



## U.S. R&D Increased by \$20 Billion in 2015, to \$495 Billion; Estimates for 2016 Indicate a Rise to \$510 Billion

by Mark Boroush<sup>1</sup>

New data from the National Center for Science and Engineering Statistics (NCSES) within the National Science Foundation (NSF) indicate that research and experimental development (R&D) performed in the United States totaled \$495.1 billion in 2015 (table 1). The estimated total for 2016, based on performer-reported expectations, is \$510.0 billion. These numbers compare to U.S. R&D totals of \$454.0 billion in 2013 and \$475.4 billion in 2014. In 2008—just before the onset of the main economic effects of the national and international financial crisis and the Great Recession—the U.S. total was \$404.8 billion. (All amounts and calculations are in current dollars, unless otherwise noted.)

These data reflect sizable increases of \$21.5 billion in 2014 and \$19.7 billion in 2015. After essentially no change between 2008 and 2010, year-over-year increases in the U.S. total from 2010 to 2015 averaged \$17.7 billion. The 2016 increase is estimated to be \$14.8 billion. The 2014 and 2015 increases are mainly due to higher levels of business R&D performance (figure 1). However, as presently estimated, the business sector's role is noticeably less predominant in the 2016 increase.

Adjusted for inflation, growth in U.S. total R&D averaged 1.4% annually over the 7-year period 2008–15, marginally behind the 1.5% the average pace of U.S. gross domestic product (GDP) over the same period (table 2). By comparison, the average annual rate of growth was notably higher in the prior 10-year period (1998–2008): 3.6% for total R&D, and 2.2% for GDP. In part, the smaller average pace of R&D growth in 2008–15 reflects the inclusion of the Great Recession years (notably, 2009 and 2010). If just the 5-year period of 2010 to 2015 is considered, the average annual pace of growth is 2.3%, compared to 2.2% for GDP (table 2). The growth of business R&D over this same 5-year period is 3.3%, well ahead of GDP growth, but it is not strong enough to offset the slower average rates of growth (if not outright declines) in some of the other performing sectors. The estimate for 2016 shows R&D also expanding only a little faster than the pace of GDP (1.7%, compared to 1.5% for GDP).

### R&D Performers and Funders

The U.S. R&D system consists of the R&D activities of multiple performers

and sources of funding. Performers and funders include private businesses, the federal government, nonfederal government agencies, higher education institutions, and other nonprofit organizations.<sup>2</sup> Organizations that perform R&D often receive significant levels of outside funding. Furthermore, R&D funders may also be significant performers.

### R&D Performers

The business sector continues to be by far the largest performer of U.S. R&D. In 2015, domestically performed business R&D accounted for \$355.8 billion, or 72% of the \$495.1 billion national total (tables 1, 3). The business sector's predominance in the composition of national R&D performance has long been the case, with its annual share ranging between 69% and 75% over the 20-year period 1995–2015. Business R&D performance increased by \$15.1 billion in 2015, following gains of \$8.2 billion in 2012, \$20.3 billion in 2013, and \$18.2 billion in 2014 (figure 1).

Inflation-adjusted growth in business R&D averaged 1.4% annually over the 7-year period 2008–15, equal to the 1.4% annual average for U.S. total R&D but just behind the 1.5% annual

TABLE 1. U.S. R&amp;D expenditures, by performing sector and source of funding: 2008–16

