



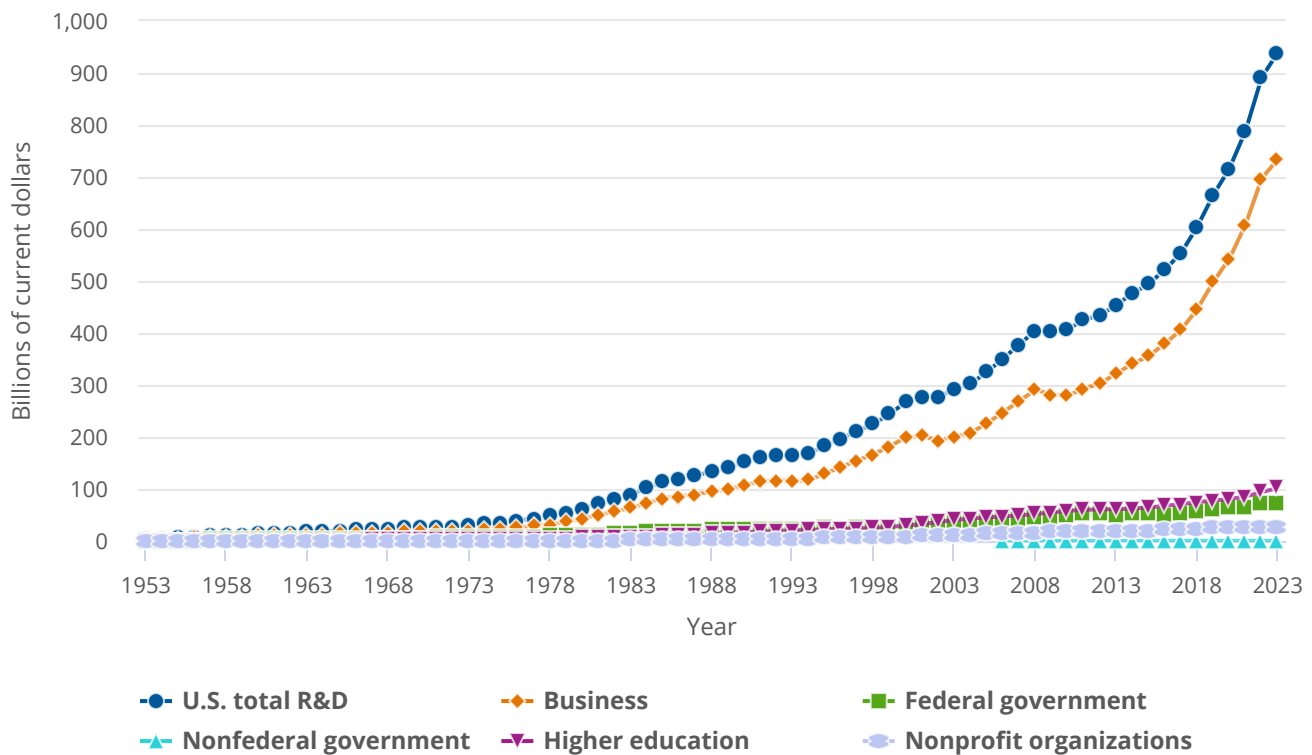
National Center for Science and
Engineering Statistics

InfoBrief

U.S. R&D Totaled \$892 Billion in 2022; Estimate for 2023 Indicates Further Increase to \$940 Billion

NSF 25-327 | February 2025

New data from the National Center for Science and Engineering Statistics (NCSES) within the U.S. National Science Foundation indicate that research and experimental development (R&D)¹ performed in the United States totaled \$892 billion in 2022 ([figure 1](#)). The estimated total for 2023, based on performer-reported expectations, is \$940 billion.² Of the 2022 domestic R&D performance, \$292 billion was research (basic and applied research combined) and \$600 billion was experimental development. Of the \$892 billion total, the business sector funded \$673 billion and the federal government funded \$164 billion.

Figure 1**U.S. R&D expenditures, by performing sector: 1953–2023****Note(s):**

Some data for 2022 are preliminary and may be revised later. The data for 2023 include estimates and are likely to be revised later. Federal performers of R&D include federal agencies and federally funded research and development centers (FFRDCs). Nonfederal government R&D performance is that of state governments (data in this series were not available prior to 2006).

Source(s):

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

R&D can be broken down by type of R&D, R&D performer, and sources of R&D funding, all of which are of interest in part because knowledge generated by R&D can have not only direct benefits (new products and services) to those performing the R&D but also “spillover” benefits. R&D spillovers occur because “[i]deas generated by one inventor may lead other inventors to create other new ideas.”³ Researchers have documented that the type of R&D⁴ and source of funds⁵ impact the magnitude of these R&D spillovers.

The U.S. R&D system consists of the activities of a diverse group of R&D performers and sources of funding. Performers and sources include private businesses, the federal government, nonfederal governments such as state and local, higher education institutions, and other nonprofit organizations. Organizations can have multiple roles in the performance and funding of R&D. They may perform R&D funded by themselves, by others, or by both. They may also only fund R&D outside their organization or may fund both internal and external R&D. The data for this InfoBrief derive mainly from NCSES surveys of the annual R&D expenditures of these performers and funders.

The “[Data Sources, Limitations, and Availability](#)” section at the end of this InfoBrief summarizes the main data sources and methodology and provides further details on the data. Data cited in this report that do not appear in one of this InfoBrief’s tables or figures come from the [National Patterns of R&D data tables](#).

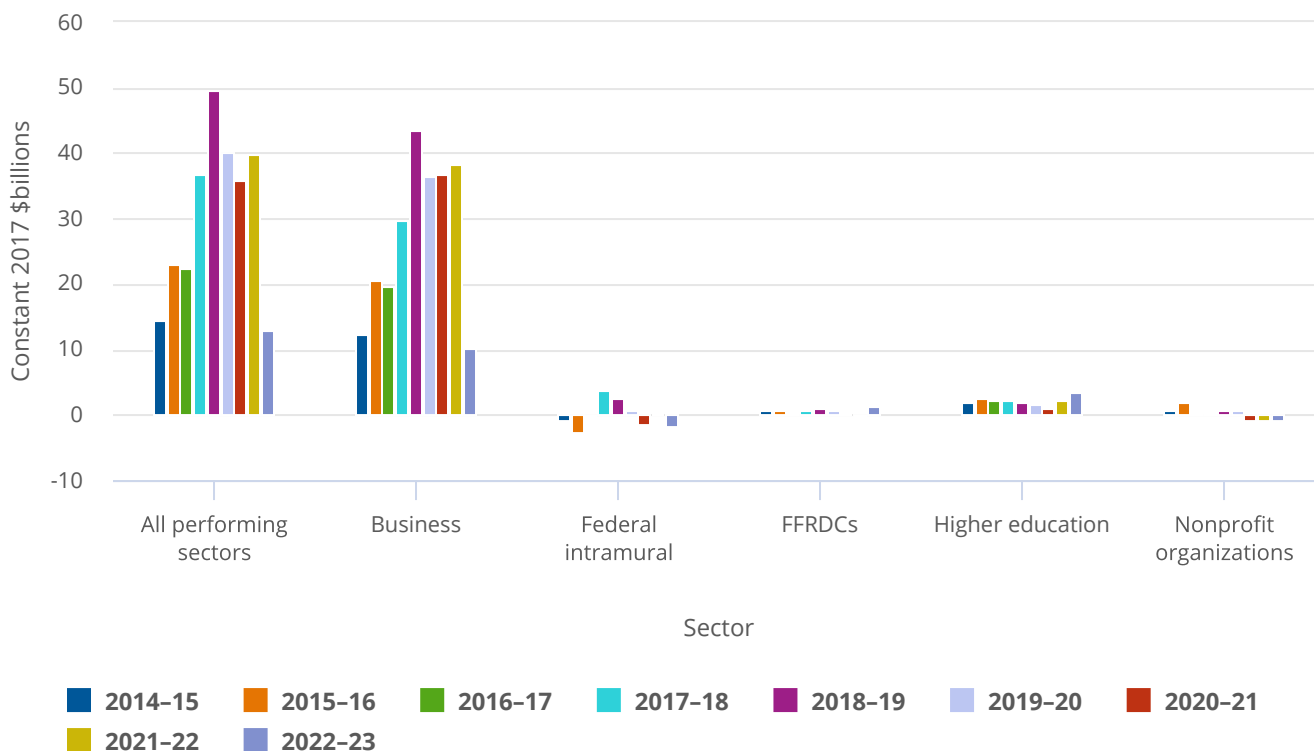
Preliminary 2023 Estimates and Current Trends in U.S. R&D Totals and National R&D Intensity

