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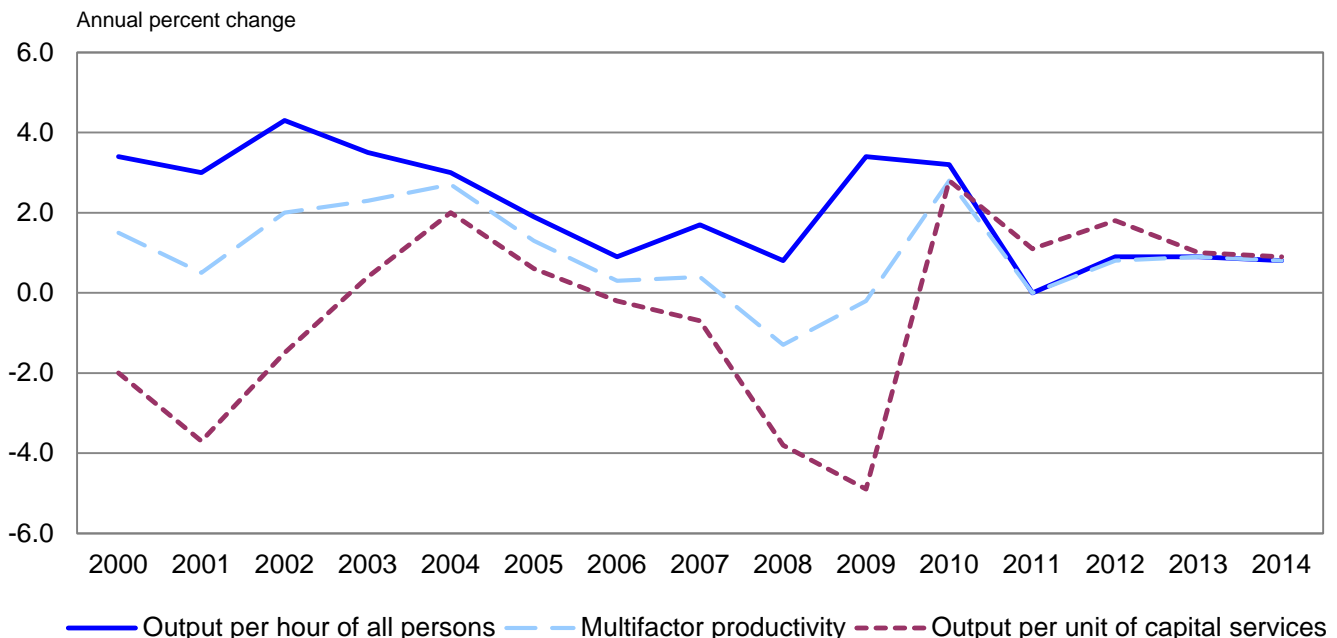
PRELIMINARY MULTIFACTOR PRODUCTIVITY TRENDS – 2014

Private nonfarm business sector multifactor productivity increased at a 0.8 percent annual rate in 2014, the U.S. Bureau of Labor Statistics reported today. (See chart 1, table A.) This 2014 gain reflected a 3.1-percent increase in output and a 2.3-percent increase in the combined inputs of capital and labor. Capital services grew by 2.1 percent and labor input – which is the combined effect of hours worked and labor composition – grew by 2.4 percent. The 2.1-percent increase in capital services was the largest annual increase since a 2.6-percent increase in 2008. Capital services per hour of all persons continued on a steady decline of 0.1 percent in 2014; the fourth consecutive decline in this measure. (See table 1.)

Multifactor productivity measures the change in output relative to the change in capital and labor inputs used to produce that output. It is designed to measure the joint influences of technological change, efficiency improvements, returns to scale, reallocation of resources, and other factors of economic growth, accounting for the effects of capital and labor. Multifactor productivity annual measures differ from BLS quarterly labor productivity (output per hour worked) measures because the former also include the influences of capital services and shifts in the composition of the workforce. Additionally, much of the source data needed to construct multifactor productivity measures are not available on a quarterly basis.

