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# R&D Recognized as Investment in U.S. GDP Statistics: GDP Increase Slightly Lowers R&D-to-GDP Ratio

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Expenditures for research and development are now capitalized—incorporated as investment—in the U.S. gross domestic product (GDP) and other national income and product accounts (NIPAs) produced and published by the Bureau of Economic Analysis (BEA). R&D investment is presented in the NIPAs in a new asset category called "intellectual property products," or intangible assets, along with software and entertainment, literary, and artistic originals. Data on R&D expenditures are based on statistics from the National Science Foundation's (NSF's) National Center for Science and Engineering Statistics (NCSES), which also collaborated in developing the methodology for using R&D expenditure statistics in NIPAs.

Before R&D expenditures were capitalized, BEA estimates treated private sector R&D expenses as an intermediate cost of production and netted out these expenses in the value-added calculations defining GDP. Also, at that time, expenditures for R&D by governments and certain nonprofit institutions were included in the consumption expenditures component of GDP, but they were not separately identified.

The new BEA treatment considers R&D as investment in all sectors of the economy. As described below, investment measures are designed to capture the value of R&D, not the current costs of R&D as in NSF measures of R&D expenditures. Thus conceptual and measurement differences exist when using R&D statistics as an expenditure versus investment within economic accounts.

## BEA's Comprehensive GDP Revisions

The change in the treatment of R&D was part of the 2013 comprehensive revision of the NIPAs, the 2014 comprehensive revision of the industry economic accounts (IEAs), and the 2014 comprehensive revision of gross domestic product by state,[2] all of which included other methodological changes in addition to the treatment of intangible assets. On average, the net result from these changes increased GDP levels. The long-run GDP growth rates are similar to those in previously published estimates. BEA updated all historical GDP and related statistics going back to 1929. Quarterly and annual GDP estimates since the July 2013 release follow the new methodology. For changes in the national and industry accounts and changes in GDP by state, see Kornfeld 2013; Rassier 2014; and Broda and Tate 2014.

The 2013 comprehensive revisions of the NIPAs, IEAs, and GDP by state are consistent with the most recent international guidelines for the compilation of economic accounts, the 2008 System of National Accounts (SNA) manual (United Nations et al. 2009). Those guidelines explicitly stated—for the first time—that expenditures on R&D should be recorded as capital formation, or as investment. Including R&D investment as part of GDP is also consistent with theoretical and empirical studies documenting the long-term contribution of R&D and technological change to economic and productivity growth (Corrado et al. 2005; Jorgenson et al. 2006).

## BEA's Estimates of R&D Investment

Consistent with the 2008 SNA, BEA estimates of R&D investment across all sectors of the economy have two components: own-account R&D (funded and performed internally) and purchased R&D.[3] Own-account R&D is estimated as the sum of the input

costs used to produce the R&D plus the depreciation for the physical fixed investment used in producing R&D. The value of purchased R&D includes profits, the seller's margin above costs.

Published BEA estimates of R&D investment in all sectors excludes R&D devoted to software applications (henceforth called software R&D) to avoid double counting. Software R&D is already part of software investment. BEA also accounts for imports and exports of R&D within its investment numbers. For further details on R&D investment methodology see BEA 2013; Kornfeld 2013; Rassier 2014; Crawford et al. 2014.

## NSF-BEA Collaboration

### *R&D Satellite Accounts*

NSF's NCSES supported experimental R&D "satellite accounts" at BEA before R&D investment was fully incorporated into the core NIPAs. Satellite accounts provide a means of exploring the impact of adjusting the treatment of GDP components, and they provide a framework to examine conceptual and measurement issues. Work undertaken through several versions of R&D satellite accounts allowed the two agencies to develop R&D capitalization methodologies with input from internal and external experts.[4] BEA released R&D satellite account statistics in several publications, the last of which covered data for 1959–2007 (BEA 2006; Robbins and Moylan 2007; Lee and Schmidt 2010).[5]

### *Data Development Collaboration*

NSF R&D statistics are the primary data source for BEA estimates of R&D investment (see Data Sources and Availability). NSF R&D statistics are collected from an expenditure, or current cost, perspective, generally consistent with international reporting standards as detailed in the Frascati Manual guidelines (OECD 2002). Before estimating R&D investment, BEA performs certain data adjustments to NSF cost-based statistics. For example, NSF R&D data collected for the university sector need to be further distributed into private nonprofit and state government sectors of the NIPAs (table 1).[6]

BEA and NSF's NCSES collaborated in developing the methodology to use R&D expenditure statistics for NIPA purposes. One area of collaboration involved developing questions used in several surveys so additional details could be obtained on software R&D. This information allowed for necessary calculations to avoid the double counting noted earlier when capitalizing both software and R&D. The resulting R&D investment methodology and survey enhancements were discussed at several domestic and international forums on official statistics (R&D and national accounts) and on economic growth research. Additional survey questions on types of costs statistics were also developed for the Business R&D and Innovation Survey (BRDIS) and the Higher Education Research and Development Survey (HERD).