U.S. Total R&D

Adjusting for inflation (in constant 2017 dollars), U.S. total R&D expenditures are estimated to increase by \$13 billion from 2022 to 2023, with the business sector accounting for most of this increase (figure 2). In constant dollar terms, business R&D performance is estimated to increase by \$10 billion in 2023, considerably less than the increase of \$38 billion in 2022. Every year some of the variation in R&D estimates is due to changes in individual survey respondent reporting practices. During the 2023 Business Enterprise Research and Development (BERD) Survey data collection some respondents revised their reporting practices and eliminated expenditures that did not meet the definition of R&D.⁶ Consequently, the estimated 2023 business R&D expenditures reported here are adjusted to this lower and more accurate R&D expenditure amount. This has resulted in a meaningful decrease in estimated 2023 U.S. R&D performance compared to what would have been estimated based on respondent reporting practices used in 2022 and earlier.⁷

Figure 2

Year-over-year changes in U.S. R&D expenditures, by performing sector: 2014–23



FFRDC = federally funded research and development center.

Note(s):

Some data for 2022 are preliminary and may be revised later. The data for 2023 include estimates and are likely to be revised later. Annual changes in nonfederal government R&D expenditures are included in the all performing sectors total but are not shown separately because they are less than \$0.1 billion. The estimated 2023 business R&D expenditures reflect changed reporting practices by respondents in the Business Enterprise Research and Development Survey, affecting comparability over time and producing a meaningfully lower estimate than would have resulted under past reporting practices. See the “Data Sources, Limitations, and Availability” section for more information.

Source(s):

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

Compared to the business sector, annual changes in inflation-adjusted R&D estimated for 2023 are minor for other R&D sectors, such as federal intramural performers (\$2 billion decrease) and federally funded research and development centers (FFRDCs) (\$1 billion increase). R&D performance in the higher education sector is estimated to increase \$4 billion in 2023, building on incremental real increases in R&D expenditures over the last several years. For nonprofit organizations, the change in 2023 R&D performance is not statistically significant.

Over the last decade (2012–22), the average annual increase in U.S. total R&D expenditures was 7.5% (measured as compound average growth rate [CAGR]⁸) in current dollars, or \$46 billion (table 1). The recent 7.5% growth rate is higher than that observed over prior decades, such as 1992–2002 (5.3%) and 2002–2012 (4.6%). Annual growth in R&D expenditures increased in the late 2010s, with several consecutive years of increases of greater than \$50 billion beginning in 2017–18. Since 2010, annual growth peaked at 13.1% in current dollars for 2021–22 but was substantially lower for that year (5.5%) after adjusting for inflation. In constant dollars, total R&D performance grew at an average of 5.0% from 2012 to 2022. For 2023, total R&D performance and business R&D performance are both estimated to increase 5.4% in current dollars or 1.7% in constant dollars over their 2022 levels. These smaller estimated increases for 2023 incorporate revised reporting practices adopted by business R&D performers in the BERD Survey, as discussed earlier in this text.

Table 1**Annual change in U.S. R&D expenditures and gross domestic product, by performing sectors: 1992–2023**

(Percent)

R&D expenditures and gross domestic product	Longer-term trends			Most recent years												
	1992–2002	2002–12	2012–22	2010–11	2011–12	2012–13	2013–14	2014–15	2015–16	2016–17	2017–18	2018–19	2019–20	2020–21	2021–22 ^a	2022–23 ^b
Current dollars																
Total R&D, all performers	5.3	4.6	7.5	4.8	1.8	4.7	4.8	3.9	5.5	6.1	9.1	10.2	7.7	10.1	13.1	5.4
Business	5.2	4.5	8.7	5.4	2.8	6.7	5.6	4.4	6.7	6.9	9.8	11.8	9.0	12.0	14.6	5.4
Federal government	3.9	3.9	3.2	5.4	-2.6	-2.0	3.1	0.3	-3.1	2.7	11.0	7.6	3.6	2.4	7.3	2.9
Federal intramural	4.1	3.6	2.8	9.3	-2.7	-1.8	4.1	-1.7	-7.1	1.5	14.2	8.4	3.4	0.6	7.8	-1.2
FFRDCs	3.4	4.5	4.0	-1.4	-2.4	-2.5	1.3	4.2	4.2	4.6	6.1	6.3	4.1	5.6	6.5	9.8
Nonfederal government ^c	NA	NA	0.8	0.4	-4.2	-6.8	-5.9	2.0	4.3	1.9	1.7	4.9	1.2	0.3	5.0	3.1
Higher education	6.6	5.2	4.5	3.4	1.3	1.0	1.3	3.7	4.9	4.9	5.3	4.3	3.4	6.1	10.0	8.2
Nonprofit organizations	9.1	4.1	4.7	-1.3	-0.3	4.1	6.1	5.0	9.6	3.9	4.2	4.4	4.7	1.2	3.8	0.5
Gross domestic product	5.3	4.0	4.8	3.7	4.2	3.9	4.3	3.9	2.8	4.3	5.3	4.3	-0.9	10.9	9.8	6.6
Constant 2017 dollars																
Total R&D, all performers	3.4	2.4	5.0	2.7	-0.1	3.0	3.0	2.9	4.5	4.2	6.6	8.4	6.3	5.3	5.5	1.7
Business	3.3	2.4	6.2	3.3	0.9	4.9	3.8	3.5	5.7	5.0	7.3	10.0	7.6	7.1	6.9	1.7
Federal government	2.0	1.8	0.8	3.2	-4.4	-3.7	1.4	-0.6	-4.1	0.9	8.6	5.9	2.3	-2.1	0.2	-0.7
Federal intramural	2.2	1.5	0.4	7.1	-4.5	-3.4	2.3	-2.6	-8.0	-0.3	11.6	6.6	2.0	-3.8	0.6	-4.6
FFRDCs	1.5	2.3	1.6	-3.3	-4.2	-4.1	-0.5	3.2	3.2	2.8	3.7	4.6	2.7	0.9	-0.6	6.0
Nonfederal government ^c	NA	NA	-1.6	-1.6	-5.9	-8.3	-7.5	1.0	3.3	0.1	-0.6	3.2	-0.2	-4.0	-2.0	-0.5
Higher education	4.6	3.0	2.0	1.4	-0.5	-0.6	-0.4	2.7	3.9	3.1	2.9	2.6	2.1	1.5	2.7	4.5
Nonprofit organizations	7.0	1.9	2.2	-3.3	-2.1	2.3	4.3	4.0	8.5	2.0	1.8	2.7	3.4	-3.2	-3.1	-3.0
Gross domestic product	3.4	1.9	2.4	1.6	2.3	2.1	2.5	2.9	1.8	2.5	3.0	2.6	-2.2	6.1	2.5	2.9

NA = not available.

FFRDC = federally funded research and development center.

^a Some data for 2022 are preliminary and may be revised later.^b The R&D data for 2023 include estimates and are likely to be revised later.^c Survey data on state internal R&D performance were not available prior to 2006; data for 2008 were not collected.**Note(s):**

The longer-term trend rates are calculated as compound annual growth rates.