Performing sector and funding source	2008	2009	2010	2011	2012	2013	2014	2015 <sup>a</sup>	2016 <sup>b</sup>
Current \$millions									
All performing sectors	404,773	402,931	406,580	426,160	433,619	453,964	475,426	495,144	509,967
Business	290,680	282,393	278,977	294,092	302,251	322,528	340,728	355,821	363,753
Federal government	45,649	47,572	50,798	53,524	52,144	51,086	52,687	54,322	57,459
Federal intramural <sup>c</sup>	29,839	30,560	31,970	34,950	34,017	33,406	34,783	35,673	37,999
FFRDCs	15,810	17,013	18,828	18,574	18,128	17,680	17,903	18,649	19,460
Nonfederal government	491	606	691	694	665	620	583	610	651
Higher education	52,054	54,909	58,084	60,089	60,896	61,546	62,354	64,653	67,520
Other nonprofit organizations <sup>d</sup>	15,898	17,452	18,030	17,762	17,663	18,185	19,075	19,738	20,583
All funding sources	404,773	402,931	406,580	426,160	433,619	453,964	475,426	495,144	509,967
Business	258,016	246,610	248,124	266,421	275,717	297,167	318,382	333,207	343,562
Federal government	117,615	125,765	126,617	127,015	123,838	120,130	118,363	120,933	122,656
Nonfederal government	4,221	4,295	4,302	4,386	4,158	4,244	4,214	4,280	4,425
Higher education	11,738	12,056	12,262	13,104	14,300	15,378	16,217	17,334	18,686
Other nonprofit organizations <sup>d</sup>	13,184	14,205	15,275	15,235	15,607	17,045	18,250	19,390	20,638
Constant 2009 \$millions									
All performing sectors	407,848	402,931	401,673	412,503	412,127	424,610	436,844	450,080	457,715
Business	292,888	282,393	275,610	284,667	287,271	301,673	313,077	323,437	326,482
Federal government	45,995	47,572	50,185	51,809	49,560	47,783	48,411	49,378	51,572
Federal intramural <sup>c</sup>	30,066	30,560	31,584	33,830	32,331	31,246	31,961	32,427	34,106
FFRDCs	15,930	17,013	18,601	17,978	17,229	16,537	16,451	16,951	17,466
Nonfederal government	495	606	683	672	632	580	536	555	585
Higher education	52,450	54,909	57,383	58,163	57,877	57,566	57,293	58,768	60,602
Other nonprofit organizations <sup>d</sup>	16,019	17,452	17,812	17,193	16,788	17,009	17,527	17,942	18,474
All funding sources	407,848	402,931	401,673	412,503	412,127	424,610	436,844	450,080	457,715
Business	259,975	246,610	245,129	257,883	262,051	277,952	292,544	302,881	308,360
Federal government	118,508	125,765	125,089	122,944	117,700	112,363	108,758	109,927	110,089
Nonfederal government	4,253	4,295	4,250	4,245	3,952	3,970	3,872	3,890	3,971
Higher education	11,827	12,056	12,114	12,684	13,591	14,383	14,901	15,756	16,771
Other nonprofit organizations <sup>d</sup>	13,284	14,205	15,091	14,747	14,833	15,943	16,769	17,625	18,524

FFRDCs = federally funded research and development centers.

<sup>a</sup> Some data for 2015 are preliminary and may later be revised.

<sup>b</sup> The data for 2016 are estimates and will later be revised.

<sup>c</sup> Includes expenditures of federal intramural R&D as well as costs associated with administering extramural R&D.

<sup>d</sup> Some components of the R&D performed by other nonprofit organizations are projected and may later be revised.

NOTES: Data are based on annual reports by performers, except for the nonprofit sector. Expenditure levels for higher education, federal government, and nonfederal government performers are calendar-year approximations based on fiscal year data.

SOURCE: National Science Foundation, National Center for Science and Engineering Statistics, National Patterns of R&D Resources (annual series).

average for GDP (table 2). Nonetheless, growth in business R&D substantially surpassed the growth rates for both total R&D and GDP in 4 of the 7 years spanning the full 2008–15 period (2011, 2013, 2014, and 2015).

The higher education sector is the second-largest performer of U.S. R&D. Universities and colleges performed

\$64.7 billion in 2015, or 13% of U.S. total R&D (tables 1, 3).<sup>3</sup> Over the 20-year period 1995–2015, the higher education share of U.S. R&D has ranged between 11% and 14%.

