

## **Research and Development Contributions and Stocks in the Total Economy: 1987-2010**

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 research and development (R&D) contributions and stocks are measured for the total economy from 1987 to 2010. 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.

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

Current dollar expenditures for publicly and privately financed research and development for the years 1987-2010 are obtained from annual issues of Research and Development in Industry published by the National Science Foundation. Price deflators for the 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) in the December 2006 and October 2007 issues of the *Survey of Current Business* 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. In contrast, the measures prepared 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. For instance, the BEA reported that in 2007 the R&D stock was \$1,828 billion, of which R&D financed by private firms was \$1,183 billion.<sup>3</sup> In contrast, in 2007 the BLS R&D stock, which then measured the R&D of private firms, was \$1,775 billion. R&D stock for the total economy in 2007 was \$3,638.8 billion. 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>4</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>.

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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> *Survey of Current Business*, December 2010, Table 2.4, page 36. All stocks mentioned here are in 2005 dollars.

<sup>4</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.

The R&D contributions and stocks<sup>5</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<sup>6</sup> 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>5</sup> Reflect the Total Economy Production Accounts data as of April 30, 2012.

<sup>6</sup> Total R&D stock in the private nonfarm business sector for the year 2010 was \$1980 billion. Whereas, the total R&D stock in the total economy for the same year was \$ 4065.6 billion.

Table 1. Contribution of Private and Public R&D to Productivity Growth in the Total Economy: 1987-2010

(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	0.22
1988	0.15	0.05	0.20
1989	0.13	0.06	0.19
1990	0.14	0.05	0.19
1991	0.15	0.05	0.20
1992	0.16	0.05	0.21
1993	0.17	0.04	0.21
1994	0.16	0.04	0.20
1995	0.13	0.03	0.17
1996	0.13	0.03	0.16
1997	0.16	0.03	0.19
1998	0.17	0.03	0.20
1999	0.18	0.03	0.21
2000	0.19	0.03	0.23
2001	0.21	0.03	0.24
2002	0.24	0.03	0.27
2003	0.19	0.04	0.23
2004	0.15	0.04	0.19
2005	0.13	0.04	0.17
2006	0.12	0.04	0.16
2007	0.12	0.05	0.17
2008	0.14	0.05	0.19
2009	0.15	0.05	0.20
2010	0.14	0.06	0.20

Table 2. Long-term Contribution of Private and Public R&D to Productivity Growth in the Total Economy: 1987-2010  
 (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)
1987-2010	0.16	0.04	0.20
1987-1990	0.14	0.05	0.19
1990-1995	0.15	0.04	0.20
1995-2000	0.17	0.03	0.20
2000-2007	0.17	0.04	0.20
2007-2010	0.16	0.04	0.20

<sup>1</sup>Based on a ten percent rate of return. With a 15 percent rate of return, public R&D contribution for 1987-2010 would have been 0.06 percent.

Table 3. Private and Public R&D Stocks in the Total Economy: 1987-2010  
(in Billions of 2005 dollars)  
((1) plus (2) equals (3))

Year	Private R&D Stocks (1)	Public R&D Stocks (2)	Total R&D Stocks (3)
1987	650.8	990.6	1641.4
1988	688.6	1034.6	1723.2
1989	723.8	1081.9	1805.7
1990	761.8	1127.8	1889.6
1991	805.3	1171.2	1976.5
1992	853.1	1212.7	2065.8
1993	901.8	1249.8	2151.7
1994	949.1	1285.6	2234.8
1995	990.0	1319.3	2309.3
1996	1031.7	1353.1	2384.8
1997	1083.8	1388.8	2472.6
1998	1143.5	1424.5	2568.0
1999	1209.3	1460.9	2670.2
2000	1283.0	1497.8	2780.8
2001	1367.1	1535.4	2902.5
2002	1462.6	1572.5	3035.1
2003	1541.8	1619.4	3161.2
2004	1604.1	1673.4	3277.5
2005	1661.6	1732.2	3393.8
2006	1716.4	1796.0	3512.5
2007	1774.9	1863.9	3638.8
2008	1841.6	1933.5	3775.1
2009	1912.9	2004.8	3917.8
2010	1981.2	2084.5	4065.6

Table 4. Basic and Applied Private and Public R&D Stocks in the Total Economy: 1987-2010  
(in Billions of 2005 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	73.9	576.9	302.7	688.0
1988	77.7	610.9	319.8	714.8
1989	82.1	641.7	338.1	743.8
1990	86.9	674.8	357.7	770.1
1991	93.6	711.7	378.8	792.4
1992	100.3	752.8	401.1	811.6
1993	106.9	795.0	424.8	825.0
1994	113.8	835.3	450.4	835.3
1995	120.6	869.4	476.6	842.7
1996	130.5	901.2	504.1	849.0
1997	139.7	944.0	531.9	856.9
1998	149.1	994.4	560.3	864.2
1999	158.6	1050.7	589.2	871.7
2000	167.2	1115.8	618.4	879.4
2001	177.6	1189.5	649.2	886.2
2002	190.5	1272.2	682.0	890.5
2003	198.5	1343.3	716.7	902.8
2004	207.3	1396.8	753.7	919.7
2005	216.6	1445.0	792.9	939.3
2006	227.0	1489.5	835.5	960.6
2007	236.5	1538.4	882.1	981.8
2008	246.0	1595.6	930.5	1003.0
2009	255.1	1657.8	979.5	1025.4
2010	264.9	1716.3	1029.4	1055.1

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