Source(s):

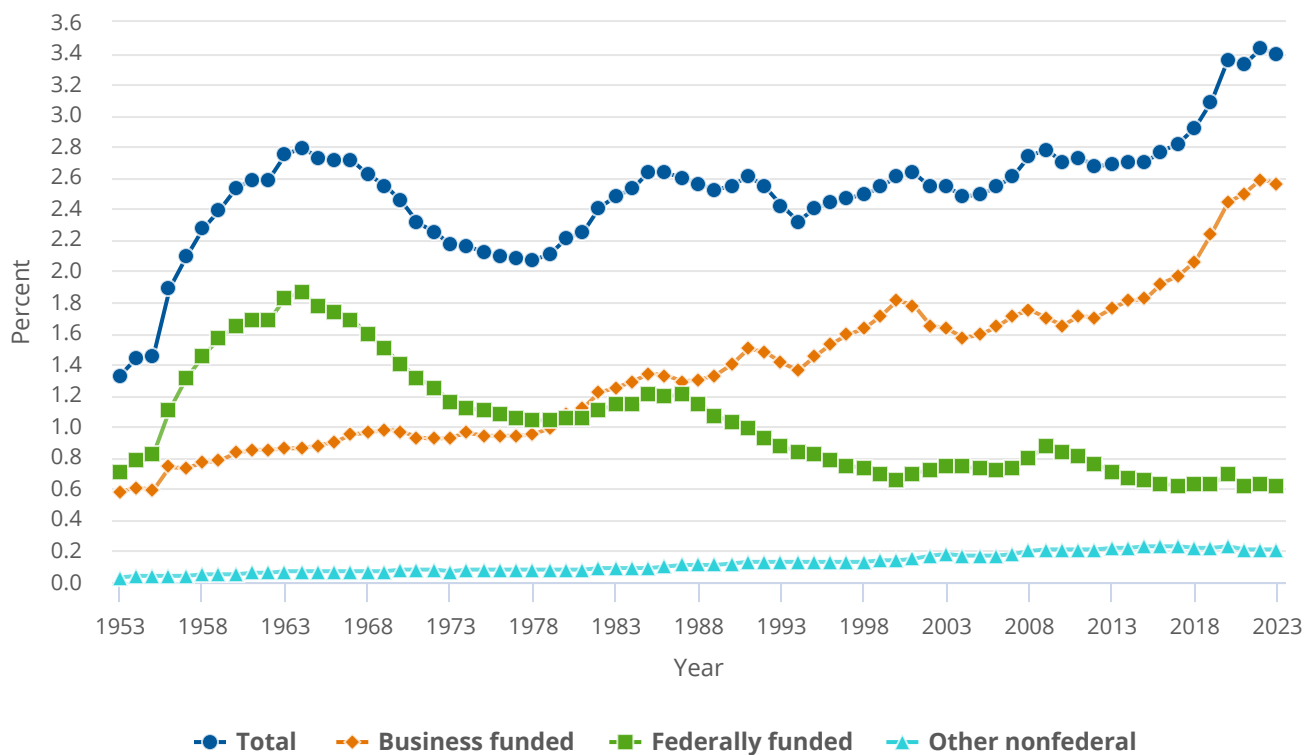
National Center for Science and Engineering Statistics, National Patterns of R&D Resources (annual series).

R&D-to-GDP Ratio

The ratio of total national R&D expenditures to gross domestic product (GDP) (i.e., R&D intensity) is widely used as an overall gauge of the relative priority of a nation's R&D effort among multiple investment and consumption options. Numerous Organisation for Economic Co-operation and Development (OECD) and European Union (EU) nations, as well as the EU overall, have set R&D intensity targets at or above 3.0%.⁹ In this edition of the *National Patterns* series, the ratio of U.S. R&D to GDP was 3.43% in 2022 and is estimated to be 3.39% in 2023 (figure 3). Prior to 2019 when R&D intensity reached 3.09%, the highest U.S. ratios recorded were 2.79% in 1964, 2.78% in 2009, 2.77% again in 2016, 2.82% in 2017, and 2.92% in 2018.¹⁰ The U.S. 2022 R&D to GDP ratio exceeded the OECD average (2.73%). The U.S. ratio also exceeded that of other key R&D-performing nations, such as China (2.56%), France (2.18% [provisional]), and the United Kingdom (2.90% [provisional, 2021]). Israel (6.02% [estimated]) and South Korea (5.21% [provisional]) had higher ratios than the United States, whereas Taiwan (3.96%), Germany (3.13% [provisional]), and Japan (3.41%) had similar ratios to the United States.¹¹

Figure 3

Ratio of U.S. R&D to GDP, by source of funds: 1953–2023



GDP = gross domestic product

Note(s):

Some data for 2022 are preliminary and may be revised later. The data for 2023 include estimates and are likely to be revised later. The federally funded data represent the federal government as a funder of R&D by all performers; similarly the business-funded data cover the business sector as a funder of R&D by all performers. The other nonfederal category includes the R&D funded by all other sources—mainly, by higher education, nonfederal government, and nonprofit organizations. The gross domestic product data used reflect the U.S. Bureau of Economic Analysis statistics of October 2024.

Source(s):

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

The rising ratio of U.S. R&D to GDP is primarily attributable to increased business funding of R&D. Over the past decade (2012–22), business funding grew at a 9.3% rate in current dollars whereas federal funding grew at a 2.9% rate and GDP grew at a 4.8% rate. The higher education sector’s funding of R&D grew at 6.4% over the same period.

Federally funded R&D as a percentage of GDP peaked in the 1960s at 1.86% in 1964 and has since steadily declined. Since 2014, federal funding for R&D has remained at or below 0.70% of GDP, falling to 0.63% of GDP in 2022. By contrast, business R&D funding, which was below 1.00% of GDP through the 1960s, had reached 1.81% in 2014 and increased to 2.59% by 2022.

Performers of R&D

Business

The business sector is by far the largest performer of U.S. R&D. In 2022, domestically performed business R&D accounted for \$697 billion, or 78% of the \$892 billion national R&D total ([table 2](#)). The business sector’s predominance in national R&D performance has long been the case, with its annual share ranging between 69% and 78% since 2000.

Table 2**U.S. R&D expenditures, by performing sector and source of funds: 2010–23**

(Millions of current and constant 2017 dollars)

Performing sector and source of funds	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022 ^a	2023 ^b
Current \$millions														
All performing sectors	406,599	426,214	433,698	454,232	475,938	494,471	521,686	553,530	603,844	665,267	716,479	788,718	891,834	939,561
Business	278,977	294,092	302,251	322,528	340,728	355,821	379,529	405,792	445,563	498,175	543,220	608,625	697,256	734,959
Federal government	50,798	53,524	52,144	51,086	52,687	52,847	51,187	52,553	58,356	62,802	65,093	66,662	71,533	73,621
Federal intramural ^c	31,970	34,950	34,017	33,406	34,783	34,199	31,762	32,231	36,793	39,870	41,227	41,469	44,699	44,161
FFRDCs	18,828	18,574	18,128	17,680	17,903	18,649	19,424	20,322	21,563	22,932	23,866	25,193	26,834	29,460
Nonfederal government	691	694	665	620	583	595	620	632	643	675	683	685	719	742
Higher education	58,083	60,087	60,876	61,511	62,318	64,605	67,778	71,108	74,863	78,113	80,775	85,717	94,275	102,044
Nonprofit organizations	18,050	17,817	17,762	18,487	19,622	20,604	22,573	23,445	24,419	25,503	26,709	27,030	28,052	28,195
All funding sources	406,599	426,214	433,698	454,232	475,938	494,471	521,686	553,530	603,844	665,267	716,479	788,718	891,834	939,561
Business	248,126	266,426	275,728	297,188	318,410	333,243	360,291	386,533	426,472	482,199	520,324	590,946	673,127	709,161
Federal government	126,617	127,014	123,837	120,131	118,367	119,532	118,174	122,435	131,017	135,646	147,985	147,258	164,471	172,345
Nonfederal government	4,303	4,386	4,158	4,244	4,214	4,277	4,995	5,075	5,251	5,471	5,672	5,733	6,010	6,382
Higher education	12,262	13,103	14,282	15,341	16,176	17,260	18,729	19,878	20,987	21,882	22,557	23,786	26,560	29,043
Nonprofit organizations	15,292	15,284	15,694	17,327	18,771	20,160	19,497	19,608	20,118	20,070	19,940	20,996	21,665	22,629
Constant 2017 \$millions														
All performing sectors	453,633	465,904	465,418	479,297	493,604	508,109	531,030	553,530	590,321	639,808	680,024	715,899	755,622	768,410
Business	311,248	321,479	324,357	340,326	353,376	365,635	386,327	405,792	435,585	479,111	515,581	552,433	590,762	601,079
Federal government	56,674	58,508	55,958	53,905	54,643	54,305	52,103	52,553	57,049	60,398	61,781	60,507	60,608	60,210
Federal intramural ^c	35,668	38,205	36,504	35,250	36,074	35,142	32,331	32,231	35,969	38,344	39,129	37,640	37,872	36,116
FFRDCs	21,006	20,303	19,453	18,656	18,568	19,163	19,772	20,322	21,080	22,054	22,652	22,867	22,736	24,094
Nonfederal government	771	758	713	654	605	611	631	632	629	649	648	622	609	607
Higher education	64,802	65,682	65,328	64,905	64,631	66,386	68,991	71,108	73,186	75,123	76,665	77,803	79,876	83,456
Nonprofit organizations	20,138	19,476	19,061	19,507	20,350	21,172	22,977	23,445	23,872	24,527	25,350	24,534	23,768	23,059
All funding sources	453,633	465,904	465,418	479,297	493,604	508,109	531,030	553,530	590,321	639,808	680,024	715,899	755,622	768,410
Business	276,828	291,237	295,894	313,588	330,229	342,434	366,744	386,533	416,921	463,746	493,850	536,386	570,319	579,981
Federal government	141,263	138,842	132,894	126,760	122,760	122,829	120,290	122,435	128,082	130,455	140,456	133,662	139,351	140,950
Nonfederal government	4,800	4,795	4,462	4,478	4,370	4,394	5,084	5,075	5,133	5,262	5,384	5,204	5,092	5,219
Higher education	13,680	14,323	15,326	16,188	16,776	17,736	19,064	19,878	20,517	21,044	21,409	21,590	22,504	23,753
Nonprofit organizations	17,061	16,707	16,841	18,284	19,468	20,716	19,846	19,608	19,668	19,302	18,925	19,057	18,356	18,507

