity in the manufacturing sector for selected periods, 1987-2018

Average annual growth/percentage point

	1987-2018	1987-1990	1990-1995	1995-2000	2000-2007	2007-2018	2017-2018
Labor Productivity[1]	2.5	1.7	3.2	4.5	4.3	0.2	-2.6
Contribution of capital intensity[2]	0.7	0.5	0.5	0.9	1.0	0.6	-0.1
Information processing equipment intensity[3]	0.1	0.1	0.1	0.2	0.1	0.0	0.0
Research and Development intensity[4]	0.3	0.2	0.1	0.3	0.4	0.3	0.1
All other intellectual property products intensity[5]	0.1	0.1	0.1	0.1	0.0	0.0	0.0
All other capital services Intensity	0.3	0.2	0.2	0.3	0.5	0.2	-0.2
Contribution of intermediate inputs intensity[6]	0.6	0.3	0.7	1.1	1.4	-0.1	-1.5
Energy intensity[7]	0.0	0.0	-0.1	0.3	-0.1	-0.1	-0.1
Materials intensity[8]	0.4	-0.3	0.8	0.5	1.0	0.0	-0.9
Purchased business services intensity[9]	0.2	0.6	0.0	0.4	0.4	0.0	-0.5
Contribution of labor composition[10]	0.2	0.1	0.2	0.2	0.2	0.1	0.0
Multifactor productivity[11]	0.9	0.8	1.7	2.2	1.7	-0.4	-1.0

1 Output per hour worked.

2 Capital intensity multiplied by capital's share of current dollar costs.

3 Information processing equipment per hour multiplied by its share of current dollar costs.

4 Research and development per hour multiplied by its share of current dollar costs.

5 Software and artistic originals per hour multiplied by their share of current dollar costs.

6 Intermediate inputs per hour multiplied by intermediate inputs' share of current dollar costs.

7 Energy per hour multiplied by energy's share of current dollar costs.

8 Materials per hour multiplied by materials' share of current dollar costs.

9 Purchased business services per hour multiplied by purchased business services' share of current dollar costs.

10 Labor composition multiplied by labor's share of current dollar costs.

11 Output per combined units of labor input, capital services, energy, materials, and purchased business services.

Table C. Multifactor productivity and related measures in the total, durable and nondurable manufacturing sectors, for selected periods, 1987-2018

Average annual growth

	1987-2018	1987-1990	1990-1995	1995-2000	2000-2007	2007-2018	2017-2018
Manufacturing							
Multifactor productivity[1]	0.9	0.8	1.7	2.2	1.7	-0.4	-1.0
Labor productivity	2.5	1.7	3.2	4.5	4.3	0.2	-2.6
Sectoral Output	1.5	1.8	3.1	4.4	1.2	-0.5	-0.6
Combined Inputs[2]	0.5	1.0	1.5	2.1	-0.6	-0.1	0.3
Capital Services	2.3	2.7	2.7	4.3	1.5	1.8	1.5
Labor Input[3]	-0.4	0.5	0.7	0.5	-2.4	-0.3	1.9
Energy	-2.1	-0.8	-2.6	10.9	-5.5	-5.4	-3.9
Materials	0.5	-0.9	3.1	1.5	0.5	-0.7	-0.9
Purchased Business Services	0.4	3.9	-0.2	2.2	-0.4	-0.7	-2.0
Durable Manufacturing							
Multifactor productivity[1]	1.7	1.5	2.3	3.7	2.5	0.0	-1.1
Labor productivity	2.9	2.0	4.5	5.9	4.5	0.2	-2.7
Sectoral Output	2.0	1.9	4.3	6.7	1.3	-0.6	-0.4
Combined Inputs[2]	0.3	0.3	1.9	2.8	-1.2	-0.6	0.7
Capital Services	2.2	2.6	2.3	5.4	1.1	1.3	1.4
Labor Input[3]	-0.4	0.3	0.5	1.3	-2.4	-0.4	2.1
Energy	-3.3	-2.6	-3.3	10.1	-5.7	-7.6	-4.9
Materials	0.4	-1.3	5.2	2.3	-1.2	-1.2	0.2
Purchased Business Services	0.1	1.2	0.7	3.6	0.0	-2.1	-2.6
Nondurable Manufacturing							
Multifactor productivity[1]	0.0	-0.2	0.6	0.0	0.6	-0.7	-0.5
Labor productivity	1.7	1.3	1.8	2.9	3.7	0.1	-2.5
Sectoral Output	0.7	1.7	1.8	1.4	0.6	-0.4	-1.0
Combined Inputs[2]	0.7	1.9	1.2	1.4	-0.1	0.3	-0.5
Capital Services	2.4	2.8	3.1	3.1	1.8	2.2	1.7
Labor Input[3]	-0.5	0.8	0.9	-0.8	-2.4	0.0	1.6
Energy	-1.1	1.0	-1.8	11.7	-5.4	-3.9	-2.2
Materials	0.5	0.6	1.6	1.1	1.0	-0.5	-2.2
Purchased Business Services	0.7	7.3	-1.0	0.7	-1.2	1.0	-1.0