Private business sector multifactor productivity grew by 0.6 percent in 2014. A 2.9-percent increase in output and a 2.3-percent increase in the combined inputs of capital and labor contributed to the multifactor productivity gain in 2014. (See table A, table 2.)

Chart 1. Output per hour of all persons, multifactor productivity, and output per unit of capital services in the private nonfarm business sector, 2000-2014



Historical trends in the private nonfarm business sector

Multifactor productivity in the private nonfarm business sector grew 0.9 percent annually from 1987 to 2014. For the 2007-2014 period, multifactor productivity grew 0.5 percent on average as combined inputs increased 0.7 percent and output increased 1.3 percent. The increase in combined inputs reflected an increase in labor input of 0.3 percent along with a 1.5-percent increase in capital services. (See table A, table 1.)

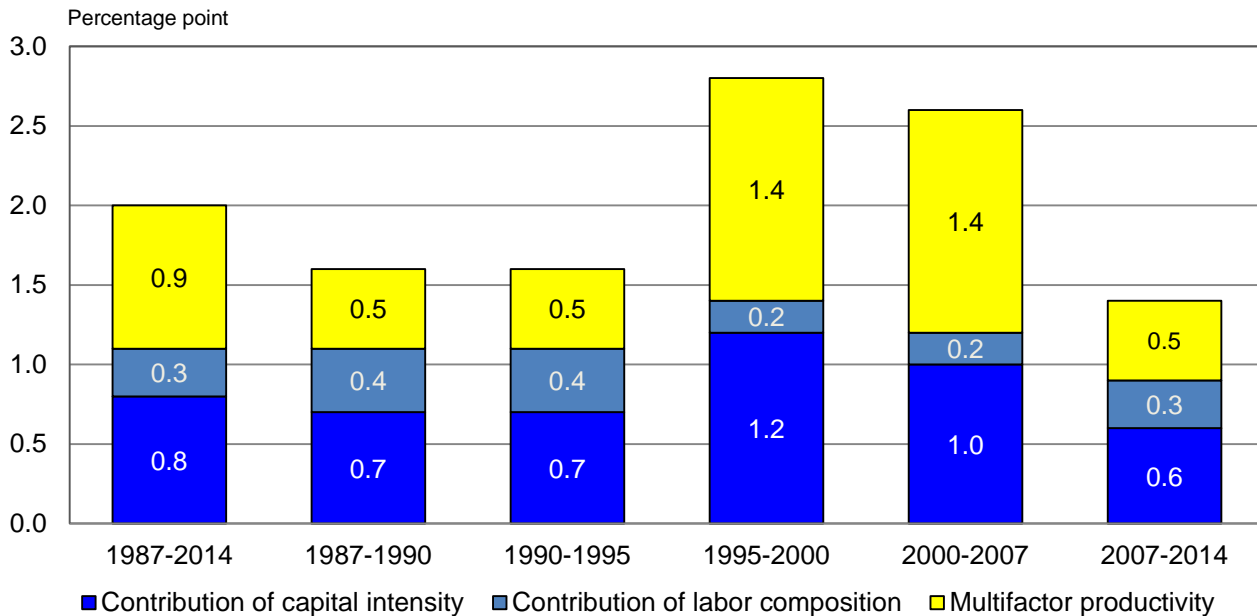
Annual labor productivity growth can be viewed as the sum of three components: multifactor productivity growth, the contribution of capital intensity, and the contribution of shifts in labor composition. Prior to 1995, multifactor productivity and the contributions of capital intensity to labor productivity grew 0.5 percent and 0.7 percent respectively. The contribution of labor composition grew 0.4 percent, leading to an average annual growth rate of 1.6 percent in output per hour.