FFRDC = federally funded research and development center.

^a Some data for 2022 are preliminary and may be revised later.

^b The data for 2023 include estimates and are likely to be revised later.

^c Federal intramural includes expenditures of federal intramural R&D as well as costs associated with administering extramural R&D.

Note(s):

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(s):

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

Higher Education

R&D performed in the United States by the higher education sector totaled \$94 billion in 2022, or 11% of U.S. total R&D ([table 2](#)).¹² In the period 2000–22, the higher education share of U.S. total R&D ranged between 11% and 14%.

Adjusted for inflation, growth in the higher education sector's R&D performance averaged 2.0% annually during 2012–22, well behind U.S. total annual R&D growth (5.0%) over the same period. The annual percent change in higher education R&D has varied in recent years, with low growth or contraction in 2010–14 with a return to modest increases in 2015 in constant dollars. The estimate for 2023 indicates 4.5% growth from 2022 when measured in constant dollars ([table 1](#)). In terms of long-term trends, constant-dollar annual growth in higher education R&D performance has been lower during the most recent decade (2.0% for 2012–22) than it has in preceding decades (4.6% for 1992–2002 and 3.0% for 2002–12).

Federal Agencies and Federally Funded Research and Development Centers

The federal government performed \$72 billion of the U.S. R&D total in 2022 ([table 2](#)). This amount included \$45 billion (5% of the U.S. total) performed by the intramural R&D facilities of federal agencies and \$27 billion (3%) performed by the 42 FFRDCs. The federal share of U.S. R&D performance ranged between 11% and 13% in 2001–11 and declined to 9% by 2019. Subsequently, the federal share is estimated to further decline to 8% in 2023. Measured in constant dollars, federal R&D performance is estimated to decrease in 2023 after a modest increase in 2022 ([table 1](#)).

State Government

State agency intramural R&D performance in 2022 totaled \$719 million—a small share (about 0.1%) of the U.S. total ([table 2](#)). This includes all 50 states and the District of Columbia.

Nonprofit Organizations

R&D performed in the United States by nonprofit organizations (excluding higher education institutions and federal and nonfederal government) was \$28 billion in 2022 ([table 2](#)).¹³ This was 3% of U.S. total R&D, a share that has changed little since the early 2000s.

R&D by Type of R&D

In 2022, basic research activities in all sectors accounted for \$130 billion, or 15% of U.S. total R&D expenditures ([table 3](#)). Applied research was \$162 billion, or 18% of the total. Most of the total of U.S. R&D expenditures was experimental development at \$600 billion, or 67%. Over the past decade, the share of R&D classified as experimental development increased slightly (from 63% to 67%), whereas shares of basic research (17% to 15%) and applied research (20% to 18%) decreased. Adjusting for inflation, basic research expenditures increased by about \$31 billion from 2012 to 2022, applied research increased by \$44 billion, and experimental development grew by \$215 billion.

Table 3

U.S. R&D expenditures, by type of R&D and performing sector: Selected years: 1970–2023

(Billions of current and constant 2017 dollars and percent)

Type of R&D	1970	1980	1990	2000	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022 ^a	2023 ^b
Current \$billions																		
All R&D	26.3	63.2	152.0	267.9	406.6	426.2	433.7	454.2	475.9	494.5	521.7	553.5	603.8	665.3	716.5	788.7	891.8	939.6
Basic research	3.6	8.7	23.0	42.0	76.5	73.7	74.0	79.3	82.9	84.4	87.5	90.1	97.8	104.9	111.6	118.6	130.3	138.2
Applied research	5.8	13.7	34.9	56.5	78.9	81.7	86.6	88.0	91.6	97.1	109.5	113.3	118.2	130.1	132.4	143.7	161.6	170.4
Experimental development	16.9	40.7	94.1	169.4	251.2	270.8	273.1	287.0	301.4	313.0	324.7	350.1	387.8	430.3	472.5	526.4	600.0	631.0
Constant 2017 \$billions																		
All R&D	130.1	160.6	256.3	368.5	453.6	465.9	465.4	479.3	493.6	508.1	531.0	553.5	590.3	639.8	680.0	715.9	755.6	768.4
Basic research	17.8	22.2	38.8	57.8	85.3	80.6	79.4	83.6	86.0	86.8	89.1	90.1	95.6	100.9	106.0	107.7	110.4	113.0
Applied research	28.5	34.9	58.8	77.7	88.0	89.3	93.0	92.8	95.0	99.7	111.4	113.3	115.6	125.1	125.6	130.4	136.9	139.4
Experimental development	83.8	103.5	158.6	233.0	280.3	296.0	293.1	302.8	312.6	321.6	330.5	350.1	379.1	413.8	448.5	477.8	508.3	516.0
Percent distribution																		
R&D performance																		
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	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Basic research	13.7	13.8	15.2	15.7	18.8	17.3	17.1	17.4	17.4	17.1	16.8	16.3	16.2	15.8	15.6	15.0	14.6	14.7
Applied research	21.9	21.7	23.0	21.1	19.4	19.2	20.0	19.4	19.2	19.6	21.0	20.5	19.6	19.6	18.5	18.2	18.1	18.1
Experimental development	64.4	64.5	61.9	63.2	61.8	63.5	63.0	63.2	63.3	63.3	62.2	63.3	64.2	64.7	65.9	66.7	67.3	67.2
R&D performance by performer																		
Basic research	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Business	15.7	13.8	20.1	16.7	21.4	17.7	18.0	24.6	26.5	25.8	28.6	28.4	29.9	31.1	32.6	34.4	33.3	33.1
Federal intramural	15.6	13.9	10.1	9.0	6.7	6.8	7.4	6.7	6.9	7.0	7.0	6.9	7.0	7.0	6.6	5.6	6.0	5.8
FFRDCs	8.5	14.8	13.2	9.6	8.7	8.8	7.7	5.3	5.0	4.9	4.8	4.6	4.4	4.4	4.3	4.3	4.1	4.3
Nonfederal government	NA	NA	NA	NA	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Higher education	51.6	49.3	48.3	53.0	50.7	53.9	54.0	50.7	48.7	49.2	49.0	49.7	48.4	47.0	45.5	45.6	45.8	46.7
Nonprofit organizations	8.5	8.2	8.3	11.7	12.4	12.7	12.8	12.6	12.8	13.0	10.4	10.2	10.3	10.4	10.9	10.1	10.7	10.1
Applied research	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Business	57.9	59.5	69.9	69.3	56.9	57.7	58.6	58.0	58.3	58.2	57.4	56.5	56.3	58.6	59.2	61.7	63.5	63.6
Federal intramural	23.2	18.5	10.5	10.8	10.2	9.8	9.9	9.4	9.6	9.6	9.0	8.9	9.4	8.7	8.7	7.7	7.9	7.4
FFRDCs	5.8	5.5	3.3	3.1	6.6	6.4	6.6	7.8	7.6	7.6	7.0	7.1	7.3	7.1	7.2	7.0	6.7	7.0
Nonfederal government	NA	NA	NA	NA	0.7	0.7	0.6	0.6	0.5	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.3	0.3
Higher education	7.8	11.8	12.6	11.3	18.2	18.6	17.8	17.8	17.5	17.5	16.9	17.3	17.4	16.5	16.8	16.3	15.8	16.2
Nonprofit organizations	5.2	4.6	3.7	5.5	7.4	6.8	6.4	6.4	6.5	6.6	9.3	9.7	9.2	8.7	7.6	6.8	5.7	5.5
Experimental development	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Business	80.9	83.1	83.3	90.8	86.7	86.4	87.2	87.8	88.0	88.7	89.8	90.3	90.2	90.5	90.7	91.0	91.9	92.1
Federal intramural	13.3	10.0	10.3	5.5	7.5	8.1	7.3	6.9	6.7	6.1	4.9	4.5	4.9	4.9	4.7	4.5	4.0	3.7