To help BEA estimate depreciation rates for R&D asset types, the 2010 BRDIS collected information regarding how long R&D results generated revenue. BEA used the responses from these questions to estimate depreciation rates and services lives for various types of R&D assets.[7]

TABLE 1. NIPA's use of NSF's R&D performer surveys, by NIPA sector

| NIPA sector (BEA) | R&D survey (NSF) |
|---|---|
| Within private investment | |
| Business | Business R&D and Innovation Survey (BRDIS): 2008 forward; Survey of Industrial Research and Development (SIRD): 1953–2007. |
| Nonprofit institutions serving households | |
| Private nonprofit universities | Higher Education Research and Development Survey: 2010 forward; Survey of R&D Expenditures at Universities and Colleges: 1972–2009 |
| Other nonprofit institutions | Survey of R&D Funding and Performance by Nonprofit Organizations (last collected in 1997) |
| Within government investment | |
| Federal | Survey of Federal Funds for Research and Development: FY 1951 forward |
| State and local | |
| Public universities | Higher Education Research and Development Survey: 2010 forward; Survey of R&D Expenditures at Universities and Colleges: 1972–2009 |
| Other state and local | Survey of State Government Research and Development: 2006 forward |

BEA = Bureau of Economic Analysis; NIPA = national income and product account; NSF = National Science Foundation.

NOTE: R&D in federally funded R&D centers (FFRDCs) are included in the sector of their administrator based on the FFRDC Research and Development Survey: 2001 forward.

SOURCES: Bureau of Economic Analysis; National Science Foundation, National Center for Science and Engineering Statistics.

The extensive geographic detail in NSF's R&D surveys was also used by BEA's Regional Directorate to incorporate R&D investment in the GDP by state statistics, released in June 2014.[8]

## R&D Expenditures and R&D Investment

Figure 1 compares R&D expenditures (NSF) and R&D investment (BEA). When comparing the series shown in the figure, there are two broad features with opposing effects. BEA estimates of R&D investment exclude software R&D, so the scope of R&D investment presented in NIPAs is smaller than total R&D expenditures published by NSF.[9] On the other hand, BEA R&D investment is a measure designed to value the economic benefit of R&D, not the current period's costs.[10] The overall impact on the relative size of these series depends on which of these features dominate in a given year, resulting in intersecting lines in figure 1. Although there are some differences between the two time series, they follow a similar pattern and behave similarly during and outside of recessions.

## Revised GDP

The 2013 comprehensive revision of the NIPAs implemented several methodological changes that resulted in higher GDP levels (see table C in Kornfeld 2013). However, the long-run growth rates of GDP are similar to those in the previously published estimates. For 1929–2012, the average annual growth rate of GDP is 0.1 percentage point higher than in the previously published estimates (Kornfeld 2013). Figure 2 shows current dollar GDP for 1953–2012 under the new and previous BEA methodologies. GDP in 2012 was $16.245 trillion in current dollars under the revised methodology, 3.6% higher than the $15.685 trillion following the previous methodology.