The contributions to labor productivity growth differed from the 1995-2000 and 2000-2007 periods, as upward shifts in multifactor productivity and capital intensity resulted in stronger output per hour growth. For the 2007-2014 period, the contribution of capital intensity and the contribution of labor composition amounted to 0.6 percent and 0.3 percent, respectively. Additionally, the growth in multifactor productivity of 0.5 percent contributed to an overall growth of output per hour of 1.4 percent. (See chart 2, table B.)

In 2014, annual labor productivity growth was less than half the average annual rate of change from 1987 to 2014 for the fourth consecutive year. The contributions of capital intensity and labor composition in the private nonfarm business sector in 2014 were little changed. The main component of the 0.8-percent increase in output per hour was the 0.8-percent increase in multifactor productivity. (See table B, table 1.)

The methodology for measuring preliminary multifactor productivity for 2014 is a simplified version of the methodology that BLS uses when more detailed data are available. Measures will be revised early in the next calendar year.

Chart 2. Percentage point contributions to growth in output per hour in the private nonfarm business sector, 1987-2014



Note: Multifactor productivity plus the contributions of capital intensity and labor composition may not sum to output per hour due to independent rounding.

Table A. Compound annual growth rates for productivity, output, and inputs in the private nonfarm business and private business sectors for selected periods, 1987-2014

Percent

	1987-2014	1987-1990	1990-1995	1995-2000	2000-2007	2007-2014	2013-2014
<u>Private nonfarm business¹</u>							
Productivity							
Multifactor Productivity ²	0.9	0.5	0.5	1.4	1.4	0.5	0.8
Output per hour of all persons	2.1	1.6	1.6	2.9	2.6	1.4	0.8
Output per unit of capital services	-0.4	-0.5	-0.4	-0.8	-0.4	-0.2	0.9
Output	2.9	3.3	3.0	5.0	2.8	1.3	3.1
Inputs							
Combined inputs ³	2.0	2.8	2.4	3.6	1.4	0.7	2.3
Labor Input ⁴	1.3	2.3	2.0	2.4	0.5	0.3	2.4
Hours	0.8	1.7	1.3	2.1	0.2	-0.2	2.2
Labor composition ⁵	0.5	0.6	0.7	0.3	0.3	0.5	0.2
Capital services	3.4	3.8	3.4	5.9	3.3	1.5	2.1
Analytic ratio							
Capital services per hour of all persons	2.5	2.1	2.0	3.7	3.1	1.6	-0.1
<u>Private business¹</u>							
Productivity							
Multifactor Productivity ²	1.0	0.6	0.5	1.6	1.4	0.5	0.6
Output per hour of all persons	2.1	1.7	1.6	3.0	2.7	1.4	0.6
Output per unit of capital services	-0.4	-0.5	-0.3	-0.6	-0.4	-0.2	0.8
Output	2.9	3.3	2.9	5.1	2.8	1.3	2.9
Inputs							
Combined inputs ³	1.9	2.7	2.4	3.4	1.4	0.7	2.3
Labor Input ⁴	1.2	2.1	2.1	2.3	0.5	0.3	2.4
Hours	0.8	1.5	1.4	2.0	0.1	-0.1	2.3
Labor composition ⁵	0.5	0.6	0.7	0.3	0.3	0.5	0.1
Capital services	3.3	3.8	3.2	5.7	3.2	1.4	2.1
Analytic ratio							
Capital services per hour of all persons	2.5	2.2	1.8	3.7	3.1	1.6	-0.2

1 Excludes government enterprises.

2 Output per combined units of labor input and capital services.

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. Compound annual growth rates in output per hour of all persons and the contribution of capital intensity, labor composition, and multifactor productivity in the private nonfarm business and private business sectors for selected periods, 1987-2014