Table 3**U.S. R&D expenditures, by type of R&D and performing sector: Selected years: 1970–2023**

(Billions of current and constant 2017 dollars and percent)

Type of R&D	1970	1980	1990	2000	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022 ^a	2023 ^b
FFRDCs	4.7	4.9	3.9	2.1	2.8	2.5	2.5	2.3	2.2	2.3	2.3	2.3	2.2	2.1	2.0	1.9	1.8	1.8
Nonfederal government	NA	NA	NA	NA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Higher education	0.7	1.3	1.5	0.7	2.0	1.9	2.0	2.0	2.0	2.0	2.0	1.9	1.8	1.7	1.6	1.6	1.5	1.6
Nonprofit organizations	0.4	0.7	1.0	0.9	1.1	1.1	1.0	1.0	1.0	1.0	1.0	0.9	0.9	0.7	0.9	1.0	0.8	0.8

NA = not available

FFRDC = federally funded research and development center.

^a Some data for 2022 are preliminary and may later be revised.^b The data for 2023 include estimates and are likely to later be revised.**Note(s):**

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

Source(s):

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

Type of R&D by Performer

The higher education sector accounted for just under half (46%) of basic research performance in 2022 (table 3). The business sector was the second largest basic research performer (33%). Business was the majority performer (64%) of the \$162 billion of applied research in 2022; higher education was second at 16%. Federal intramural performers plus FFRDCs accounted for 15% of the applied research total. Business continued to dominate development performance, accounting for 92% of the U.S. total \$600 billion of that category in 2022. From 2012 to 2022, the business sector increased its share of R&D performance across all three types of R&D, notably increasing its share of basic research performance, from 18% to 33%. The share of U.S. basic research performed by higher education institutions—historically, the nation’s largest basic research performer—declined from 54% in 2012 to 46% in 2022. In absolute terms, higher education basic research performance increased from \$40 billion to \$60 billion during this period.¹⁴ The increased relative role of the business sector as a performer of basic and applied research is remarkable given its historical focus on experimental development.

Type of R&D by Source of Funds

Federal funding accounted for 41% of the \$130 billion of basic research in 2022 (table 4).¹⁵ Federal funds were less prominent for applied research (29% of \$162 billion) and experimental development (11% of \$600 billion). The business sector provided the greatest share of funding for applied research (62%) and the predominant share for experimental development (88%). Notably, it also accounted for a sizable share (35%) of funding for basic research.

Table 4

U.S. R&D expenditures, by performing sector, source of funds, and type of R&D: 2022

(Millions of dollars and percent)

Performing sector and type of R&D	Source of funds (\$millions)						Percent distribution by performer
	Total	Business	Federal government	Nonfederal government	Higher education	Nonprofit organizations	
R&D	891,834	673,127	164,471	6,010	26,560	21,665	100.0
Business	697,256	663,717	32,321	244	**	974	78.2
Federal government	71,533	212	71,123	38	**	161	8.0
Federal intramural	44,699	0	44,699	0	0	0	5.0
FFRDCs	26,834	212	26,424	38	**	161	3.0
Nonfederal government	719	16	321	369	3	11	0.1
Higher education	94,275	5,590	49,059	4,945	26,121	8,560	10.6
Nonprofit organizations	28,052	3,593	11,648	415	437	11,959	3.1
Percent distribution by funding source	100.0	75.5	18.4	0.7	3.0	2.4	-
Basic research	130,252	45,778	52,866	3,249	16,831	11,527	100.0
Business	43,355	40,768	2,480	21	**	86	33.3
Federal government	13,247	39	13,171	7	**	30	10.2
Federal intramural	7,859	0	7,859	0	0	0	6.0
FFRDCs	5,388	39	5,312	7	**	30	4.1
Nonfederal government	121	3	54	62	1	2	0.1
Higher education	59,619	3,139	31,605	2,948	16,609	5,320	45.8
Nonprofit organizations	13,910	1,829	5,556	211	222	6,090	10.7
Percent distribution by funding source	100.0	35.1	40.6	2.5	12.9	8.8	-
Applied research	161,627	99,467	47,307	1,961	6,955	5,937	100.0
Business	102,688	96,727	5,614	71	**	276	63.5
Federal government	23,501	98	23,312	17	**	74	14.5
Federal intramural	12,745	0	12,745	0	0	0	7.9
FFRDCs	10,757	98	10,568	17	**	74	6.7

Table 4**U.S. R&D expenditures, by performing sector, source of funds, and type of R&D: 2022**

(Millions of dollars and percent)

Performing sector and type of R&D	Source of funds (\$millions)						Percent distribution by performer
	Total	Business	Federal government	Nonfederal government	Higher education	Nonprofit organizations	
Nonfederal government	557	12	248	285	2	8	0.3
Higher education	25,605	1,632	13,410	1,473	6,832	2,259	15.8
Nonprofit organizations	9,277	997	4,724	115	121	3,320	5.7
Percent distribution by funding source	100.0	61.5	29.3	1.2	4.3	3.7	-
Experimental development	599,959	527,883	64,298	799	2,774	4,205	100.0
Business	551,217	526,222	24,227	152	**	616	91.9
Federal government	34,784	75	34,639	13	**	57	5.8
Federal intramural	24,095	0	24,095	0	0	0	4.0
FFRDCs	10,690	75	10,544	13	**	57	1.8
Nonfederal government	42	1	19	21	*	1	0.0
Higher education	9,051	820	4,045	525	2,681	982	1.5
Nonprofit organizations	4,865	766	1,368	88	93	2,550	0.8
Percent distribution by funding source	100.0	88.0	10.7	0.1	0.5	0.7	-

* = amount < \$0.5 million; ** = small to negligible amount, included as part of the funding provided by nonprofit organizations.

FFRDC = federally funded research and development center.

Note(s):

Some data for 2022 are preliminary and may be revised later.

Source(s):

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

Trends in Type of R&D by Source of Funds

Social scientists have noted important differences in the nature, role, and impact of research (basic research and applied research combined) and experimental development.¹⁶ Additionally, the shifting in the relative roles of performers and funders by sector—particularly among business, government, and higher education—is of great interest. For example, recent findings have highlighted the significant R&D spillovers from government-funded research.¹⁷ Measured in constant 2017 dollars, 2022 business expenditures on R&D performed by domestic businesses, higher education institutions, governments, and nonprofit organizations totaled \$570 billion, divided between \$123 billion (22%) on research and \$447 billion (78%) on experimental development (table 5, figure 4). In 2000, \$62 billion (24%) of business R&D expenditures were on research and \$193 billion (76%) of business expenditures were on experimental development. The federal government funded \$139 billion in R&D in 2022 divided between \$85 billion in research and \$54 billion in experimental development (table 5, figure 4).

