

## **Research and Development Contributions and Stocks in the Total Economy: 1987-2014**

Table 1 shows the year-to-year contributions of private, public, and total research and development (R&D) to productivity growth in the total economy. Table 2 reports the long-term R&D contributions to the total economy. Table 3 reports private, public, and total R&D stocks and Table 4 further breaks down into private and public basic and applied R&D stocks in the total economy.

Research is divided into two categories – applied and basic research. Applied research refers to the research performed in any organization with an objective of understanding or gaining knowledge in order to fulfill a specified need. Applied research involves explorations to discover new scientific knowledge that has specified objectives with respect to products or processes. Basic research refers to the research performed in any organization with the objective of gaining knowledge or understanding of a subject. Development refers to the application of the knowledge obtained from research performed with an objective of producing materials, devices, systems, or methods.

Private and public R&D contributions and stocks are measured for the total economy from 1987 to 2014. R&D stocks in the total economy are obtained by cumulating constant dollar measures of research and development expenditures and allowing for depreciation. The same lags and depreciation used in determining R&D stocks in the private nonfarm business sector are also used in calculations for the total economy. The rate of return for public R&D tends to be lower than that of private R&D because some of the public research is either not relevant to commercial matters or has very low returns. Because some of the university or government research is not oriented towards economic growth or does not appear in measures of growth,<sup>1</sup> a ten percent rate of return is assumed for public R&D even though a thirty percent rate of return is assumed for private R&D. “Public R&D and Productivity Growth” by Leo Sveikauskas at <http://www.bls.gov/mfp/publicrd.pdf> includes more information on how these rates are determined. Current dollar expenditures for publicly and privately financed research and development for the years 1987-2014 are obtained from annual issues of Research and Development in Industry published by the National Science Foundation. Price deflators for the

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<sup>1</sup> For example research done by the National Institute of Health (NIH).

total economy are based upon the hourly compensation and implicit price deflators for the private nonfarm business sector prepared by the Division of Major Sector Productivity.

The main difference between R&D stocks for the total economy and the R&D stocks published by the Bureau of Economic Analysis (BEA) is as follows: the stocks calculated in this document are designed to measure the benefits of R&D, which spill over from the original investors to other firms, while the R&D measures published by the BEA are the value of R&D stocks as an asset to the owners; the private firms, government, colleges and universities which finance and conduct research. The BEA measures do not include spillover effects. R&D estimates for the total economy, including those reported here and their counterparts at the BEA, include R&D financed by private firms, government, colleges and universities and nonprofit institutions.

Because of the above discussed differences in concepts and coverage the BEA and BLS R&D stocks use different lags<sup>2</sup> and rates of depreciation, and report different magnitudes for the U.S. national R&D stock. BLS stocks are larger as spillovers, associated with the diffusion of knowledge, typically take more time to take place, and therefore depreciate more slowly.<sup>3</sup> Conceptual differences between BLS and BEA are discussed in section I of BLS working paper 408, at <http://www.bls.gov/ore/pdf/ec070070.pdf>.

The R&D contributions and stocks<sup>4</sup> to the productivity growth in the total economy are greater than those of the private nonfarm business sector. The differences in the R&D stocks between the total economy and the private nonfarm business sector are to be expected since the former includes public R&D expenditure data.

Further description of these data and methods can be found in the 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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<sup>2</sup> 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.

<sup>3</sup> In addition, differences in the R&D deflator also have an important influence upon differences between the BLS and BEA R&D stocks. The BEA discusses the R&D deflator in “BEA’s 2006 Research and Development Satellite Account” in the December 2006 Survey of Current Business.

<sup>4</sup> Reflect the Total Economy Production Accounts data as of March 24, 2016.

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Table 1. Contribution of Private and Public R&D to Productivity Growth in the Total Economy: 1987-2014  
(in percent)

((1) plus (2) equals (3))

Year	Private R&D	Public R&D	Total R&D
	(1)	(2)	(3)
1987	0.16	0.06	0.21
1988	0.14	0.05	0.20
1989	0.12	0.05	0.18
1990	0.13	0.05	0.18
1991	0.15	0.05	0.20
1992	0.16	0.05	0.21
1993	0.16	0.04	0.20
1994	0.15	0.04	0.19
1995	0.13	0.03	0.16
1996	0.12	0.03	0.16
1997	0.15	0.03	0.18
1998	0.16	0.03	0.20
1999	0.17	0.03	0.20
2000	0.19	0.03	0.22
2001	0.21	0.03	0.24
2002	0.23	0.03	0.26
2003	0.19	0.04	0.22
2004	0.14	0.04	0.18
2005	0.13	0.04	0.17
2006	0.12	0.05	0.16
2007	0.12	0.05	0.17
2008	0.14	0.05	0.19
2009	0.15	0.05	0.21
2010	0.11	0.07	0.18
2011	0.07	0.07	0.14
2012	0.06	0.07	0.12
2013	0.08	0.06	0.14
2014	0.08	0.06	0.14