Percent

	1987-2014	1987-1990	1990-1995	1995-2000	2000-2007	2007-2014	2013-2014
<u>Private nonfarm business¹</u>							
Output per hour of all persons	2.1	1.6	1.6	2.9	2.6	1.4	0.8
Contribution of capital intensity ²	0.8	0.7	0.7	1.2	1.0	0.6	0.0
Contribution of labor composition ³	0.3	0.4	0.4	0.2	0.2	0.3	0.1
Multifactor productivity ⁴	0.9	0.5	0.5	1.4	1.4	0.5	0.8
<u>Private business¹</u>							
Output per hour of all persons	2.1	1.7	1.6	3.0	2.7	1.4	0.6
Contribution of capital intensity ²	0.8	0.7	0.6	1.2	1.0	0.6	-0.1
Contribution of labor composition ³	0.3	0.4	0.5	0.2	0.2	0.3	0.1
Multifactor productivity ⁴	1.0	0.6	0.5	1.6	1.4	0.5	0.6

1 Excludes government enterprises.

2 Capital services per hour multiplied by capital's share of current dollar costs.

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

4 Output per combined units of labor input and capital services.

Note: Multifactor productivity plus the contributions of capital intensity and labor composition may not sum to output per hour due to independent rounding.

Technical Notes

The simplified methodology for preparing preliminary estimates of MFP is outlined in 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>. This methodology is applied to both the private nonfarm business and private business sectors and measures are calculated only for the most recent year. Data for all previous years are identical to the March 26, 2015 “Multifactor Productivity Trends” news release (USDL-15-0480).

Capital Services

Capital services are the services derived from the stock of physical assets and intellectual property assets. Capital services measures constructed for the preliminary MFP measures are based on less detail only for the most recent year. The preliminary measures consist of six 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 preliminary estimates 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 services are calculated by a chained superlative Tornqvist index combining stocks of the six asset categories, weighted by capital income shares.

Labor Input

Labor input in private business and private nonfarm business is obtained by chained superlative Tornqvist aggregation of the hours at work by all persons, 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 the efficiency of hours worked. The preliminary estimates of 2014 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 February 5, 2015 “Productivity and Costs” news release (USDL-14-0157).

Additional information concerning data sources and methods of measuring labor composition can be found in Cindy Zoghi, 2007, “Measuring Labor Composition: A Comparison of Alternate Methodologies” <http://www.bls.gov/bls/fesacp1121407.pdf> and in “Changes in the Composition of Labor for BLS Multifactor Productivity Measures, 2013” <http://www.bls.gov/mfp/mprlabor.pdf>.

Combined Inputs

Labor input and capital services are combined using chained superlative Tornqvist aggregation, applying weights that represent each component's 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 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 when the price of one factor is less than the other factor; there is a tendency for 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/mprdownload.htm>.

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. The private business sector accounted for approximately 74 percent of gross domestic product in 2013. Additionally, the private nonfarm business sector excludes farms from the private business sector, but includes agricultural services. Multifactor productivity measures exclude government enterprises, while the BLS Quarterly Productivity and Cost series include them. The output measures are based on the National Income and Product Accounts (NIPA) data released by the Bureau of Economic Analysis (BEA) on January 30, 2015 but do not reflect the revised data released by BEA on February 27, 2015. The preliminary estimates of 2015 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 February 5, 2015 “Productivity and Costs” news release (USD-15-0157).

Multifactor Productivity

Multifactor 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, multifactor 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 multifactor productivity indexes for private business and private nonfarm business are derived by dividing an output index by an index of capital services and labor input. The output indexes are computed as chained superlative indexes (Fisher Ideal indexes) of components of real output.

Table 1. Private nonfarm business sector: productivity and related measures for the 1987-2014¹ period