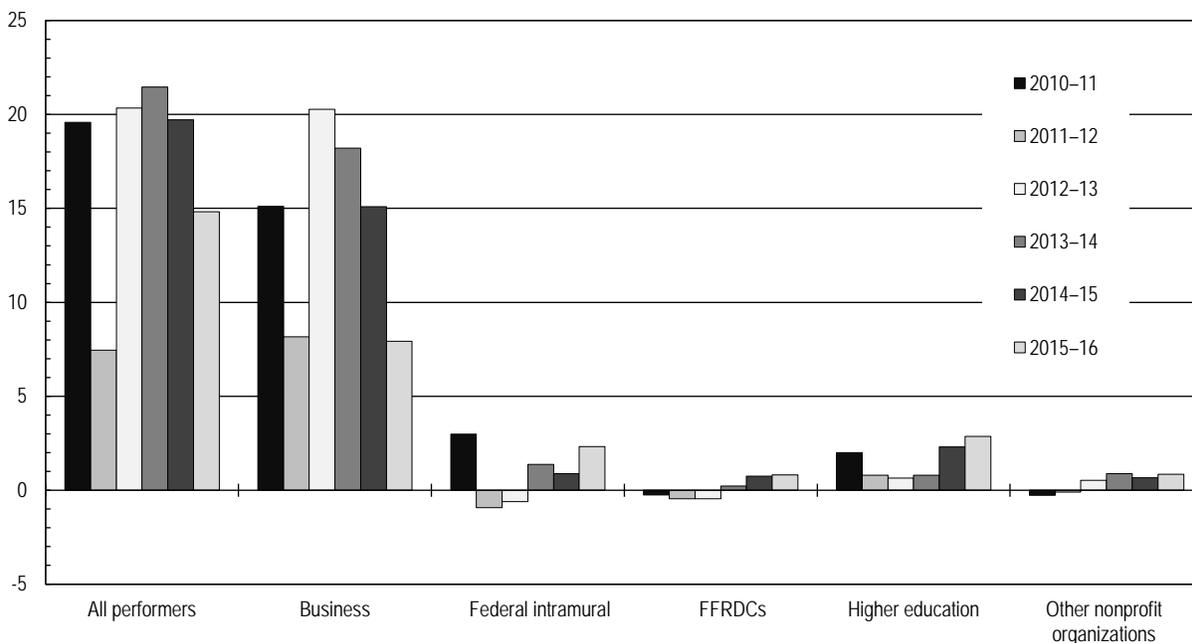
Higher education R&D performance increased by \$2 to \$3 billion each year over 2009–11; however, the increases dropped below \$1 billion in 2012–14

(figure 1). The data show a \$2.3 billion increase in 2015. After adjustment for inflation, growth in this sector's R&D performance averaged 1.6% annually over 2008–15, compared to 1.4% for U.S. total R&D and 1.5% for GDP.

However, when the year-by-year track is examined, the sector's growth was stronger in the first half of the period (2009, 2010, and 2011) (table 2).

FIGURE 1. Year-to-year changes in U.S. R&D expenditures, by performing and funding sources: 2010–16

Current dollars (billions)



FFRDCs = federally funded research and development centers.

NOTE: Data for 2015 are preliminary, and those for 2016 are estimates; some of these data may later be revised.

SOURCE: National Science Foundation, National Center for Science and Engineering Statistics, National Patterns of R&D Resources (annual series).

The federal government conducted \$54.3 billion, or 11%, of U.S. R&D in 2015 (tables 1, 3). This included \$35.7 billion (7% of the U.S. total) for intramural R&D performed by federal agencies in their own research facilities and \$18.6 billion (4%) of R&D performed by the 41 federally funded research and development centers (FFRDCs). In 1995, the federal performance share was about 14%, but it has gradually declined—with some occasional increases—in the years since.

The federal performance total increased by \$2 to \$3 billion each year over 2009–11. But it decreased \$1.4 billion in 2012 and \$1.1 billion in 2013. In 2014, there was a \$1.6 billion increase, and there was about the same increase in 2015. These changes affected performance for both federal intramural R&D and FFRDCs (table 1). Adjusted for

inflation, growth in this sector’s R&D performance averaged 1.0% annually over 2008–15, behind that for U.S. total R&D (1.4%) and GDP (1.5%).

R&D performed in the United States by other nonprofit organizations (which excludes universities and FFRDCs) is estimated at \$19.7 billion in 2015 (table 3). This was 4% of U.S. total R&D that year, a share that has increased only a little since the late 1990s.

### R&D Funders

The business sector is also the leading source of funding for R&D performed in the United States. In 2015, business sector funding accounted for \$333.2 billion, or 67% of the \$495.1 billion of total U.S. R&D performance (tables 1, 3). Nearly all (98%) of the business sector’s funding for R&D that year reflected R&D by business

performers (even if funding provided by some businesses was performed by other businesses) (table 3). The small remainder went to R&D performers in higher education, other nonprofit organizations, and FFRDCs.

In 1995, R&D funding from the business sector accounted for 60% of the U.S. R&D total. It has been above that level throughout the years since, fluctuating in the range of 60%–69%.