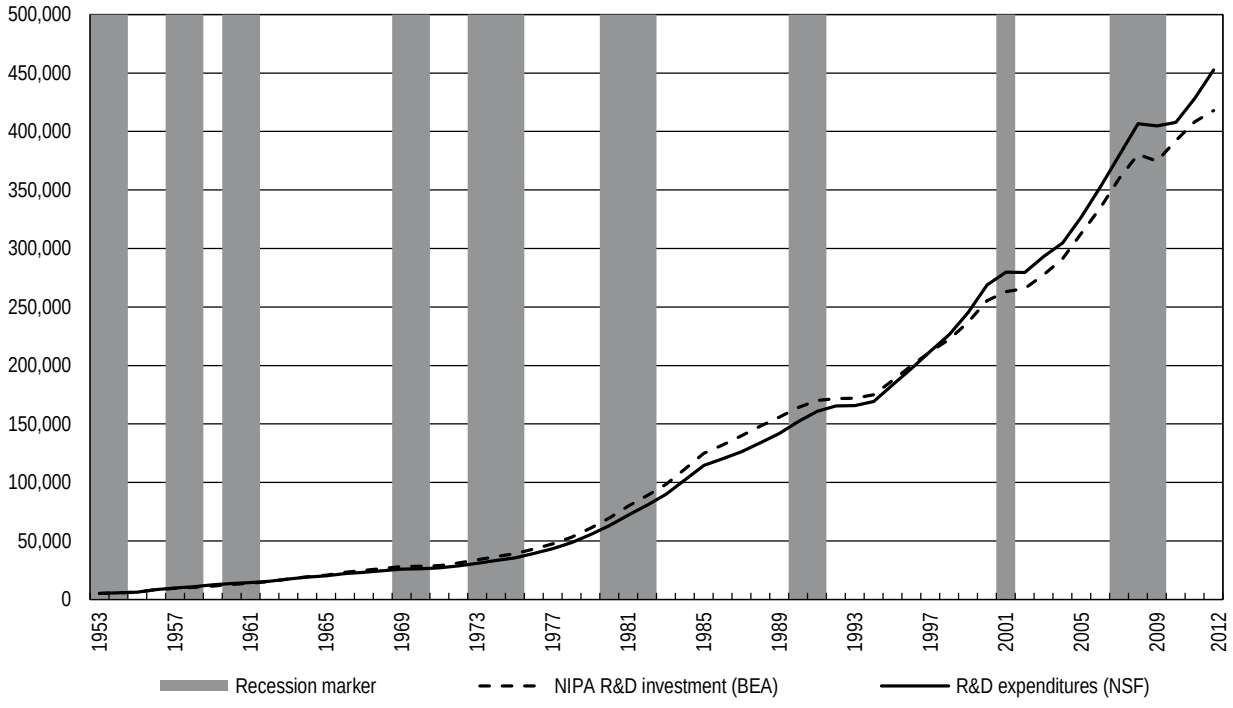
## Revised R&D-to-GDP Ratio

The ratio of total national R&D expenditures to GDP is often reported as a measure of the intensity of a nation's overall R&D effort. This metric is of interest to national policymakers, and it is widely used internationally as a benchmark for comparing countries' overall R&D systems.

Given higher GDP levels in the denominator (due to the revised methodology)

FIGURE 1. NIPA R&D investment versus NSF R&D expenditures: 1953–2012

Millions of current dollars



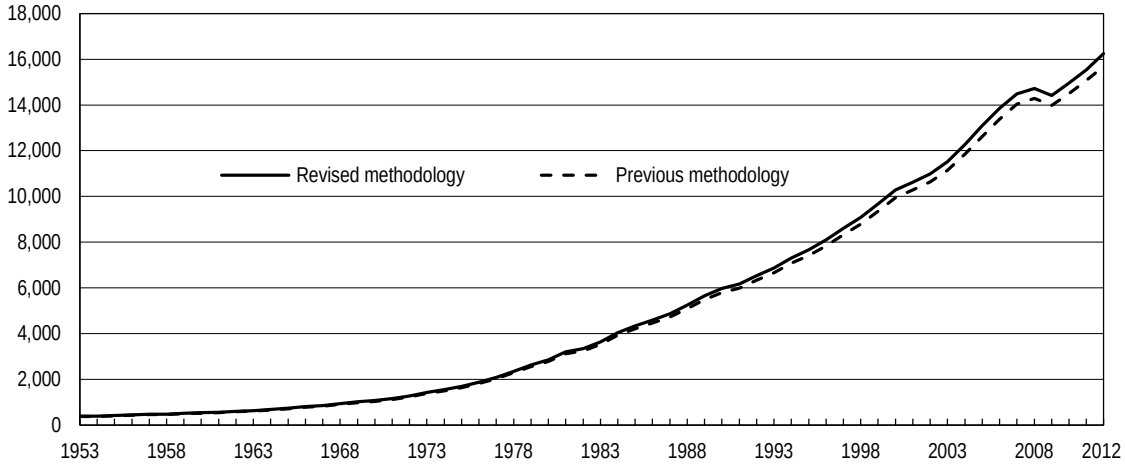

BEA = Bureau of Economic Analysis; NIPA = national income and product account; NSF = National Science Foundation.

NOTE: R&D expenditures refer to current costs.