Table 5

U.S. R&D expenditures, by type of R&D and source of funds: Selected years, 1970–2023

(Billions of current and constant 2017 dollars and percent)

Type of R&D and source of funds	1970	1975	1980	1985	1990	1995	2000	2005	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022 ^a	2023 ^b	
Current \$billions																								
Research	9.3	13.0	22.5	40.1	57.9	70.5	98.5	129.7	145.2	155.4	155.4	160.6	167.2	174.5	181.5	197.0	203.4	216.0	235.0	244.0	262.3	291.9	308.6	
Business	3.0	4.2	8.0	16.1	23.6	31.1	45.4	50.7	56.2	58.6	58.7	63.0	67.2	70.9	74.5	85.4	87.7	93.7	107.4	113.0	129.9	145.2	153.1	
Federal government	5.6	7.5	12.4	20.3	27.8	30.5	39.7	58.9	63.1	69.7	68.7	68.3	68.6	70.3	71.7	75.0	77.5	82.5	86.6	89.4	89.4	100.2	105.7	
Other nonfederal	0.8	1.2	2.1	3.7	6.5	8.9	13.4	20.0	26.0	27.1	28.0	29.3	31.5	33.3	35.3	36.6	38.2	39.8	41.0	41.6	43.0	46.5	49.8	
Nonfederal government	0.2	0.3	0.5	0.8	1.3	1.6	2.1	2.8	3.8	3.8	3.7	3.7	3.7	3.7	3.8	4.3	4.4	4.6	4.7	4.9	4.9	5.2	5.5	
Higher education	0.3	0.4	0.9	1.6	3.0	3.8	5.9	8.9	11.1	11.1	11.8	12.8	13.7	14.5	15.4	16.7	17.7	18.7	19.6	20.2	21.3	23.8	26.0	
Nonprofit organizations	0.3	0.5	0.8	1.3	2.3	3.4	5.4	8.3	11.0	12.2	12.4	12.8	14.0	15.1	16.1	15.6	16.0	16.5	16.6	16.5	16.8	17.5	18.3	
Constant 2017 \$billions																								
Research	46.3	46.6	57.1	79.0	97.7	105.4	135.5	159.0	165.0	173.3	169.9	172.4	176.5	181.0	186.5	200.5	203.4	211.2	226.0	231.6	238.1	247.3	252.4	
Business	14.7	15.2	20.3	31.7	39.9	46.5	62.5	62.2	63.8	65.4	64.2	67.6	70.9	73.6	76.5	86.9	87.7	91.6	103.3	107.3	117.9	123.1	125.2	
Federal government	27.7	27.1	31.5	40.0	46.8	45.6	54.7	72.3	71.7	77.7	75.1	73.3	72.4	72.9	73.7	76.3	77.5	80.7	83.3	84.8	81.1	84.9	86.4	
Other nonfederal	3.9	4.3	5.3	7.3	11.0	13.3	18.4	24.5	29.5	30.2	30.6	31.5	33.2	34.5	36.3	37.3	38.2	38.9	39.4	39.5	39.1	39.4	40.7	
Nonfederal government	1.1	1.2	1.2	1.5	2.2	2.4	2.8	3.5	4.3	4.2	4.1	3.9	3.9	3.9	3.9	4.4	4.4	4.5	4.6	4.7	4.5	4.4	4.5	
Higher education	1.2	1.5	2.2	3.2	5.0	5.7	8.1	10.9	12.7	12.4	12.9	13.8	14.5	15.0	15.8	17.0	17.7	18.3	18.9	19.2	19.3	20.2	21.3	
Nonprofit organizations	1.5	1.7	1.9	2.6	3.8	5.1	7.4	10.2	12.5	13.7	13.6	13.8	14.8	15.7	16.6	15.9	16.0	16.1	16.0	15.6	15.3	14.8	14.9	
Percent distribution																								
Research	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Business	31.7	32.6	35.5	40.1	40.8	44.1	46.1	39.1	38.7	37.7	37.8	39.2	40.2	40.6	41.0	43.3	43.1	43.4	45.7	46.3	49.5	49.8	49.6	
Federal government	59.9	58.2	55.2	50.7	47.9	43.3	40.3	45.5	43.4	44.9	44.2	42.5	41.0	40.3	39.5	38.1	38.1	38.2	36.8	36.6	34.1	34.3	34.2	
Other nonfederal	8.4	9.3	9.3	9.2	11.3	12.6	13.6	15.4	17.9	17.4	18.0	18.3	18.8	19.1	19.5	18.6	18.8	18.4	17.4	17.1	16.4	15.9	16.1	
Nonfederal government	2.5	2.5	2.1	1.9	2.2	2.3	2.1	2.2	2.6	2.4	2.4	2.3	2.2	2.1	2.1	2.2	2.2	2.1	2.0	2.0	1.9	1.8	1.8	
Higher education	2.7	3.1	3.8	4.0	5.1	5.4	6.0	6.8	7.7	7.1	7.6	8.0	8.2	8.3	8.5	8.5	8.7	8.7	8.3	8.3	8.1	8.1	8.4	
Nonprofit organizations	3.2	3.6	3.4	3.3	3.9	4.9	5.5	6.4	7.6	7.9	8.0	8.0	8.4	8.7	8.9	7.9	7.9	7.6	7.1	6.8	6.4	6.0	5.9	
Current \$billions																								
Experimental development	16.9	22.7	40.7	74.5	94.1	113.1	169.4	195.6	259.6	251.2	270.8	273.1	287.0	301.4	313.0	324.7	350.1	387.8	430.3	472.5	526.4	600.0	631.0	
Business	7.5	11.6	22.9	41.9	59.6	79.7	140.5	157.1	201.8	189.5	207.7	212.7	230.0	247.5	258.8	274.9	298.8	332.7	374.8	407.3	461.0	527.9	556.1	
Federal government	9.4	11.0	17.6	32.3	33.9	32.4	27.5	36.5	54.5	56.9	58.3	55.6	51.5	48.1	47.8	43.2	44.9	48.5	49.1	58.6	57.9	64.3	66.7	
Other nonfederal	0.1	0.1	0.2	0.4	0.6	0.9	1.4	2.1	3.2	4.8	4.8	4.8	5.4	5.9	6.4	6.6	6.4	6.6	6.4	6.5	7.5	7.8	8.3	
Nonfederal government	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.2	0.4	0.5	0.6	0.5	0.5	0.5	0.5	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.9	
Higher education	0.0	0.0	0.1	0.1	0.2	0.3	0.4	0.5	0.6	1.2	1.3	1.5	1.6	1.7	1.9	2.0	2.1	2.2	2.3	2.3	2.5	2.8	3.0	
Nonprofit organizations	0.0	0.1	0.1	0.2	0.3	0.5	0.9	1.4	2.2	3.0	2.9	2.9	3.3	3.6	4.0	3.9	3.6	3.6	3.4	3.5	4.2	4.2	4.4	
Constant 2017 \$billions																								
Experimental development	83.8	81.7	103.5	146.6	158.6	168.9	233.0	239.9	294.9	280.3	296.0	293.1	302.8	312.6	321.6	330.5	350.1	379.1	413.8	448.5	477.8	508.3	516.0	

Table 5**U.S. R&D expenditures, by type of R&D and source of funds: Selected years, 1970–2023**

(Billions of current and constant 2017 dollars and percent)