Annual percent change from previous year

Year	Productivity			Output ³	Inputs			Capital services per hour of all persons
	Output per hour of all persons	Output per unit of capital services	Multifactor Productivity ²		Labor Input ⁴	Capital Services ⁵	Combined units of labor input and capital services ⁶	
1988	1.7	0.7	1.0	4.6	3.5	3.8	3.6	0.9
1989	0.9	-0.3	0.1	3.7	3.4	4.1	3.6	1.2
1990	2.1	-1.8	0.4	1.5	0.0	3.5	1.1	4.0
1991	2.0	-3.5	-0.8	-0.5	-1.1	3.0	0.2	5.7
1992	4.3	1.5	2.5	4.1	1.0	2.5	1.5	2.7
1993	0.2	-0.1	-0.1	3.2	3.4	3.3	3.3	0.3
1994	1.0	1.0	0.7	4.7	4.1	3.6	4.0	0.0
1995	0.8	-0.8	0.3	3.6	2.6	4.4	3.2	1.6
1996	2.7	-0.2	1.5	4.6	2.1	4.8	3.0	2.9
1997	1.6	-0.2	0.7	5.3	4.1	5.5	4.5	1.8
1998	3.1	-0.8	1.7	5.3	2.4	6.2	3.6	4.0
1999	3.4	-1.0	1.7	5.6	2.5	6.7	3.8	4.4
2000	3.4	-2.0	1.5	4.4	1.1	6.5	2.8	5.5
2001	3.0	-3.7	0.5	0.9	-1.6	4.8	0.3	7.0
2002	4.3	-1.5	2.0	1.8	-1.8	3.3	-0.2	5.9
2003	3.5	0.4	2.3	3.2	-0.1	2.7	0.8	3.1
2004	3.0	2.0	2.7	4.5	1.3	2.5	1.7	1.0
2005	1.9	0.6	1.3	3.8	2.1	3.2	2.4	1.3
2006	0.9	-0.2	0.3	3.3	2.7	3.5	3.0	1.1
2007	1.7	-0.7	0.4	2.4	1.4	3.1	2.0	2.4
2008	0.8	-3.8	-1.3	-1.3	-1.4	2.6	0.0	4.8
2009	3.4	-4.9	-0.2	-4.1	-6.5	0.9	-3.9	8.8
2010	3.2	2.8	2.8	3.2	0.4	0.4	0.4	0.4
2011	0.0	1.1	0.0	2.2	2.9	1.1	2.3	-1.1
2012	0.9	1.8	0.8	3.3	3.0	1.5	2.4	-0.8
2013	0.9	1.0	0.9	2.7	1.8	1.7	1.8	-0.1
2014	0.8	0.9	0.8	3.1	2.4	2.1	2.3	-0.1

See footnotes following table 4.

Source: Bureau of Labor Statistics

Table 2. Private business sector: productivity and related measures for the 1987-2014¹ period

Annual percent change from previous year

Year	Productivity			Output ³	Inputs			Capital services per hour of all persons
	Output per hour of all persons	Output per unit of capital services	Multifactor Productivity ²		Labor Input ⁴	Capital Services ⁵	Combined units of labor input and capital services ⁶	
1988	1.5	0.3	0.7	4.3	3.4	4.0	3.6	1.2
1989	1.1	-0.2	0.3	3.9	3.3	4.0	3.5	1.3
1990	2.4	-1.6	0.7	1.6	-0.2	3.3	1.0	4.1
1991	1.9	-3.3	-0.8	-0.5	-1.0	2.9	0.3	5.4
1992	4.5	1.9	2.8	4.3	1.0	2.4	1.5	2.5
1993	0.2	-0.2	-0.2	3.0	3.1	3.1	3.1	0.4
1994	0.9	1.3	0.7	4.9	4.5	3.5	4.2	-0.5
1995	0.4	-0.9	0.0	3.2	2.6	4.1	3.1	1.4
1996	3.1	0.1	1.8	4.7	1.9	4.5	2.8	2.9
1997	1.9	0.1	0.9	5.3	3.9	5.3	4.4	1.8
1998	3.2	-0.8	1.6	5.2	2.2	6.0	3.5	4.0
1999	3.6	-0.8	1.9	5.6	2.3	6.5	3.6	4.4
2000	3.6	-1.7	1.7	4.5	1.1	6.3	2.8	5.3
2001	3.1	-3.7	0.6	0.8	-1.8	4.6	0.2	7.0
2002	4.2	-1.3	2.0	1.8	-1.8	3.1	-0.2	5.6
2003	3.7	0.6	2.5	3.2	-0.2	2.6	0.7	3.1
2004	3.1	2.0	2.8	4.5	1.2	2.5	1.7	1.2
2005	2.0	0.6	1.3	3.8	2.0	3.2	2.5	1.4
2006	1.0	-0.3	0.3	3.2	2.5	3.5	2.9	1.2
2007	1.5	-0.8	0.3	2.2	1.3	3.0	1.9	2.3
2008	0.8	-3.6	-1.2	-1.2	-1.3	2.5	0.0	4.5
2009	3.5	-4.6	0.0	-3.9	-6.5	0.7	-3.9	8.5
2010	3.2	2.8	2.7	3.2	0.5	0.4	0.5	0.4
2011	-0.1	0.9	-0.1	2.1	2.9	1.3	2.3	-0.9
2012	0.8	1.6	0.7	3.2	2.9	1.5	2.4	-0.8
2013	1.2	1.2	1.1	2.9	1.7	1.7	1.7	0.0
2014	0.6	0.8	0.6	2.9	2.4	2.1	2.3	-0.2