SOURCES: R&D investment statistics are from the BEA, NIPA tables 5.6.5 and 5.9.5, available at http://www.bea.gov/iTable/index_nipa.cfm, accessed 10 March 2014. R&D expenditures are from the NSF, National Center for Science and Engineering Statistics. National Patterns of R&D Resources (annual series). Recession dates were obtained from http://www.nber.org/cycles/cyclesmain.html, accessed 10 March 2014.

FIGURE 2. U.S. GDP, revised versus previous methodology: 1953–2012

Billions of current dollars




GDP = gross domestic product.

NOTE: Revised GDP methodology refers to statistics generated after the 2013 comprehensive revision of the national income and product accounts.

SOURCES: Bureau of Economic Analysis, National Economic Accounts, Gross Domestic Product, http://www.bea.gov/national/, accessed 26 June 2013 (previous methodology) and 6 December 2013 (revised methodology).

and unchanged NSF R&D expenditures in the numerator, the R&D-to-GDP ratio is now modestly lower than what has previously been reported by NSF in its National Patterns of R&D Resources series. Figure 3 compares the ratios for these two series. For example, NSF reported R&D-to-GDP ratios as 2.81%, 2.84%, and 2.89% for the years 2010, 2011, and 2012, respectively, under the previous GDP methodology (NSF/NCSES 2013; Boroush 2013). After incorporating revised GDP figures, these ratios are now 2.73%, 2.76%, and 2.79%, respectively. Over the 10-year period (2002–12), the change resulting from the revised GDP methodology amounts to about a 0.1 reduction in the R&D-to-GDP ratio for any given year.

Figure 3 also shows the 1953–2012 time series for the R&D-to-GDP ratio for the subcomponent ratios showing R&D performed with federal government funding versus nonfederal funding. The relative roles of these differing funding sources are unchanged from the ratios based on the previous GDP methodology (Boroush 2013).

The R&D-to-GDP ratios presented in this InfoBrief represent an update of ratios reported in NSF/NCSES (NSF/NCSES 2013; Boroush 2013). See table 2 for data on GDP and R&D expenditures and GDP ratios.

## International Aspects

The interagency collaboration described earlier contributed to U.S. input on the revision of the 2008 SNA that recognized R&D as investment. BEA and NCSES also participated in the OECD Task Force on R&D and Other Intellectual Property Products (IPPs), a multiyear working group that developed practical guidance on the measurement of R&D and other IPPs. This work led to a new statistical manual documenting internationally comparable methodology for the incorporation of R&D and other intangibles in the national accounts (OECD 2010).

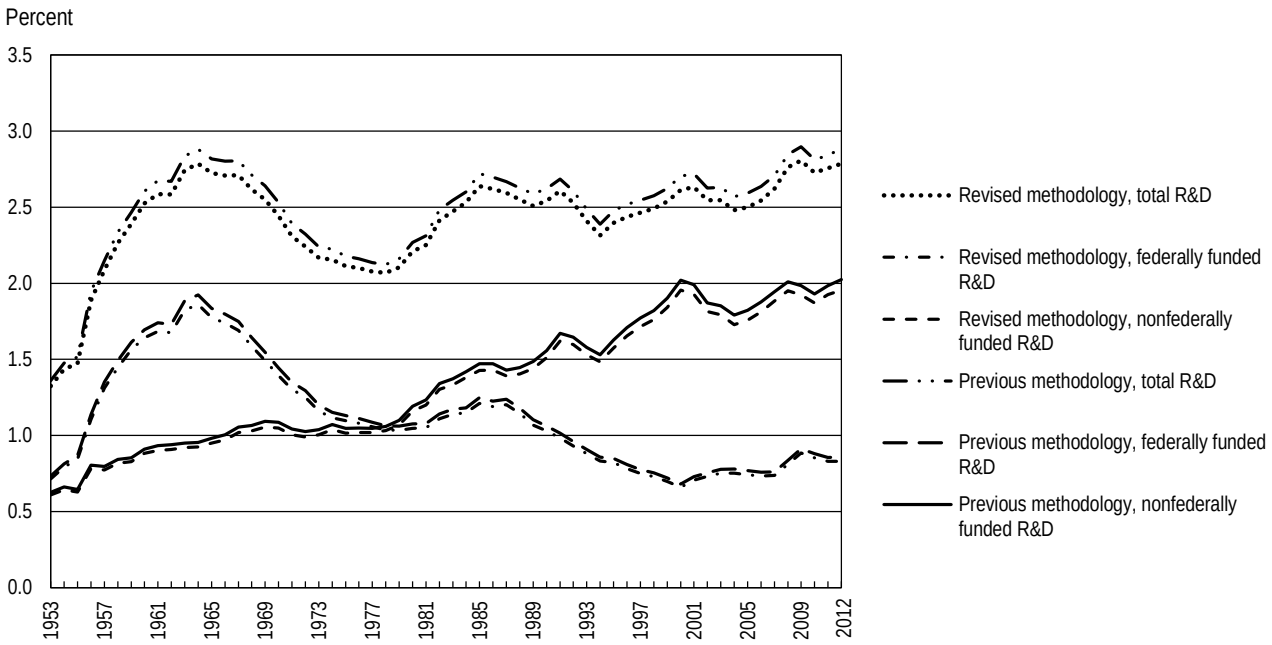
Other countries have also developed R&D satellite accounts before proceeding to incorporate R&D in their GDP and related statistics. As of early 2014, Australia, Canada, Israel, and the United Kingdom have completed capitalizing R&D in their core national economic accounts.