1 Output per combined units of hours, capital services, energy, materials, and purchased business services.

2 The growth rate of each input is weighted by its share of current dollar costs.

3 Hours at work by age, education, and gender group, weighted by each group's share of total wages.

Table D. Difference between revised and previous multifactor productivity and related measures, for selected periods 1987-2017

Average annual growth

	1987-2017	1987-1990	1990-1995	1995-2000	2000-2007	2007-2017	2015-2016	2016-2017
Manufacturing								
Multifactor productivity[1]	0.4	0.6	0.8	0.4	-0.1	0.3	0.6	1.7
Labor productivity	-0.1	0.0	-0.1	-0.1	0.1	0.0	-0.2	0.2
Sectoral Output	-0.1	0.0	0.0	-0.1	0.1	-0.1	-0.1	0.2
Combined Inputs[2]	-0.4	-0.6	-0.7	-0.5	0.0	-0.4	-0.7	-1.6
Capital Services	0.1	0.0	0.1	0.1	0.0	0.0	0.2	0.1
Labor Input[3]	0.0	0.0	0.1	0.1	0.0	0.0	0.1	-0.1
Energy	-0.9	-2.8	-4.2	0.9	0.1	-0.4	-5.9	12.0
Materials	-0.9	-1.3	-0.2	-2.3	0.3	-1.3	-2.0	-8.7
Purchased Business Services	-0.6	-1.5	-3.3	0.9	0.1	-0.3	0.3	9.3
Durable Manufacturing								
Multifactor productivity[1]	0.5	0.8	1.1	0.7	0.0	0.4	0.1	3.5
Labor productivity	0.0	0.0	0.1	-0.1	0.0	0.1	0.0	0.4
Sectoral Output	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.4
Combined Inputs[2]	-0.5	-0.8	-1.1	-0.9	0.0	-0.4	-0.2	-3.3
Capital Services	0.1	0.2	0.1	0.0	0.0	0.1	0.1	0.1
Labor Input[3]	0.0	0.0	0.0	0.1	0.0	0.0	0.1	-0.2
Energy	-1.2	-4.0	-4.1	-0.2	0.0	-0.2	1.9	-1.4
Materials	-1.2	-2.4	-0.9	-3.0	0.0	-1.1	-1.1	-11.2
Purchased Business Services	-0.7	-0.6	-3.0	0.9	0.0	-0.6	0.4	2.8
Nondurable Manufacturing								
Multifactor productivity[1]	0.1	0.2	0.2	0.0	-0.1	0.2	0.9	-0.2
Labor productivity	0.0	0.0	-0.1	-0.1	0.0	0.0	-0.2	0.1
Sectoral Output	0.0	0.0	-0.1	0.0	0.0	-0.1	-0.1	0.1
Combined Inputs[2]	-0.2	-0.2	-0.3	0.0	0.0	-0.3	-1.1	0.2
Capital Services	0.0	0.0	0.1	0.0	0.0	0.0	0.3	-0.1
Labor Input[3]	0.1	-0.1	0.1	0.1	0.0	0.0	0.2	-0.1
Energy	-0.6	-1.6	-4.0	1.8	0.0	-0.2	-9.7	19.9
Materials	-0.2	0.0	0.8	-0.5	0.2	-0.8	-1.7	-3.9
Purchased Business Services	-0.6	-2.7	-3.5	1.1	0.0	0.1	-0.2	15.5

1 Output per combined units of hours, capital services, energy, materials, and purchased business services.

2 The growth rate of each input is weighted by its share of current dollar costs.

3 Hours at work by age, education, and gender group, weighted by each group's share of total wages.

Technical Notes

BLS includes a measure of the effects of changes in the composition of the work force for manufacturing sectors and industries. Labor input in manufacturing sectors and NAICS industry groups is obtained by chained superlative Tornqvist aggregation of the hours at work, classified by age, education, and gender with weights determined by each group's share of total wages. The labor composition index estimates the effect of shifts in the age, education, and gender composition of the work force on hours worked.

