**Contribution (1987-2016) and Stocks (1960-2016) of Research and Development (R&D)**

Labor productivity, or output per hour, is calculated by dividing an index of real value added output by an index of hours worked by all persons. In contrast, multifactor productivity (MFP) is derived by dividing an index of real value added output by an index of combined inputs of capital services and labor input. The BLS quarterly measures of labor productivity include government enterprises, and so are called "nonfarm business sector", and the annual MFP measures exclude government enterprises and so are called the "private nonfarm business sector".

Tables 1 and 1A show the year-to year contribution to private nonfarm business sector and nonfarm business sector labor productivity respectively. Tables 2 and 2A show the long-term contribution of Research and Development (R&D) to multifactor productivity (MFP) growth and labor productivity growth respectively. The only difference between table 1, table 1A, table 2 and table 2A is the output data used. Tables 1 and 2 use real value added data prepared by the major sector multifactor program. Tables 1A and 2A instead use nonfarm business sector real value added data from the Bureau of Economic Analysis (BEA). These tables also show growth rates of their corresponding productivity measures.

Table 3 shows R&D stocks. The stock of R&D in the private nonfarm business sector is prepared by cumulating constant dollar measures of research and development expenditures and by 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. The BLS develops price deflators and estimates rate of depreciation.

Bureau of Labor Statistics (BLS) estimates of R&D spillover stocks are designed to measure the benefits of R&D that spill over from the original investors to other firms.[1] The Bureau of Economic Analysis (BEA) of the Department of Commerce 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. In contrast to the BLS concept, the BEA measures the value of R&D investment as an asset to its owners, the private firms, government, or colleges and universities which finance and conduct research; spillover effects are not included. In terms of coverage, BEA includes R&D financed by private firms, government, colleges and universities, and non-profit institutions, whereas the BLS considers only R&D financed by private firms.

Because of these differences in concept and coverage, the BEA and BLS R&D stocks utilize different lags[2] and rates of depreciation, and report different magnitudes for the U.S. national R&D stock. BLS stocks are larger because spillovers, associated with the diffusion of knowledge, typically take more time to occur, and therefore depreciate more slowly. Section I of

[1] U.S. Department of Labor, Bureau of Labor Statistics, Bulletin 2331, The Impact of Research and Development on Productivity Growth, available on request, reports the methodology underlying Bureau of Labor Statistics R&D stocks.

[2] Lags refer to the period of time between an investment in R&D and its ability to contribute to production. R&D stocks often incorporate a lag before R&D is assumed to affect production.

the BLS Working Paper 408, at http://www.bls.gov/ore/pdf/ec070070.pdf, contains a further discussion of differences between the BLS and BEA concepts.

Users of R&D data should view the BEA and BLS measures as complementary, since asset and spillover effects both have to be taken into account to describe the total effect of R&D on the economy. The BEA stocks provide information on how much value R&D stocks bring to their owners who hold R&D as an asset. The BLS data show how much R&D spills over to create value for other firms in the economy. Since R&D brings both direct benefits to holders of R&D and indirect benefits to other firms who eventually utilize this same knowledge, both elements have to be included to understand the total impact of R&D.

Further description of these data and methods can be found in BLS Bulletin 2331, *The Impact of Research and Development on Productivity Growth* (September 1989). Copies can be obtained by sending an email or calling:


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Table 1. Contribution of Research and Development to Multifactor Productivity: 1987-2016
(percent per year)

| Year | R&D contribution | Multifactor Productivity Growth Rate |
|---|---|---|
| 1987 | 0.25 | N.A. |
| 1988 | 0.23 | 1.1 |
| 1989 | 0.20 | 0.0 |
| 1990 | 0.21 | 0.3 |
| 1991 | 0.24 | -0.7 |
| 1992 | 0.26 | 3.0 |
| 1993 | 0.26 | -0.5 |
| 1994 | 0.24 | 0.5 |
| 1995 | 0.20 | 0.0 |
| 1996 | 0.20 | 1.1 |
| 1997 | 0.23 | 0.9 |
| 1998 | 0.25 | 1.5 |
| 1999 | 0.26 | 1.8 |
| 2000 | 0.28 | 1.3 |
| 2001 | 0.31 | 0.5 |
| 2002 | 0.35 | 2.0 |
| 2003 | 0.28 | 2.1 |
| 2004 | 0.22 | 2.6 |
| 2005 | 0.20 | 1.5 |
| 2006 | 0.18 | 0.3 |
| 2007 | 0.19 | 0.5 |
| 2008 | 0.21 | -1.3 |
| 2009 | 0.23 | -0.4 |
| 2010 | 0.15 | 3.3 |
| 2011 | 0.10 | 0.2 |
| 2012 | 0.08 | 0.9 |
| 2013 | 0.11 | 0.1 |
| 2014 | 0.11 | 1.0 |
| 2015 | 0.13 | 0.9 |
| 2016 | 0.14 | -0.6 |

Data are based on the results discussed in Multifactor Productivity Trends, March 21, 2018