## Data Sources and Availability

This InfoBrief presented updated R&D-to-GDP ratios. Future updates will be available at http://www.nsf.gov/statistics/natlpatterns/. NSF statistics from R&D surveys are available at http://www.nsf.gov/statistics/data.cfm. Survey forms and methodology information are available at http://www.nsf.gov/statistics/surveys.cfm.

For a full list of changes (including but not limited to R&D) that arose from the 2013 comprehensive revision of the NIPAs, see tables A and B and related text in Kornfeld 2013. For release materials related to the 2013 Comprehensive Revision of the NIPAs,

FIGURE 3. Ratio of U.S. R&D to GDP for total, federally funded, and nonfederally funded R&D, under revised and previous GDP methodology: 1953–2012




GDP = gross domestic product.

NOTES: Revised GDP methodology refers to statistics generated after the 2013 comprehensive revision of the national income and product accounts. U.S. R&D expenditures from NSF for 2012 are preliminary. Federal R&D/GDP ratios represent the federal government as a funder of R&D by all performers; the nonfederal ratios reflect all other sources of R&D funding.

SOURCES: Bureau of Economic Analysis, National Economic Accounts, Gross Domestic Product, http://www.bea.gov/national/, accessed 26 June 2013 (previous methodology) and 6 December 2013 (revised methodology). National Science Foundation, National Center for Science and Engineering Statistics, National Patterns of R&D Resources (annual series).

see http://www.bea.gov/national/an1.htm#2013comprehensive. Details on the 2013 comprehensive revision of the industry economic accounts are available in Strassner and Wasshausen 2013; Kim, Strassner, and Wasshausen 2014. For the 2014 comprehensive revision of gross domestic product by state, see Broada and Tate 2014.

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TABLE 2. U.S. GDP, R&D expenditures, and R&D/GDP by GDP calculation methodology: 1953–2012