Type of R&D and source of funds	1970	1975	1980	1985	1990	1995	2000	2005	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022 ^a	2023 ^b	
Business	37.1	41.7	58.3	82.4	100.4	119.1	193.3	192.6	229.3	211.5	227.1	228.3	242.7	256.7	265.9	279.9	298.8	325.3	360.5	386.6	418.5	447.3	454.8	
Federal government	46.5	39.5	44.7	63.6	57.1	48.5	37.8	44.7	62.0	63.5	63.7	59.6	54.4	49.9	49.2	44.0	44.9	47.4	47.2	55.7	52.5	54.5	54.5	
Other nonfederal	0.3	0.4	0.5	0.7	1.1	1.4	1.9	2.6	3.6	5.3	5.2	5.2	5.7	6.1	6.6	6.7	6.4	6.4	6.2	6.2	6.8	6.6	6.8	
Nonfederal government	0.0	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.5	0.6	0.7	0.5	0.6	0.5	0.5	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	
Higher education	0.0	0.1	0.2	0.2	0.4	0.4	0.5	0.6	0.7	1.3	1.4	1.6	1.7	1.8	1.9	2.1	2.1	2.2	2.2	2.2	2.3	2.4	2.5	
Nonprofit organizations	0.2	0.2	0.3	0.4	0.5	0.7	1.2	1.8	2.5	3.4	3.1	3.1	3.5	3.8	4.2	4.0	3.6	3.5	3.3	3.3	3.8	3.6	3.6	
	Percent distribution																							
Experimental development	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Business	44.2	51.1	56.3	56.2	63.3	70.5	83.0	80.3	77.8	75.4	76.7	77.9	80.1	82.1	82.7	84.7	85.3	85.8	87.1	86.2	87.6	88.0	88.1	
Federal government	55.4	48.4	43.2	43.3	36.0	28.7	16.2	18.6	21.0	22.7	21.5	20.3	18.0	16.0	15.3	13.3	12.8	12.5	11.4	12.4	11.0	10.7	10.6	
Other nonfederal	0.3	0.5	0.5	0.5	0.7	0.8	0.8	1.1	1.2	1.9	1.8	1.8	1.9	1.9	2.0	2.0	1.8	1.7	1.5	1.4	1.4	1.3	1.3	
Nonfederal government	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	
Higher education	0.0	0.1	0.2	0.2	0.2	0.3	0.2	0.3	0.2	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.5	
Nonprofit organizations	0.2	0.3	0.3	0.2	0.3	0.4	0.5	0.7	0.8	1.2	1.1	1.1	1.2	1.2	1.3	1.2	1.0	0.9	0.8	0.7	0.8	0.7	0.7	

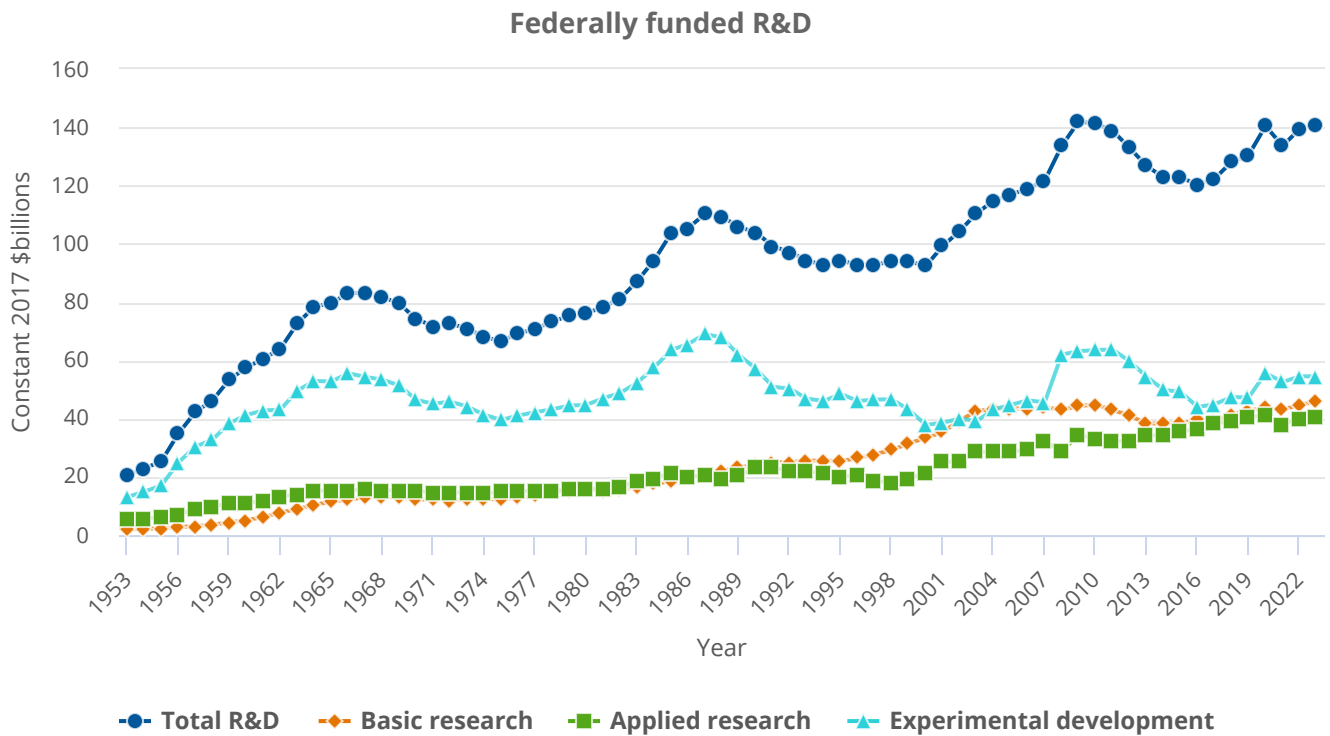
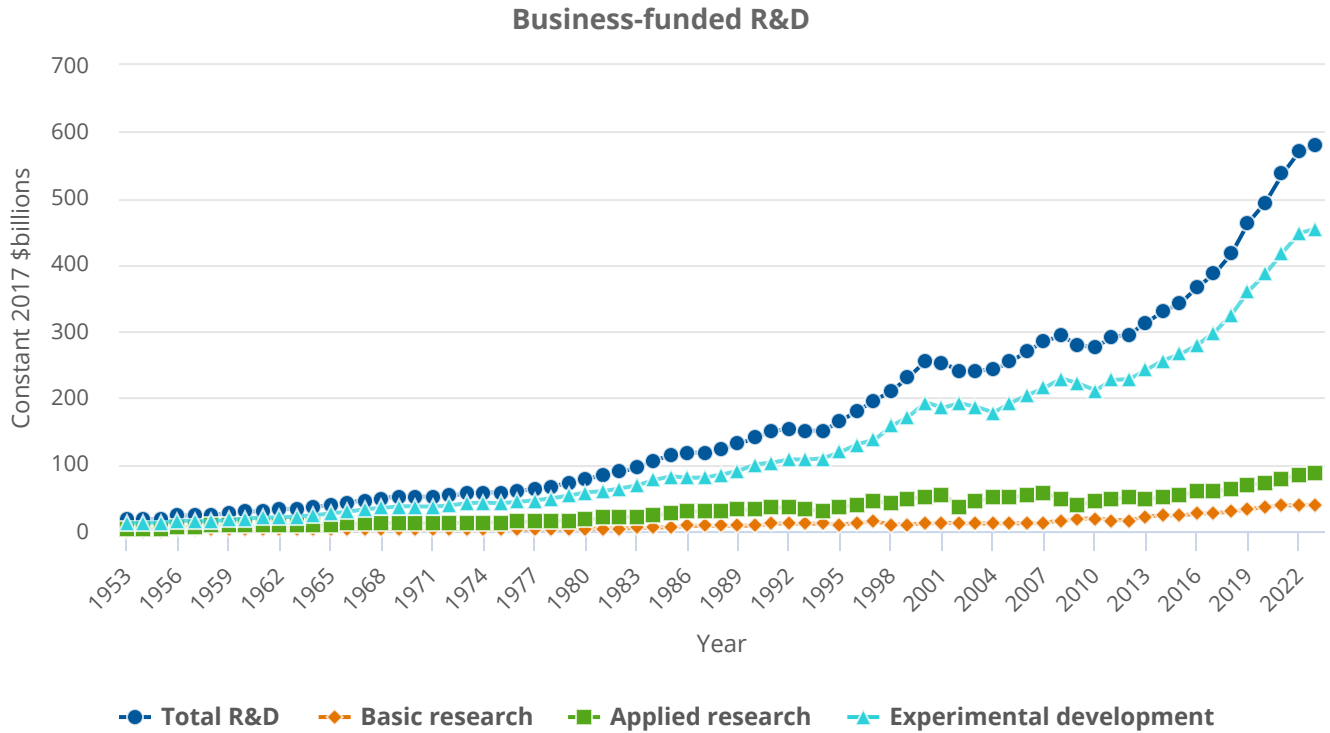
^a Some data for 2022 are preliminary and may be revised later.^b The data for 2023 include estimates and are likely to be revised later.**Note(s):**

Other nonfederal includes nonfederal government, higher education, and nonprofit organizations.