Capital Services

Capital services are 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. The aggregate capital services measures are obtained by Tornqvist aggregation of the capital stocks for each asset type within each of the eighteen manufacturing 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. Data on investment for fixed assets are obtained from BEA. Data on inventories are estimated using data from BEA and additional information from IRS Corporation Income Returns. Data for land in the farm sector are obtained from 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.

Labor Input

Labor input in manufacturing sectors and industries is obtained by chained superlative Tornqvist aggregation of the hours at work, classified by age, education, and gender with weights determined by each group's share of total wages. The labor composition index estimates the effect of shifts in the age, education, and gender composition of the work force on hours worked. Hours at work data reflect Productivity and Costs data as of the December 10, 2019 "Productivity and Costs" news release (USDL-19-2143). 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.

The growth rate of labor composition in manufacturing may be underestimated due to limitations in the source data. The education proxy does not include training certifications and licensing. The proxy only includes number of years of schooling.

Additional information concerning data sources and methods of measuring labor composition can be found in "Changes in the Composition of Labor for BLS Multifactor Productivity Measures, 2014" (www.bls.gov/mfp/mprlabor.pdf).

Intermediate Inputs

In manufacturing, intermediate inputs consist of energy, materials, and purchased business services, and represent a large share of production costs. Research has shown that substitution among inputs, including intermediate inputs, affects productivity change. Therefore, it is important to account for intermediate inputs in productivity measures at the industry level. In contrast, the more aggregate productivity measures compare "value-added" output with two classes of inputs, capital and labor. Because of these differences in concepts and methodology, productivity change in manufacturing cannot be directly compared with changes in private business or private nonfarm business.

Data on intermediate inputs are obtained from BEA based on BEA annual input-output tables. Tornqvist indexes of each of these three input classes are derived at the three-digit NAICS level and then aggregated to the manufacturing sectors. Materials inputs are adjusted to exclude transactions between establishments within the same sector.

Combined Inputs

The five input indexes (capital services, labor, energy, materials, and purchased business services) are combined using chained superlative Tornqvist aggregation, applying weights that represent each component's share of total costs. Total costs are defined as the current dollar value of manufacturing sectoral output. 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 services to hours worked in the production process. The higher the capital to hours ratio, the more capital intensive the production process is.

In a production process, profit maximizing/cost-minimizing firms adjust the factor proportions of capital and labor if the price of one factor falls relative to the price of the other factor; there would be 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 services. 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 http://www.bls.gov/mfp/mprdload.htm.

Sectoral Output

The output concept used for multifactor productivity in manufacturing is “sectoral output”. Sectoral output equals gross output (sales, receipts, and other operating income, plus commodity taxes plus changes in inventories), excluding transactions between establishments within the same sector. In contrast, the output concept used for private business and private nonfarm business is “real value-added”. Real value-added output in private business equals gross domestic product less general government, government enterprises, private households (including the rental value of owner-occupied real estate), and non-profit institutions. Real value-added output excludes intermediate transactions between businesses.

The output index for manufacturing is constructed using a chained superlative index (Tornqvist) of three-digit NAICS industry outputs. Industry output is measured as sectoral output, the total value of goods and services leaving the industry. The indexes of industry output are calculated with the Tornqvist index formula. This index formula aggregates the growth rates of the various industry outputs between two periods, using their relative shares in industry value of production averaged over the two periods as weights.

Manufacturing industry output measures for 2017 and earlier years are constructed primarily using data from the economic censuses and annual surveys of the U.S. Census Bureau together with data on price changes primarily from BLS. These measures have been revised due to new and revised data from the Bureau of Economic Analysis, used in part to construct intra-industry transactions. Manufacturing industry output for 2018 is estimated based on historical relationships between BLS sectoral output, BLS price indexes, and data on industrial production from the Federal Reserve Board.