| | GDP | | R&D expenditures (NSF) | | | R&D/GDP (%) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Under revised GDP methodology | | | Under previous GDP methodology | | |
| Year | Revised methodology ($billions) | Previous methodology ($billions) | Total ($millions) | Federally funded ($millions) | Nonfederally funded ($millions) | Total R&D | Federally funded R&D | Nonfederally funded R&D | Total R&D | Federally funded R&D | Nonfederally funded R&D |
| 1953 | 389.7 | 379.3 | 5,160 | 2,783 | 2,378 | 1.32 | 0.71 | 0.61 | 1.36 | 0.73 | 0.63 |
| 1954 | 391.1 | 380.4 | 5,617 | 3,098 | 2,519 | 1.44 | 0.79 | 0.64 | 1.48 | 0.81 | 0.66 |
| 1955 | 426.2 | 414.7 | 6,281 | 3,603 | 2,678 | 1.47 | 0.85 | 0.63 | 1.51 | 0.87 | 0.65 |
| 1956 | 450.1 | 437.4 | 8,500 | 4,978 | 3,522 | 1.89 | 1.11 | 0.78 | 1.94 | 1.14 | 0.81 |
| 1957 | 474.9 | 461.1 | 9,908 | 6,233 | 3,676 | 2.09 | 1.31 | 0.77 | 2.15 | 1.35 | 0.80 |
| 1958 | 482.0 | 467.2 | 10,915 | 6,974 | 3,941 | 2.26 | 1.45 | 0.82 | 2.34 | 1.49 | 0.84 |
| 1959 | 522.5 | 506.6 | 12,490 | 8,167 | 4,323 | 2.39 | 1.56 | 0.83 | 2.47 | 1.61 | 0.85 |
| 1960 | 543.3 | 526.4 | 13,711 | 8,915 | 4,796 | 2.52 | 1.64 | 0.88 | 2.60 | 1.69 | 0.91 |
| 1961 | 563.3 | 544.8 | 14,564 | 9,484 | 5,080 | 2.59 | 1.68 | 0.90 | 2.67 | 1.74 | 0.93 |
| 1962 | 605.1 | 585.7 | 15,636 | 10,138 | 5,498 | 2.58 | 1.68 | 0.91 | 2.67 | 1.73 | 0.94 |
| 1963 | 638.6 | 617.8 | 17,519 | 11,645 | 5,874 | 2.74 | 1.82 | 0.92 | 2.84 | 1.88 | 0.95 |
| 1964 | 685.8 | 663.6 | 19,103 | 12,764 | 6,339 | 2.79 | 1.86 | 0.92 | 2.88 | 1.92 | 0.96 |
| 1965 | 743.7 | 719.1 | 20,252 | 13,194 | 7,059 | 2.72 | 1.77 | 0.95 | 2.82 | 1.83 | 0.98 |
| 1966 | 815.0 | 787.7 | 22,072 | 14,165 | 7,907 | 2.71 | 1.74 | 0.97 | 2.80 | 1.80 | 1.00 |
| 1967 | 861.7 | 832.4 | 23,346 | 14,563 | 8,784 | 2.71 | 1.69 | 1.02 | 2.80 | 1.75 | 1.06 |
| 1968 | 942.5 | 909.8 | 24,666 | 14,964 | 9,702 | 2.62 | 1.59 | 1.03 | 2.71 | 1.64 | 1.07 |
| 1969 | 1,019.9 | 984.4 | 25,996 | 15,228 | 10,768 | 2.55 | 1.49 | 1.06 | 2.64 | 1.55 | 1.09 |
| 1970 | 1,075.9 | 1,038.3 | 26,271 | 14,984 | 11,287 | 2.44 | 1.39 | 1.05 | 2.53 | 1.44 | 1.09 |
| 1971 | 1,167.8 | 1,126.8 | 26,952 | 15,210 | 11,742 | 2.31 | 1.30 | 1.01 | 2.39 | 1.35 | 1.04 |
| 1972 | 1,282.4 | 1,237.9 | 28,740 | 16,039 | 12,701 | 2.24 | 1.25 | 0.99 | 2.32 | 1.30 | 1.03 |
| 1973 | 1,428.5 | 1,382.3 | 30,952 | 16,587 | 14,365 | 2.17 | 1.16 | 1.01 | 2.24 | 1.20 | 1.04 |
| 1974 | 1,548.8 | 1,499.5 | 33,359 | 17,287 | 16,072 | 2.15 | 1.12 | 1.04 | 2.22 | 1.15 | 1.07 |