Funds from the federal government accounted for \$120.9 billion, or 24%, of U.S. total R&D in 2015 (tables 1, 3). This federal funding was directed mainly to R&D performance by the federal government, business, and higher education (table 3). Federal funding accounted for all the \$35.7 billion of federal intramural R&D performance in 2015 and most of the \$18.6 billion of

TABLE 2. Annual rates of growth in U.S. R&D expenditures and gross domestic product, total and by performing sectors: 1988–2016 (Percent)

Expenditures and gross domestic product	Longer-term trends			Most recent years								
	1988–98	1998–2008	2008–15	2008–09	2009–10	2010–11	2011–12	2012–13	2013–14	2014–15	2015–16	
	Current \$											
Total R&D, all performers	5.4	6.0	2.9	-0.5	0.9	4.8	1.8	4.7	4.7	4.1	3.0	
Business	5.8	5.7	2.9	-2.9	-1.2	5.4	2.8	6.7	5.6	4.4	2.2	
Federal government	1.8	5.9	2.5	4.2	6.8	5.4	-2.6	-2.0	3.1	3.1	5.8	
Federal intramural <sup>a</sup>	1.9	5.6	2.6	2.4	4.6	9.3	-2.7	-1.8	4.1	2.6	6.5	
FFRDCs	1.6	6.4	2.4	7.6	10.7	-1.4	-2.4	-2.5	1.3	4.2	4.4	
Nonfederal government <sup>d</sup>	NA	NA	3.1	NA	14.1	0.4	-4.2	-6.8	-5.9	4.6	6.8	
Higher education	6.0	7.4	3.1	5.5	5.8	3.5	1.3	1.1	1.3	3.7	4.4	
Other nonprofit organizations <sup>c</sup>	8.5	8.2	3.1	9.8	3.3	-1.5	-0.6	3.0	4.9	3.5	4.3	
Gross domestic product	5.6	4.9	3.0	-2.0	3.8	3.7	4.1	3.3	4.4	4.0	2.8	
	Constant 2009 \$											
Total R&D, all performers	2.9	3.6	1.4	-1.2	-0.3	2.7	-0.1	3.0	2.9	3.0	1.7	
Business	3.3	3.3	1.4	-3.6	-2.4	3.3	0.9	5.0	3.8	3.3	0.9	
Federal government	-0.6	3.4	1.0	3.4	5.5	3.2	-4.3	-3.6	1.3	2.0	4.4	
Federal intramural <sup>a</sup>	-0.5	3.2	1.1	1.6	3.4	7.1	-4.4	-3.4	2.3	1.5	5.2	
FFRDCs	-0.8	4.0	0.9	6.8	9.3	-3.3	-4.2	-4.0	-0.5	3.0	3.0	
Nonfederal government <sup>d</sup>	NA	NA	1.6	NA	12.7	-1.6	-5.9	-8.3	-7.5	3.5	5.4	
Higher education	3.5	4.9	1.6	4.7	4.5	1.4	-0.5	-0.5	-0.5	2.6	3.1	
Other nonprofit organizations <sup>c</sup>	5.9	5.7	1.6	8.9	2.1	-3.5	-2.4	1.3	3.0	2.4	3.0	
Gross domestic product	3.4	2.2	1.5	-2.8	2.5	1.6	2.2	1.7	2.6	2.9	1.5	

NA = not available.

FFRDCs = federally funded research and development centers.

<sup>a</sup> Includes expenditures of federal intramural R&D, as well as costs associated with administering extramural R&D.

<sup>b</sup> Survey data on state internal R&D performance was not available prior to 2006; data for 2008 were not collected.

<sup>c</sup> Some components of the R&D performed by other nonprofit organizations are projected and may later be revised.

NOTES: Longer-term trend rates are calculated as compound annual growth rates. Data for 2015 are preliminary and those for 2016 are estimates; some of these data may later be revised.

SOURCE: National Science Foundation, National Center for Science and Engineering Statistics, National Patterns of R&D Resources (annual series).