Multifactor Productivity

The manufacturing multifactor productivity measures describe the relationship between output in real terms and the inputs involved in its production. Multifactor productivity measures are not intended to capture the specific contributions of labor, capital, or intermediate inputs. Rather, they are designed to measure the joint influences on economic growth of technological change, efficiency improvements, returns to scale, reallocation of resources and other factors of economic growth, allowing for the effects of capital, labor, and intermediate inputs. The multifactor productivity indexes are derived by dividing an output index by an index of the combined inputs of labor, capital services, energy, non-energy materials, and purchased business services.

Other information

Comprehensive tables containing more detailed data than that which is published in this press release are available upon request at 202-691-5606 or at www.bls.gov/mfp/mprdload.htm. Industry specific contributions to output are available at www.bls.gov/mfp/contributions-to-output.htm.

More detailed information on methods, limitations, and data sources of capital and labor are provided in BLS Bulletin 2178 (September 1983), *Trends in Multifactor Productivity, 1948-81* and on the BLS Multifactor Productivity website under the title “Technical Information About the BLS Multifactor Productivity Measures” for Major Sectors and 18 NAICS 3-digit Manufacturing Industries www.bls.gov/mfp/mprtech.pdf.

General information is available on the BLS Multifactor Productivity website at www.bls.gov/mfp/mprover.htm. Additional data not contained in the release can be obtained in print or at www.bls.gov/mfp. A number of comprehensive tables set up as zip files can be obtained at www.bls.gov/mfp/mprdload.htm. Methods for measuring manufacturing multifactor productivity are discussed in the July 1995 issue of the *Monthly Labor Review,* "Measurement of productivity growth in U.S. manufacturing”. See www.bls.gov/mfp/mprgul95.pdf.

Table 1. Manufacturing sector: productivity and related measures for the 1987-2018 period

Annual percent change from previous year

	Productivity				Inputs					
	Labor Productivity[1]	Output per unit of capital services	Multifactor Productivity[2]	Sectoral Output	Labor[3]	Capital Services	Energy	Materials	Purchased business services	Combined Inputs[4]
1988	1.9	1.7	2.3	4.2	2.5	2.4	0.6	-1.5	6.3	1.9
1989	-0.1	-1.5	0.0	1.2	1.7	2.8	0.2	-2.1	4.3	1.2
1990	3.5	-2.9	0.0	0.0	-2.7	3.0	-3.2	1.1	1.3	0.0
1991	1.9	-4.2	-1.6	-1.8	-2.9	2.6	-5.9	4.2	-3.2	-0.2
1992	5.2	1.6	1.8	4.1	-0.1	2.5	-3.1	5.5	2.7	2.2
1993	2.5	1.3	3.6	3.7	2.1	2.4	-3.4	-1.7	-2.7	0.2
1994	2.9	3.0	1.4	5.6	3.3	2.5	-1.4	9.2	0.5	4.1
1995	3.7	0.8	3.3	4.3	1.2	3.5	0.9	-1.4	1.8	1.0
1996	3.9	-0.3	0.9	3.9	0.6	4.2	-3.1	6.0	0.8	2.9
1997	4.9	2.1	3.9	6.9	2.6	4.7	2.3	-0.3	7.3	2.8
1998	4.5	-0.2	0.9	4.8	0.9	5.0	0.4	6.1	4.8	3.9
1999	5.6	0.1	2.2	4.1	-0.9	4.0	44.7	0.9	1.0	1.9
2000	3.7	-0.8	3.3	2.6	-0.5	3.4	16.7	-4.8	-2.4	-0.7
2001	2.3	-6.6	-1.6	-4.4	-6.0	2.4	16.2	-7.9	1.7	-2.8
2002	8.4	-0.7	2.5	0.8	-6.0	1.5	-33.7	9.6	-5.1	-1.6
2003	6.5	0.4	4.9	1.3	-4.0	0.8	-17.3	-7.5	1.5	-3.5
2004	2.7	1.7	2.7	2.1	0.1	0.4	0.3	5.6	-13.9	-0.6
2005	5.1	2.7	0.7	3.9	-0.7	1.2	18.0	5.1	7.1	3.2
2006	1.0	0.0	2.4	1.6	0.9	1.6	-19.1	-4.1	5.0	-0.8
2007	4.6	0.7	0.6	3.0	-0.8	2.3	10.5	4.3	2.3	2.4
2008	-0.5	-7.5	0.1	-4.6	-2.8	3.2	5.1	-6.8	-16.8	-4.7
2009	1.3	-13.0	-3.6	-11.9	-12.0	1.2	-26.5	-12.7	-2.3	-8.6
2010	6.2	5.5	4.1	6.4	0.9	0.8	-3.2	4.3	3.6	2.2
2011	0.8	1.5	-0.5	2.7	1.9	1.3	9.9	7.4	-3.9	3.2
2012	-0.9	-0.2	-1.6	1.3	2.6	1.5	1.2	3.7	4.4	2.9
2013	1.1	-0.1	-0.1	1.9	0.9	2.1	3.5	3.1	0.2	2.0
2014	-0.4	-1.1	1.1	1.2	1.7	2.2	-8.1	-1.6	-0.6	0.0
2015	-1.8	-2.8	-1.0	-0.9	1.0	2.0	-19.5	2.5	-8.6	0.1
2016	-0.4	-2.1	-2.2	-0.2	0.6	2.0	-8.3	3.0	4.4	2.0
2017	-0.3	-0.9	0.3	0.6	1.0	1.5	-3.4	-7.6	17.9	0.3
2018	-2.6	-2.1	-1.0	-0.6	1.9	1.5	-3.9	-0.9	-2.0	0.3