| 1975 | 1,688.9 | 1,637.7 | 35,671 | 18,533 | 17,138 | 2.11 | 1.10 | 1.01 | 2.18 | 1.13 | 1.05 |
| 1976 | 1,877.6 | 1,824.6 | 39,435 | 20,292 | 19,143 | 2.10 | 1.08 | 1.02 | 2.16 | 1.11 | 1.05 |
| 1977 | 2,086.0 | 2,030.1 | 43,338 | 22,071 | 21,267 | 2.08 | 1.06 | 1.02 | 2.13 | 1.09 | 1.05 |
| 1978 | 2,356.6 | 2,293.8 | 48,719 | 24,414 | 24,305 | 2.07 | 1.04 | 1.03 | 2.12 | 1.06 | 1.06 |
| 1979 | 2,632.1 | 2,562.2 | 55,379 | 27,225 | 28,154 | 2.10 | 1.03 | 1.07 | 2.16 | 1.06 | 1.10 |
| 1980 | 2,862.5 | 2,788.1 | 63,224 | 29,986 | 33,238 | 2.21 | 1.05 | 1.16 | 2.27 | 1.08 | 1.19 |
| 1981 | 3,210.9 | 3,126.8 | 72,292 | 33,739 | 38,553 | 2.25 | 1.05 | 1.20 | 2.31 | 1.08 | 1.23 |
| 1982 | 3,345.0 | 3,253.2 | 80,748 | 37,133 | 43,615 | 2.41 | 1.11 | 1.30 | 2.48 | 1.14 | 1.34 |
| 1983 | 3,638.1 | 3,534.6 | 89,950 | 41,451 | 48,499 | 2.47 | 1.14 | 1.33 | 2.54 | 1.17 | 1.37 |
| 1984 | 4,040.7 | 3,930.9 | 102,244 | 46,470 | 55,773 | 2.53 | 1.15 | 1.38 | 2.60 | 1.18 | 1.42 |
| 1985 | 4,346.7 | 4,217.5 | 114,671 | 52,641 | 62,029 | 2.64 | 1.21 | 1.43 | 2.72 | 1.25 | 1.47 |
| 1986 | 4,590.1 | 4,460.1 | 120,249 | 54,622 | 65,626 | 2.62 | 1.19 | 1.43 | 2.70 | 1.22 | 1.47 |
| 1987 | 4,870.2 | 4,736.4 | 126,360 | 58,609 | 67,751 | 2.59 | 1.20 | 1.39 | 2.67 | 1.24 | 1.43 |
| 1988 | 5,252.6 | 5,100.4 | 133,881 | 60,131 | 73,750 | 2.55 | 1.14 | 1.40 | 2.62 | 1.18 | 1.45 |
| 1989 | 5,657.7 | 5,482.1 | 141,891 | 60,466 | 81,425 | 2.51 | 1.07 | 1.44 | 2.59 | 1.10 | 1.49 |
| 1990 | 5,979.6 | 5,800.5 | 151,993 | 61,610 | 90,382 | 2.54 | 1.03 | 1.51 | 2.62 | 1.06 | 1.56 |
| 1991 | 6,174.0 | 5,992.1 | 160,876 | 60,783 | 100,093 | 2.61 | 0.98 | 1.62 | 2.68 | 1.01 | 1.67 |
| 1992 | 6,539.3 | 6,342.3 | 165,350 | 60,915 | 104,435 | 2.53 | 0.93 | 1.60 | 2.61 | 0.96 | 1.65 |
| 1993 | 6,878.7 | 6,667.4 | 165,730 | 60,528 | 105,203 | 2.41 | 0.88 | 1.53 | 2.49 | 0.91 | 1.58 |
| 1994 | 7,308.7 | 7,085.2 | 169,207 | 60,777 | 108,429 | 2.32 | 0.83 | 1.48 | 2.39 | 0.86 | 1.53 |
| 1995 | 7,664.0 | 7,414.7 | 183,625 | 62,969 | 120,657 | 2.40 | 0.82 | 1.57 | 2.48 | 0.85 | 1.63 |
| 1996 | 8,100.2 | 7,838.5 | 197,346 | 63,394 | 133,952 | 2.44 | 0.78 | 1.65 | 2.52 | 0.81 | 1.71 |
| 1997 | 8,608.5 | 8,332.4 | 212,152 | 64,574 | 147,578 | 2.46 | 0.75 | 1.71 | 2.55 | 0.77 | 1.77 |
| 1998 | 9,089.1 | 8,793.5 | 226,457 | 66,383 | 160,074 | 2.49 | 0.73 | 1.76 | 2.58 | 0.75 | 1.82 |
| 1999 | 9,665.7 | 9,353.5 | 245,318 | 67,366 | 177,952 | 2.54 | 0.70 | 1.84 | 2.62 | 0.72 | 1.90 |
| 2000 | 10,289.7 | 9,951.5 | 268,905 | 67,862 | 201,043 | 2.61 | 0.66 | 1.95 | 2.70 | 0.68 | 2.02 |