R&D performed by FFRDCs. (Nonfederal support for FFRDC R&D has been around \$0.4 billion in recent years, or 2% of the FFRDC's total support.) Federal funding to the business sector accounted for \$27.0 billion of business R&D performance in 2015, or 8% of the sector's R&D total that year (table 3). Federal funds to higher education supported \$33.5 billion (52%) of the \$64.7 billion spent on academic R&D in 2015. For the R&D performed by other nonprofit organizations, \$6.2 billion (31%) of this sector's \$19.7 billion of performance was supported by federal funds.

In 1995, the federal funding share of U.S. total R&D was 34%. Thereafter, it declined to about 25% in 2000, rose

gradually to 31% in 2009 and 2010, and then declined to 24% in 2015.

The remainder of R&D funding from other sources is relatively small: \$41.0 billion in 2015, or 8% of all U.S. R&D performance. Of this amount, \$17.3 billion (4%) was academia's own institutional funds, all of which remain in the academic sector; \$4.3 billion (1%) was from state and local governments, primarily supporting academic research; and \$19.4 billion (4%) was from other nonprofit organizations, the majority which funds this sector's own R&D. In addition, funds from the nonprofit sector support some R&D in higher education and small amounts of R&D in businesses and FFRDCs.

## R&D by Type of Work

Basic research activities accounted for \$83.5 billion in 2015, or 17% of the total of U.S. R&D expenditures (table 4). Applied research was \$97.2 billion, or 20% of the total. Most of the R&D total is experimental development: \$314.5 billion, or 64%.

Higher education accounted for just under half (49%) of the \$83.5 billion of basic research in 2015 (table 3). The business sector was the second-largest basic research performer (26%). Business was the predominant performer (58%) of the \$97.2 billion of applied research in 2015. Higher education was second at 18%, and combining federal intramural performers and FFRDCs

TABLE 3. U.S. R&amp;D expenditures, by performing sector, source of funds, and type of work: 2015

Performing sector and type of work	Source of funds (\$millions)						Percent distribution by performer
	Total	Business	Federal government	Nonfederal government	Higher education	Other nonprofit organizations	
<b>R&amp;D</b>	495,144	333,207	120,933	4,280	17,334	19,390	100.0
Business	355,821	327,589	26,990	127	*	1,115	71.9
Federal government	54,322	205	53,960	19	*	138	11.0
Federal intramural	35,673	0	35,673	0	0	0	7.2
FFRDCs	18,649	205	18,287	19	*	138	3.8
Nonfederal government	610	*	249	361	*	*	0.1
Higher education	64,653	3,842	33,546	3,772	17,334	6,159	13.1
Other nonprofit organizations	19,738	1,572	6,189	*	*	11,978	4.0
Percent distribution by funding source	100.0	67.3	24.4	0.9	3.5	3.9	-
<b>Basic research</b>	83,462	22,717	36,946	2,354	10,880	10,565	100.0
Business	21,792	19,621	2,038	14	*	120	26.1
Federal government	10,053	47	9,969	4	*	32	12.0
Federal intramural	5,926	0	5,926	0	0	0	7.1
FFRDCs	4,127	47	4,043	4	*	32	4.9
Nonfederal government	100	*	41	60	*	*	0.1
Higher education	40,983	2,176	21,888	2,277	10,880	3,763	49.1
Other nonprofit organizations	10,534	873	3,010	*	*	6,651	12.6
Percent distribution by funding source	100.0	27.2	44.3	2.8	13.0	12.7	-
<b>Applied research</b>	97,150	51,738	34,511	1,419	4,567	4,917	100.0
Business	56,472	50,137	6,102	24	*	209	58.1
Federal government	16,551	96	16,382	9	*	64	17.0
Federal intramural	9,200	0	9,200	0	0	0	9.5
FFRDCs	7,351	96	7,182	9	*	64	7.6
Nonfederal government	496	*	202	294	*	*	0.5
Higher education	17,466	1,107	9,094	1,092	4,567	1,608	18.0
Other nonprofit organizations	6,165	398	2,731	*	*	3,036	6.3
Percent distribution by funding source	100.0	53.3	35.5	1.5	4.7	5.1	-
<b>Experimental development</b>	314,532	258,753	49,476	507	1,888	3,908	100.0
Business	277,557	257,831	18,850	90	*	786	88.2
Federal government	27,718	62	27,609	6	*	42	8.8
Federal intramural	20,547	0	20,547	0	0	0	6.5
FFRDCs	7,171	62	7,062	6	*	42	2.3
Nonfederal government	14	*	6	8	*	*	0.0
Higher education	6,204	560	2,565	404	1,888	789	2.0
Other nonprofit organizations	3,040	301	447	*	*	2,292	1.0
Percent distribution by funding source	100.0	82.3	15.7	0.2	0.6	1.2	-

\* = small to negligible amount, included as part of the funding provided by other sectors.