See footnotes following table 4.

Source: Bureau of Labor Statistics

Table 3. Private nonfarm business sector: indexes of productivity and related measures, 1987-2014¹

Indexes 2009=100

Year	Productivity			Output ³	Inputs			Capital services per hour of all persons
	Output per hour of all persons	Output per unit of capital services	Multifactor Productivity ²		Labor Input ⁴	Capital Services ⁵	Combined units of labor input and capital services ⁶	
1987	61.2	121.7	82.6	53.4	78.5	43.8	64.6	50.3
1988	62.2	122.6	83.4	55.8	81.2	45.5	66.9	50.7
1989	62.7	122.2	83.5	57.9	84.0	47.4	69.3	51.3
1990	64.1	119.9	83.8	58.8	83.9	49.0	70.1	53.4
1991	65.3	115.7	83.2	58.4	83.0	50.5	70.3	56.4
1992	68.1	117.5	85.3	60.8	83.9	51.8	71.3	58.0
1993	68.3	117.4	85.2	62.8	86.7	53.5	73.7	58.1
1994	69.0	118.6	85.8	65.7	90.3	55.4	76.6	58.1
1995	69.5	117.7	86.1	68.1	92.7	57.8	79.1	59.0
1996	71.4	117.5	87.3	71.2	94.6	60.6	81.5	60.8
1997	72.6	117.3	87.9	74.9	98.5	63.9	85.2	61.9
1998	74.9	116.3	89.4	78.9	100.8	67.9	88.3	64.4
1999	77.4	115.1	90.9	83.3	103.4	72.4	91.7	67.2
2000	80.0	112.8	92.3	87.0	104.5	77.1	94.2	70.9
2001	82.5	108.6	92.8	87.7	102.8	80.7	94.5	75.9
2002	86.0	107.0	94.7	89.3	100.9	83.4	94.3	80.4
2003	89.1	107.5	96.9	92.1	100.8	85.7	95.1	82.8
2004	91.7	109.6	99.5	96.2	102.1	87.8	96.7	83.7
2005	93.5	110.3	100.9	99.9	104.2	90.6	99.0	84.8
2006	94.3	110.1	101.2	103.2	107.0	93.7	102.0	85.7
2007	95.9	109.4	101.6	105.6	108.5	96.6	104.0	87.7
2008	96.7	105.2	100.2	104.3	106.9	99.1	104.0	91.9
2009	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2010	103.2	102.8	102.8	103.2	100.4	100.4	100.4	100.4
2011	103.2	103.9	102.8	105.5	103.3	101.5	102.7	99.3
2012	104.2	105.8	103.7	109.0	106.4	103.1	105.2	98.5
2013	105.1	106.8	104.6	111.9	108.4	104.8	107.0	98.4
2014	105.9	107.8	105.4	115.4	111.0	107.1	109.5	98.3

See footnotes following table 4.