Table 1A. Contribution of Research and Development to Labor Productivity: 1987-2016
(percent per year)

| Year | R&D contribution | Labor Productivity Growth Rate |
|---|---|---|
| 1987 | 0.24 | 0.5 |
| 1988 | 0.22 | 1.6 |
| 1989 | 0.20 | 0.9 |
| 1990 | 0.20 | 1.7 |
| 1991 | 0.23 | 1.7 |
| 1992 | 0.25 | 4.5 |
| 1993 | 0.25 | 0.1 |
| 1994 | 0.23 | 0.8 |
| 1995 | 0.19 | 1.1 |
| 1996 | 0.19 | 2.1 |
| 1997 | 0.23 | 2.0 |
| 1998 | 0.25 | 3.0 |
| 1999 | 0.26 | 3.7 |
| 2000 | 0.27 | 3.0 |
| 2001 | 0.30 | 2.7 |
| 2002 | 0.34 | 4.4 |
| 2003 | 0.27 | 3.7 |
| 2004 | 0.21 | 3.1 |
| 2005 | 0.19 | 2.1 |
| 2006 | 0.17 | 0.9 |
| 2007 | 0.18 | 1.6 |
| 2008 | 0.21 | 0.8 |
| 2009 | 0.23 | 3.1 |
| 2010 | 0.14 | 3.3 |
| 2011 | 0.10 | 0.1 |
| 2012 | 0.07 | 0.9 |
| 2013 | 0.11 | 0.3 |
| 2014 | 0.11 | 1.0 |
| 2015 | 0.12 | 1.3 |
| 2016 | 0.13 | -0.1 |

Data are based on the results discussed in Productivity and Costs, February 1, 2018

Table 2. Long-term Contribution of Research and Development to Multifactor Productivity: 1987-2016 (percent)

| Period | R&D Contribution | Multifactor Productivity Growth Rate |
|---|---|---|
| 1987-2016 | 0.21 | 0.8 |
| 1987-1990 | 0.21 | 0.5 |
| 1990-1995 | 0.24 | 0.4 |
| 1995-2000 | 0.25 | 1.3 |
| 2000-2007 | 0.25 | 1.4 |
| 2007-2016 | 0.14 | 0.4 |
| 2015-2016 | 0.14 | -0.6 |

Data are based on the results discussed in Multifactor Productivity Trends, March 21, 2018

Table 2A. Long-term Contribution of Research and Development to Labor Productivity: 1987-2016 (percent)

| Period | R&D Contribution | Labor Productivity Growth Rate |
|---|---|---|
| 1987-2016 | 0.20 | 1.9 |
| 1987-1990 | 0.21 | 1.4 |
| 1990-1995 | 0.23 | 1.6 |
| 1995-2000 | 0.24 | 2.8 |
| 2000-2007 | 0.24 | 2.6 |
| 2007-2016 | 0.14 | 1.2 |
| 2015-2016 | 0.13 | -0.1 |

Data are based on the results discussed in Productivity and Costs, February 1, 2018

Table 3. Research and Development Stocks: 1960-2016
(in billions of 2009 dollars)
((1) plus (2) equals (3))

| Year | Basic Research | Applied Research | Total R&D Stocks |
|---|---|---|---|
| | (1) | (2) | (3) |
| 1960 | 12.8 | 106.9 | 119.7 |
| 1965 | 21.3 | 173.4 | 194.7 |
| 1970 | 33.5 | 258.9 | 292.4 |
| 1975 | 46.8 | 346.6 | 393.4 |
| 1978 | 54.0 | 393.5 | 447.5 |
| 1980 | 58.8 | 428.1 | 486.9 |
| 1983 | 66.4 | 498.6 | 565.0 |
| 1984 | 69.3 | 526.4 | 595.7 |
| 1987 | 79.4 | 636.2 | 715.6 |
| 1988 | 83.5 | 673.4 | 757.0 |
| 1989 | 88.4 | 707.0 | 795.4 |
| 1990 | 93.7 | 742.8 | 836.5 |
| 1991 | 101.0 | 782.6 | 883.7 |
| 1992 | 108.5 | 827.2 | 935.6 |
| 1993 | 115.6 | 873.3 | 988.9 |
| 1994 | 123.2 | 917.0 | 1040.2 |
| 1995 | 130.6 | 954.2 | 1084.8 |
| 1996 | 141.4 | 989.4 | 1130.8 |
| 1997 | 151.6 | 1036.4 | 1187.9 |
| 1998 | 161.9 | 1091.5 | 1253.4 |
| 1999 | 172.3 | 1152.7 | 1324.9 |
| 2000 | 181.7 | 1223.6 | 1405.2 |
| 2001 | 193.1 | 1302.8 | 1495.9 |
| 2002 | 207.2 | 1391.6 | 1598.7 |
| 2003 | 215.9 | 1468.5 | 1684.4 |
| 2004 | 225.4 | 1527.0 | 1752.4 |
| 2005 | 235.5 | 1581.4 | 1816.9 |
| 2006 | 246.7 | 1630.9 | 1877.6 |
| 2007 | 257.1 | 1686.0 | 1943.1 |
| 2008 | 267.5 | 1750.6 | 2018.2 |
| 2009 | 277.6 | 1820.7 | 2098.3 |
| 2010 | 288.4 | 1859.5 | 2147.8 |
| 2011 | 298.4 | 1884.2 | 2182.6 |
| 2012 | 310.0 | 1899.8 | 2209.8 |
| 2013 | 322.8 | 1928.7 | 2251.4 |
| 2014 | 337.5 | 1956.0 | 2293.4 |
| 2015 | 352.9 | 1990.0 | 2343.0 |
| 2016 | 365.6 | 2032.1 | 2397.6 |

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