FFRDCs = federally funded research and development centers.

NOTES: Data for 2015 include some estimates and may later be revised. Some components of R&D performance and funding by other nonprofit organizations are projected and may later be revised.

SOURCE: National Science Foundation, National Center for Science and Engineering Statistics, National Patterns of R&D Resources (annual series).

TABLE 4. U.S. R&amp;D expenditures, by type of work: 1970–2016

Type of work	1970	1980	1990	2000	2010	2011	2012	2013	2014	2015 <sup>a</sup>	2016 <sup>b</sup>
Current \$billions											
All R&D	26.3	63.2	152.0	267.9	406.6	426.2	433.6	454.0	475.4	495.1	510.0
Basic research	3.6	8.7	23.0	42.0	75.9	73.0	73.3	78.5	82.1	83.5	86.3
Applied research	5.8	13.7	34.9	56.5	79.3	82.1	87.1	88.3	91.9	97.2	100.3
Experimental development	16.9	40.7	94.1	169.4	251.4	271.0	273.3	287.1	301.5	314.5	323.4
Constant 2009 \$billions											
All R&D	115.3	142.5	227.6	327.2	401.7	412.5	412.1	424.6	436.8	450.1	457.7
Basic research	15.8	19.7	34.5	51.3	75.0	70.7	69.7	73.4	75.4	75.9	77.5
Applied research	25.2	30.9	52.3	69.0	78.3	79.5	82.8	82.6	84.4	88.3	90.0
Experimental development	74.3	91.8	140.9	206.9	248.4	262.3	259.7	268.6	277.0	285.9	290.2
Percent distribution											
All R&D	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Basic research	13.7	13.8	15.2	15.7	18.7	17.1	16.9	17.3	17.3	16.9	16.9
Applied research	21.9	21.7	23.0	21.1	19.5	19.3	20.1	19.5	19.3	19.6	19.7
Experimental development	64.4	64.5	61.9	63.2	61.8	63.6	63.0	63.3	63.4	63.5	63.4

<sup>a</sup> Some data for 2015 are preliminary and may later be revised.

<sup>b</sup> The data for 2016 are estimates and will later be revised.

NOTES: Data throughout the time series reported here are consistently based on Organisation for Economic Co-operation and Development's Frascati Manual definitions for basic research, applied research, and experimental development. Prior to 2010, however, some changes have been introduced in the questionnaires of the sectoral expenditure surveys to improve the accuracy of respondents' classification of their R&D. Therefore, small percentage changes in the historical data may not be meaningful.

SOURCE: National Science Foundation, National Center for Science and Engineering Statistics, National Patterns of R&D Resources (annual series).

amounted to 17% of the applied research total. Business continues to dominate experimental development, accounting for 88% of the \$314.5 billion of that category in 2015.

Federal funding accounted for 44% of the \$83.5 billion of basic research in 2015. But federal funds were less prominent on a proportional basis for applied research (36% of \$97.2 billion) and experimental development (16% of \$314.5 billion). The business sector provided the greatest share of funding for applied research (53%) and the predominant share for experimental development (82%). It also accounted for a sizable share (27%) of funding for basic research.

Data on the split of U.S. total R&D among the three types of R&D in previous years appear in table 4. The shares of basic, applied, and experimental development in 2010 were

largely the same as those reported above for 2015. Indeed, the shares are not dramatically different back to 2000 and earlier—although care is needed in drawing trend conclusions from this data (see table 4 notes).

### Trend in National R&D Intensity

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 and is widely used by national statistical offices and other policy analysts as an international benchmark for comparing the size of countries' R&D systems. The ratio of U.S. R&D expenditures to GDP was 2.73% in 2015, compared to 2.73% in 2014 and 2.72% in 2013 (figure 2).<sup>4</sup> The ratio for 2016 (2.74%) is estimated to be slightly above the 2015 level.