Source: Bureau of Labor Statistics

Table 4. Private business sector: indexes of productivity and related measures, 1987-2014¹

Indexes 2009=100

Year	Productivity			Output ³	Inputs			Capital services per hour of all persons
	Output per hour of all persons	Output per unit of capital services	Multifactor Productivity ²		Labor Input ⁴	Capital Services ⁵	Combined units of labor input and capital services ⁶	
1987	60.3	118.6	81.4	53.3	79.5	44.9	65.4	50.9
1988	61.3	119.0	82.0	55.6	82.2	46.7	67.8	51.5
1989	62.0	118.8	82.3	57.7	84.8	48.6	70.2	52.2
1990	63.5	116.9	82.8	58.7	84.6	50.2	70.8	54.3
1991	64.7	113.0	82.1	58.3	83.8	51.6	71.1	57.2
1992	67.6	115.1	84.4	60.8	84.7	52.8	72.1	58.7
1993	67.7	114.9	84.2	62.6	87.3	54.5	74.4	58.9
1994	68.3	116.5	84.8	65.7	91.3	56.4	77.5	58.6
1995	68.6	115.4	84.8	67.8	93.7	58.8	79.9	59.4
1996	70.7	115.6	86.4	71.0	95.5	61.4	82.2	61.2
1997	72.0	115.6	87.2	74.8	99.3	64.7	85.8	62.3
1998	74.3	114.7	88.6	78.7	101.5	68.6	88.8	64.8
1999	77.0	113.8	90.3	83.1	103.8	73.0	92.0	67.6
2000	79.7	111.9	91.8	86.8	105.0	77.6	94.6	71.2
2001	82.2	107.8	92.3	87.5	103.1	81.2	94.8	76.2
2002	85.7	106.4	94.2	89.1	101.2	83.7	94.5	80.5
2003	88.8	107.1	96.6	91.9	101.0	85.9	95.2	83.0
2004	91.6	109.2	99.3	96.1	102.3	88.0	96.8	83.9
2005	93.4	109.8	100.6	99.8	104.4	90.9	99.2	85.1
2006	94.3	109.5	101.0	103.1	107.0	94.1	102.1	86.1
2007	95.8	108.7	101.2	105.3	108.4	96.9	104.0	88.1
2008	96.6	104.8	100.0	104.1	106.9	99.3	104.0	92.1
2009	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2010	103.2	102.8	102.7	103.2	100.5	100.4	100.5	100.4
2011	103.1	103.7	102.6	105.4	103.4	101.6	102.8	99.4
2012	103.9	105.4	103.3	108.7	106.5	103.2	105.2	98.7
2013	105.2	106.6	104.5	111.8	108.3	104.9	107.0	98.7
2014	105.8	107.4	105.2	115.1	111.0	107.1	109.5	98.4

See footnotes following table 4.

Source: Bureau of Labor Statistics

Footnotes, Tables 1-4

Source: The Bureau of Labor Statistics (BLS) develops productivity measures using output and compensation data published by the Bureau of Economic Analysis (BEA), hours data published by other BLS programs, and capital data supplied by BEA and U.S. Department of Agriculture. Also see Technical Notes in this release.

- (1) The private business sector covers gross domestic product with the exception of the output of general government, government enterprises, non-profit institutions, the rental value of owner-occupied real estate, and the output of paid employees of private households. The private nonfarm business sector further excludes farms but includes agricultural services.
- (2) Output per combined units of labor input and capital services.
- (3) Gross domestic product originating in the sector, chained superlative index.
- (4) Index of hours at work of all persons including employees, proprietors, and unpaid family workers, classified by age, education, and gender. This chained superlative index is computed by combining changes in the hours of each age, education, and gender group weighted by each group's share of total wages.
- (5) A measure of the flow of capital services used in the sector. Capital services measure the services derived from the stock of physical assets and intellectual property assets.
- (6) The growth rates of labor input and capital services are combined using their respective shares of current dollar costs as weights, and aggregating into a chained superlative index.