1 Output per hour worked.

2 Output per combined units of labor input, capital services, energy, materials, and purchased business services.

3 Hours at work by age, education, and gender group, weighted by each group's share of total wages.

4 The growth rate of each input is weighted by its share of current dollar costs.

Source: The Bureau of Labor Statistics (BLS) develops productivity measures using output data published by the Bureau of the Census, U.S. Department of Commerce, and modified by BLS. Compensation and hours data are from the BLS. Capital measures are based on data supplied by the BEA, U.S. Department of Commerce. See Technical Notes in this release.

Table 2. Manufacturing sector: indexes of productivity and related measures, 1987-2018 period

Indexes 2012=100

	Productivity				Inputs					
Year	Labor Productivity[1]	Output per unit of capital services	Multifactor Productivity[2]	Sectoral Output	Labor[3]	Capital Services	Energy	Materials	Purchased business services	Combined Inputs[4]
1987	45.1	118.2	72.7	64.8	122.2	54.8	124.3	83.5	98.3	89.1
1988	45.9	120.3	74.4	67.5	125.3	56.1	125.0	82.2	104.5	90.8
1989	45.9	118.5	74.4	68.3	127.4	57.7	125.3	80.5	109.0	91.9
1990	47.5	115.1	74.4	68.3	124.0	59.4	121.2	81.4	110.4	91.9
1991	48.3	110.2	73.2	67.1	120.3	60.9	114.0	84.8	106.9	91.8
1992	50.8	112.0	74.5	69.9	120.2	62.4	110.4	89.5	109.7	93.8
1993	52.1	113.4	77.1	72.5	122.6	63.9	106.6	88.0	106.8	93.9
1994	53.6	116.8	78.2	76.5	126.6	65.5	105.1	96.0	107.3	97.8
1995	55.6	117.8	80.8	79.8	128.1	67.8	106.1	94.7	109.2	98.8
1996	57.8	117.4	81.5	82.9	128.9	70.6	102.8	100.4	110.1	101.7
1997	60.6	119.8	84.7	88.6	132.3	73.9	105.2	100.1	118.1	104.5
1998	63.3	119.6	85.5	92.8	133.4	77.7	105.6	106.2	123.8	108.6
1999	66.9	119.7	87.4	96.7	132.2	80.8	152.8	107.2	125.0	110.6
2000	69.4	118.8	90.3	99.1	131.5	83.5	178.3	102.1	122.0	109.8
2001	71.0	110.9	88.8	94.8	123.6	85.5	207.2	94.0	124.1	106.7
2002	77.0	110.2	91.0	95.6	116.2	86.8	137.4	103.0	117.7	105.0
2003	82.0	110.6	95.5	96.8	111.5	87.5	113.7	95.3	119.5	101.4
2004	84.2	112.6	98.1	98.8	111.6	87.8	114.0	100.6	102.9	100.8
2005	88.5	115.5	98.8	102.7	110.8	88.9	134.6	105.7	110.2	104.0
2006	89.4	115.5	101.1	104.3	111.8	90.3	108.9	101.4	115.8	103.2
2007	93.5	116.3	101.7	107.5	110.9	92.4	120.3	105.7	118.4	105.6
2008	93.1	107.6	101.8	102.5	107.7	95.3	126.4	98.6	98.4	100.7
2009	94.2	93.6	98.1	90.3	94.8	96.5	92.9	86.0	96.2	92.0
2010	100.1	98.8	102.1	96.1	95.6	97.3	89.9	89.7	99.7	94.1
2011	100.9	100.2	101.6	98.7	97.5	98.5	98.8	96.4	95.8	97.1
2012	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2013	101.1	99.9	99.9	101.9	100.9	102.1	103.5	103.1	100.2	102.0
2014	100.6	98.8	101.0	103.1	102.6	104.3	95.2	101.4	99.5	102.0
2015	98.8	96.0	100.0	102.2	103.7	106.4	76.6	104.0	90.9	102.2
2016	98.4	94.0	97.8	102.0	104.4	108.5	70.2	107.2	94.9	104.3
2017	98.2	93.1	98.1	102.6	105.4	110.2	67.9	99.0	111.8	104.6
2018	95.6	91.1	97.1	101.9	107.5	111.8	65.2	98.1	109.6	104.9