Table 2. Long-term Contribution of Private and Public R&D to Productivity Growth in the Total Economy: 1987-2014  
 (average annual percent change)  
 ((1) plus (2) equals (3))

Period	Private R&D	Public <sup>1</sup> R&D	Total R&D
	(1)	(2)	(3)
1987-2014	0.14	0.05	0.19
1987-1990	0.13	0.05	0.18
1990-1995	0.15	0.04	0.19
1995-2000	0.16	0.03	0.19
2000-2007	0.16	0.04	0.20
2007-2014	0.10	0.06	0.16

<sup>1</sup> Based on a ten percent rate of return.

Table 3. Private and Public R&D Stocks in the Total Economy: 1987-2014  
(in Billions of 2009 dollars)

((1) plus (2) equals (3))

Year	Private R&D Stocks	Public R&D Stocks	Total R&D Stocks
	(1)	(2)	(3)
1987	713.3	1086.6	1799.9
1988	754.6	1134.6	1889.2
1989	792.9	1186.3	1979.1
1990	833.9	1236.0	2069.9
1991	880.9	1282.9	2163.8
1992	932.6	1327.7	2260.3
1993	985.5	1367.9	2353.4
1994	1036.6	1406.4	2443.0
1995	1080.9	1442.9	2523.8
1996	1126.6	1479.8	2606.4
1997	1183.6	1518.8	2702.4
1998	1248.5	1557.4	2805.9
1999	1319.7	1596.8	2916.6
2000	1399.9	1636.9	3036.8
2001	1491.2	1678.0	3169.2
2002	1595.1	1719.3	3314.4
2003	1682.0	1770.4	3452.4
2004	1751.1	1830.5	3581.7
2005	1816.6	1898.0	3714.6
2006	1878.1	1970.6	3848.7
2007	1944.1	2048.6	3992.7
2008	2019.5	2130.3	4149.8
2009	2099.9	2213.9	4313.9
2010	2156.4	2330.0	4486.3
2011	2194.0	2443.5	4637.5
2012	2224.6	2556.2	4780.8
2013	2269.5	2662.7	4932.2
2014	2316.3	2760.0	5076.2

Table 4. Basic and Applied Private and Public R&D Stocks in the Total Economy: 1987-2014  
(in Billions of 2009 dollars)

Year	Private R&D Stocks		Public R&D Stocks	
	Basic R&D Stocks	Applied R&D Stocks	Basic R&D Stocks	Applied R&D Stocks
1987	79.1	634.2	330.5	756.0
1988	83.3	671.3	349.4	785.2
1989	88.1	704.7	369.6	816.7
1990	93.4	740.5	391.1	844.9
1991	100.7	780.2	414.1	868.8
1992	108.1	824.5	438.6	889.1
1993	115.2	870.2	464.5	903.4
1994	122.8	913.7	492.3	914.1
1995	130.2	950.7	520.9	922.0
1996	140.9	985.6	551.0	928.8
1997	151.1	1032.5	581.2	937.6
1998	161.3	1087.2	612.2	945.2
1999	171.7	1148.1	643.8	953.0
2000	181.1	1218.9	675.8	961.1
2001	192.4	1298.8	709.4	968.6
2002	206.5	1388.7	745.1	974.2
2003	215.2	1466.8	782.9	987.6
2004	224.8	1526.4	823.2	1007.3
2005	234.9	1581.7	865.9	1032.1
2006	246.3	1631.8	912.4	1058.2
2007	256.7	1687.4	964.2	1084.4
2008	267.3	1752.2	1019.4	1110.9
2009	277.4	1822.5	1075.2	1138.8
2010	288.3	1868.1	1132.0	1197.9
2011	298.4	1895.6	1189.5	1253.9
2012	310.1	1914.5	1246.9	1309.3
2013	323.3	1946.2	1305.2	1357.5
2014	338.4	1977.9	1363.9	1396.1

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