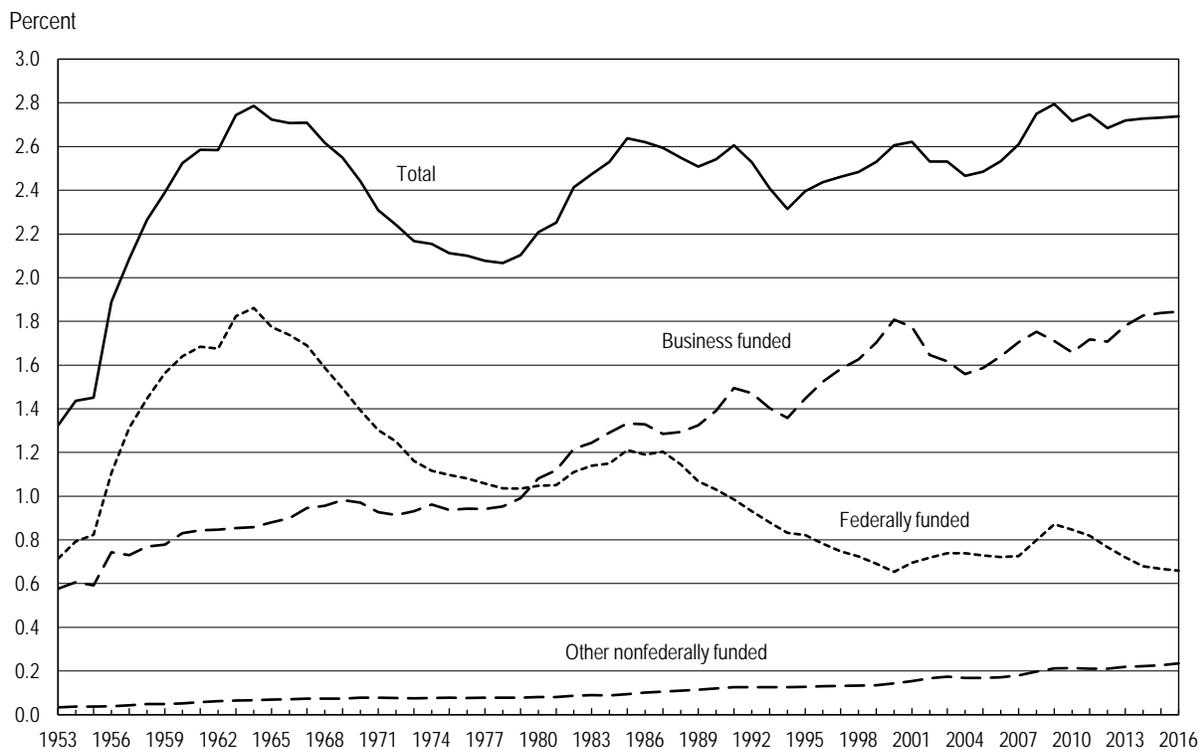
The U.S. R&D-to-GDP ratio stood at 2.79% in 2009—matching the ratio's

highest level since the start of the time series in 1953 (it was also 2.79% in 1964). Over the 10-year period from 2005 to 2015, the ratio has fluctuated year to year, between a low of 2.48% in 2005 and the aforementioned high of 2.79% in 2009 (figure 2). The broader trend since the mid-1990s has been a rising R&D-to-GDP ratio, although with some periods of decline.

Most of the rises of the R&D-to-GDP ratio over the past several decades result from the increase of nonfederal spending on R&D, particularly by the business sector. This arises from the growing role of business R&D in the national R&D system, which in turn reflects the increase of R&D-dependent goods and services in the national and global economies.

By contrast, the ratio of federally funded R&D expenditures to GDP declined from the mid-1980s to the late

FIGURE 2. Ratio of U.S. R&D to gross domestic product, by source of business, federal, and nonfederal funding for R&D: 1953–2016



NOTES: Data for 2015 are preliminary, and those for 2016 are estimates; some of these data may later be revised. The federally funded data represent the federal government as a funder of R&D by all performers; similarly for the business funded data. The other nonfederal category includes R&D funded by all other sources—mainly, higher education, nonfederal government, and other nonprofit organizations. The gross domestic product data used reflect Bureau of Economic Analysis’s comprehensive revisions of the National Income and Product Accounts of July 2017.

SOURCE: National Science Foundation, National Center for Science and Engineering Statistics, National Patterns of R&D Resources (annual series).