1 Output per hour worked.

2 Output per combined units of labor input, capital services, energy, materials, and purchased business services.

3 Hours at work by age, education, and gender group, weighted by each group's share of total wages.

4 The growth rate of each input is weighted by its share of current dollar costs.

Source: The Bureau of Labor Statistics (BLS) develops productivity measures using output data published by the Bureau of the Census, U.S. Department of Commerce, and modified by BLS. Compensation and hours data are from the BLS. Capital measures are based on data supplied by the BEA, U.S. Department of Commerce. See Technical Notes in this release.

Table 3. Multifactor productivity measures for manufacturing industries in selected periods, 1987-2018

Average annual growth

	1987- 2018	1987-1990	1990-1995	1995- 2000	2000-2007	2007-2018	2017-2018
Manufacturing	**0.9**	**0.8**	**1.7**	**2.2**	**1.7**	**-0.4**	**-1.0**
Nondurable manufacturing	**0.0**	**-0.2**	**0.6**	**0.0**	**0.6**	**-0.7**	**-0.5**
Food, beverage, and tobacco products	-0.2	-0.5	1.0	-1.5	0.7	-0.7	-0.3
Textile mills and textile product mills	0.4	1.3	0.9	1.2	0.5	-0.3	-0.5
Apparel, leather, and allied products	-0.2	0.7	-0.2	-0.5	-1.4	0.5	-1.4
Paper products	0.0	-0.8	0.0	0.2	0.8	-0.3	-0.3
Printing and related support activities	0.7	0.2	-0.3	-0.3	2.6	0.6	1.6
Petroleum and coal products	0.5	-0.8	2.2	2.7	-0.1	-0.4	-2.1
Chemical products	-0.5	-0.5	-0.4	-0.3	1.0	-1.6	0.5
Plastics and rubber products	0.5	0.5	1.0	1.4	0.5	-0.1	-0.6
Durable manufacturing	**1.7**	**1.5**	**2.3**	**3.7**	**2.5**	**0.0**	**-1.1**
Wood products	-0.2	0.0	-2.3	-1.1	0.9	0.3	-1.8
Nonmetallic mineral products	0.2	0.4	0.8	-0.2	0.1	0.2	-0.2
Primary metals	0.4	-0.4	0.1	1.6	0.6	0.1	-4.1
Fabricated metal products	-0.2	-0.5	0.6	-0.2	0.6	-0.9	-0.1
Machinery	-0.1	1.5	-1.6	-0.7	1.5	-0.7	1.3
Computer and electronic products	6.2	4.7	8.8	12.5	6.5	2.4	1.2
Electrical equipment, appliances, and components	0.1	0.1	-0.1	-0.9	1.5	-0.1	-1.1
Transportation equipment	1.1	0.6	2.4	2.7	1.8	-0.4	-2.4
Furniture and related products	-0.1	-0.9	0.4	0.0	-0.1	-0.2	-0.1
Miscellaneous manufacturing	0.8	3.8	-0.7	1.3	1.5	0.0	0.7

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