*Continues on next page*

TABLE 2. U.S. GDP, R&D expenditures, and R&D/GDP by GDP calculation methodology: 1953–2012

*Continued from previous page*

| | GDP | | R&D expenditures (NSF) | | | R&D/GDP (%) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Under revised GDP methodology | | | Under previous GDP methodology | | |
| Year | Revised methodology ($billions) | Previous methodology ($billions) | Total ($millions) | Federally funded ($millions) | Nonfederally funded ($millions) | Total R&D | Federally funded R&D | Nonfederally funded R&D | Total R&D | Federally funded R&D | Nonfederally funded R&D |
| 2001 | 10,625.3 | 10,286.2 | 279,716 | 74,966 | 204,750 | 2.63 | 0.71 | 1.93 | 2.72 | 0.73 | 1.99 |
| 2002 | 10,980.2 | 10,642.3 | 279,387 | 80,315 | 199,072 | 2.54 | 0.73 | 1.81 | 2.63 | 0.75 | 1.87 |
| 2003 | 11,512.2 | 11,142.2 | 293,060 | 86,705 | 206,355 | 2.55 | 0.75 | 1.79 | 2.63 | 0.78 | 1.85 |
| 2004 | 12,277.0 | 11,853.3 | 304,547 | 92,360 | 212,187 | 2.48 | 0.75 | 1.73 | 2.57 | 0.78 | 1.79 |
| 2005 | 13,095.4 | 12,623.0 | 327,185 | 97,041 | 230,144 | 2.50 | 0.74 | 1.76 | 2.59 | 0.77 | 1.82 |
| 2006 | 13,857.9 | 13,377.2 | 352,567 | 101,558 | 251,010 | 2.54 | 0.73 | 1.81 | 2.64 | 0.76 | 1.88 |
| 2007 | 14,480.3 | 14,028.7 | 379,681 | 106,858 | 272,823 | 2.62 | 0.74 | 1.88 | 2.71 | 0.76 | 1.94 |
| 2008 | 14,720.3 | 14,291.5 | 406,610 | 119,423 | 287,188 | 2.76 | 0.81 | 1.95 | 2.85 | 0.84 | 2.01 |
| 2009 | 14,417.9 | 13,973.7 | 404,731 | 127,467 | 277,263 | 2.81 | 0.88 | 1.92 | 2.90 | 0.91 | 1.98 |
| 2010 | 14,958.3 | 14,498.9 | 407,703 | 127,813 | 279,890 | 2.73 | 0.85 | 1.87 | 2.81 | 0.88 | 1.93 |
| 2011 | 15,533.8 | 15,075.7 | 428,163 | 129,068 | 299,095 | 2.76 | 0.83 | 1.93 | 2.84 | 0.86 | 1.98 |
| 2012 | 16,244.6 | 15,684.8 | 452,556 | 135,018 | 317,538 | 2.79 | 0.83 | 1.95 | 2.89 | 0.86 | 2.02 |

GDP = gross domestic product.

NOTES: Data are in current dollars. Revised GDP methodology refers to statistics generated after the 2013 Comprehensive Revision of the National Income and Product Accounts. U.S. R&D expenditures from the National Science Foundation for 2012 are preliminary.

SOURCES: Bureau of Economic Analysis, National Economic Accounts, Gross Domestic Product, http://www.bea.gov/national/, accessed 26 June 2013 (previous methodology) and 6 December 2013 (revised methodology). National Science Foundation, National Center for Science and Engineering Statistics, National Patterns of R&D Resources (annual series).

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## Notes

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2. This InfoBrief focuses on long-term changes in U.S. GDP statistics related to R&D that were introduced by BEA's 2013 comprehensive revision of the NIPAs. This InfoBrief also examines the effect on NSF's R&D-to-GDP ratio. For current national, regional, and industry GDP statistics, see http://www.bea.gov/index.htm.

3. Similar to the treatment of purchased R&D, R&D grants made by the business and federal sectors are also treated as investment by the sector making the grant because the grantor is assumed to receive the primary economic benefit (BEA 2013 and communication with BEA staff).

4. Working papers and publications on R&D satellite accounts are available at http://www.bea.gov/national/rd.htm.

5. Upon the release of the 2013 NIPAs, BEA is no longer producing R&D satellite accounts.

6. As another example, NSF and BEA both include depreciation of physical capital and intangibles (such as software) used for R&D purposes in their underlying R&D cost measures for the business sector. NSF directly collects depreciation as a separate item under current costs in the Business R&D and Innovation Survey (BRDIS), which in turn is included in total R&D expenditures. BRDIS-reported depreciation is based on industry-wide tax and regulatory accounting rules. However, BEA bases its estimates of depreciation of physical and intangible fixed investment used in business R&D on a separate BRDIS question that asks about the amount of physical and intangible capital expenditures used in R&D operations.

7. R&D depreciation rates are critical to calculating rates of return to R&D investments, which in turn are important for estimating the service costs of R&D assets used in production (Lee and Schmidt 2010). See BEA working paper on R&D depreciation rates and services lives at http://www.bea.gov/national/pdf/WendyLiDepreciationBusinessR&DCapital20130314BEAwebversion.pdf

8. A description of the regional and state impacts can be found in BEA's publications (Lee and Schmidt 2010; Broda and Tate 2014).

9. As an example of the magnitude of software R&D expenditures, for the business sector, software R&D reached $60.3 billion, or 20.5% of $294.1 billion in total business R&D, based on 2011 BRDIS statistics.

10. In particular, the current R&D costs collected by NSF do not include charges for profits on purchased R&D; the R&D purchases component of BEA estimates of R&D investment totals include profits as noted earlier.

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