1990s, notably from cuts in defense-related R&D. There had been a gradual uptick in the ratio through 2009, the result of increased federal spending on biomedical and national security R&D and the one-time incremental funding for R&D provided by the American Recovery and Reinvestment Act of 2009 (ARRA). But the federally funded share has returned to a path of decline since 2010 (figure 2).

### Data Sources and Availability

The statistics on U.S. R&D presented in this report result chiefly from integrating the data on R&D expenditures and funding collected from the annual national surveys conducted by NSF’s National Center for Science and Engi-

neering Statistics to gather information on the organizations that perform most of U.S. R&D. In some cases, the primary survey data are adjusted to enable consistent integration of the statistics from these separately conducted surveys. Further, preliminary or otherwise estimated values may be used where final data from one or more of the surveys are not yet available and can reasonably be calculated.

The R&D surveys involved include NCSES’s Business R&D and Innovation Survey (for 2008 through 2015; for 2007 and earlier years, data from the preceding Survey of Industrial R&D are used), the Higher Education R&D Survey (for FY 2010 through 2016; for 2009 and earlier years, the preceding

Survey of R&D Expenditures at Universities and Colleges), the Survey of Federal Funds for R&D (FYs 2015–17 and earlier years), and the FFRDC Research and Development Survey (FY 2016 and earlier years). Amounts for the R&D performed by other nonprofit organizations with funding from with the nonprofit sector and from business sources are estimated, based on parameters from the 1996–97 Survey of R&D Funding and Performance by Nonprofit Organizations.

A full set of detailed statistical tables associated with the National Patterns data will be available in the report *National Patterns of R&D Resources: 2015–16 Data Update*, at <https://www.nsf.gov/statistics/natlpatterns/>. For further

information on the National Patterns data and methodology, contact the author.

## Notes

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2. NCSES identifies the main categories of R&D performers as follows: businesses, federal agencies, federally funded research and development centers (administered by businesses, universities, or nonprofit organizations), state government agencies, higher education, and other nonprofit organizations. For R&D funding, the main categories are businesses, the federal government, nonfederal government (state and local), higher education, and other nonprofit organizations.

3. With this new edition of *National Patterns*, the data series for higher education R&D include a number of methodological improvements. First, starting with the FY 2012 survey year, the Higher Education R&D (HERD) Survey was revised to collect an

abbreviated set of data from institutions reporting less than \$1 million of R&D expenditures during the fiscal year. This increment of higher education R&D performance had not previously been included in the *National Patterns* total for the sector; it totaled \$143 million in FY 2012 and has ranged from \$130 million to \$150 million in subsequent years. Second, with a larger effect, the adjustment to net out funds for R&D expenditures reported by academic institutions in the HERD Survey as passed through to subrecipients has been revised in several ways from 1998 (when the pass-through adjustment was first applied) up through the estimated data for 2016 in the InfoBrief presented here. For the 1998 to 2016 survey years, the coverage of the pass-through funding adjustment was expanded to include all non-educational recipients (i.e., businesses, nonprofit organizations, and others). The effect of this revised pass-through adjustment is that the annual totals of higher education R&D performance are some \$0.4 billion lower in 1998, the first year for this adjustment, increasing to being annually approximately \$2.5 billion lower in 2012 through 2015 than previously reported in *National Patterns*. For the 2010 to 2016 survey years, this

more comprehensive pass-through funding adjustment was further improved by tabulating the adjustments on an institution-by-institution basis, which allows for a more precise estimate of the original non-federal sources of pass-through funds and better estimation of the type of R&D (basic, applied, or experimental development) being passed through to other R&D performers.

4. The Department of Commerce's Bureau of Economic Analysis (BEA) introduced a comprehensive set of revisions to the National Income and Product Accounts in July 2013—including explicitly recognizing R&D as investment in the measure of U.S. gross domestic product. Although based on NCSES R&D data, BEA's R&D investment totals differ from the R&D expenditures totals reported here and by NCSES more generally. Notably, NSF-reported R&D devoted to software applications is not reported as R&D in the BEA R&D investment totals; instead, software R&D is included in BEA's software investment totals. For a fuller explanation of this development and its implications see NCSES's recent InfoBrief on this topic: <https://www.nsf.gov/statistics/2015/nsf15315/>.