Source(s):

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

Figure 4
U.S. R&D expenditures, by source of funds and type of R&D: 1953–2023



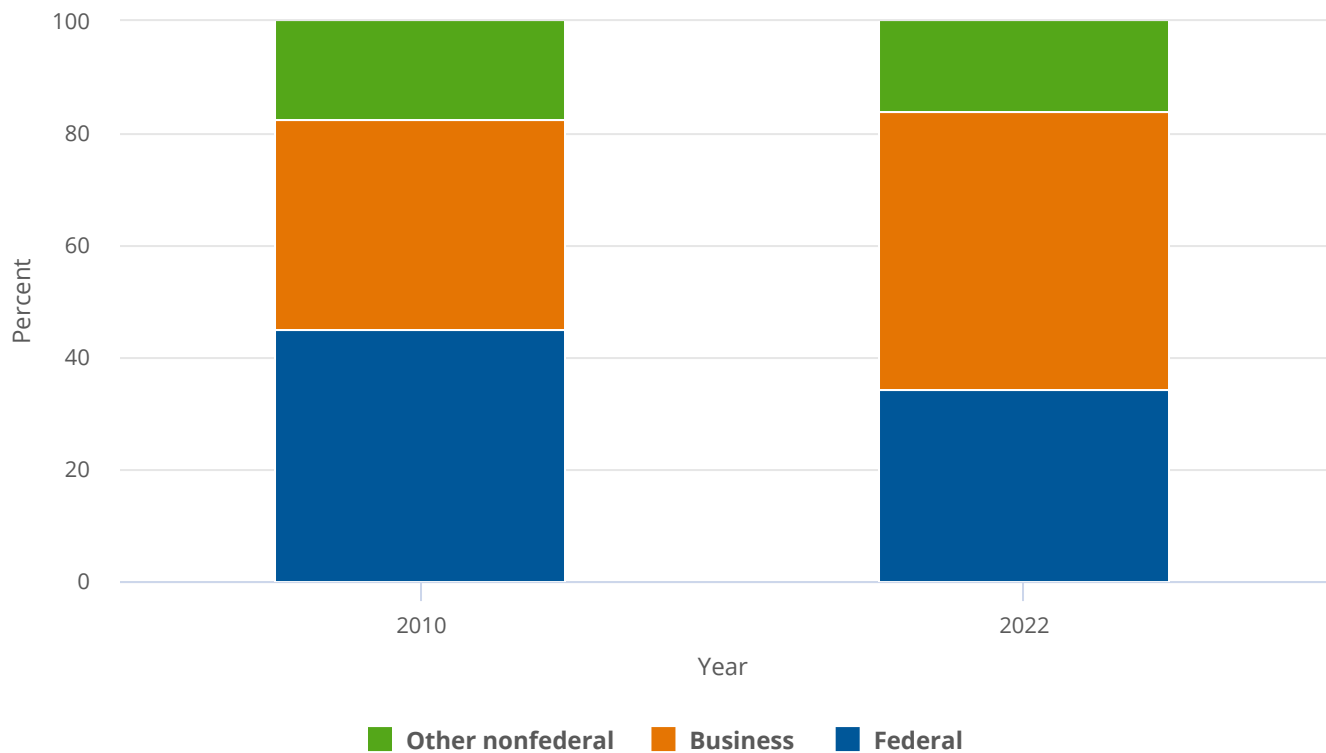
Note(s):

Some data for 2022 are preliminary and may be revised later. The data for 2023 include estimates and are likely to be revised later.

Source(s):

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

Business R&D expenditures funded 50% of total U.S. research (basic and applied research combined) in 2022, up from 38% in 2010 (figure 5, table 5). Over the same period, the federally funded share of U.S. total research declined from 45% in 2010 to 34% in 2022. Comparably, the federally funded share of basic research fell from 52% in 2010 to 41% in 2022.

Figure 5**U.S. research expenditures, by source of funds: 2010 and 2022****Note(s):**

Some data for 2022 are preliminary and may be revised later. The other nonfederal category includes the R&D funded by all other sources—mainly, by higher education, nonfederal government, and nonprofit organizations.

Source(s):

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

Business Sector R&D Personnel

Within the business sector, large companies (250 or more employees) employed over 80% of domestic business sector R&D personnel (table 6). In 2022, the R&D employment headcount for microbusinesses (companies with fewer than 10 employees) that performed or funded R&D totaled 36,000 employees, or 2% of the total R&D employment among businesses. Companies with 25,000 or more employees accounted for over a quarter of R&D employment headcount (30%, or 636,000 of the total 2.1 million business sector R&D employees). The same pattern holds for R&D full-time equivalent (FTE) employment, with microbusinesses' R&D FTE employment accounting for 1% of the business sector total,

and businesses with 25,000 or more employees accounting for 31%. Conversely, both R&D employment intensity and R&D sales intensity are higher among smaller businesses that perform or fund R&D. R&D-active microbusinesses report a 62% R&D employment intensity and a 42% R&D sales intensity; the largest businesses (25,000 or more employees) report a 5% R&D employment intensity and 5% R&D sales intensity.

Table 6

Domestic employment, R&D employment, and R&D sales intensity for companies that performed or funded business R&D in the United States, by selected industry and company size: 2022

(Thousands of employees and percent)

Industry and company size	NAICS code	Domestic employment (thousands)				R&D sales intensity (%)
		Total (headcount)	R&D employment (headcount)	R&D employment (full-time equivalent)	R&D employment intensity (%)	
All industries	31–33, 42, 51, 5413, 5415, 5417	24,150	2,146	1,970	8.9	4.9
Manufacturing industries	31–33	10,259	1,012	928	9.9	5.1
Chemicals	325	1,447	218	207	15.0	8.4
Pharmaceuticals and medicines	3254	665	172	164	25.9	16.9
Computer and electronic products	334	1,036	246	238	23.8	14.3
Semiconductor and other electronic components	3344	312	93	90	30.0	23.5
Navigational, measuring, electromedical, and control instruments	3345	321	54	50	16.8	10.6
Transportation equipment	336	1,856	195	175	10.5	5.2
Aerospace products and parts	3364	766	71	58	9.3	9.9
Nonmanufacturing industries	42, 51, 5413, 5415, 5417	13,890	1,134	1,042	8.2	4.7
Information	51	2,403	494	478	20.6	9.9
Software publishers	5112	482	148	141	30.7	13.8
Professional, scientific, and technical services	54	1,684	402	356	23.9	13.8
Computer systems design and related services	5415	545	123	111	22.6	12.5
Scientific research and development services	5417	419	159	152	38.0	30.2
Research and development in nanotechnology	541713	4	2	2	44.9	38.9
Research and development in biotechnology (except nanobiotechnology)	541714	126	38	37	30.3	39.8
Research and development in the physical, engineering, and life sciences (except nanotechnology and biotechnology)	541715	274	109	103	39.6	27.4
Microbusinesses						
1–9	–	58	36	29	62.5	42.4
Small companies						
10–19	–	86	34	30	39.5	12.7
20–49	–	267	89	76	33.3	13.0
Medium companies						
50–99	–	366	87	74	23.8	8.5
100–249	–	808	143	119	17.7	7.2
Large companies						
250–499	–	768	123	109	16.0	8.1

Table 6**Domestic employment, R&D employment, and R&D sales intensity for companies that performed or funded business R&D in the United States, by selected industry and company size: 2022**

(Thousands of employees and percent)

Industry and company size	NAICS code	Domestic employment (thousands)				R&D sales intensity (%)
		Total (headcount)	R&D employment (headcount)	R&D employment (full-time equivalent)	R&D employment intensity (%)	
500–999	–	993	131	115	13.2	5.5
1,000–4,999	–	3,159	348	318	11.0	5.1
5,000–9,999	–	1,909	181	171	9.5	3.7
10,000–24,999	–	3,373	338	318	10.0	4.2
25,000 or more	–	12,363	636	613	5.1	4.7

NAICS = North American Industry Classification System.

Note(s):

Detail may not add to total because of rounding. Industry classification is based on the dominant business code for domestic R&D performance, where available. For companies that did not report business codes, the classification used for sampling was assigned. Statistics are representative of companies located in the United States that performed or funded R&D. Only selected (NAICS 42, 51, 5413, 5415, 5417) nonmanufacturing sectors are sampled for the 1–9 employee population in the Annual Business Survey. Based on prior survey results, businesses with 1–9 employees in other nonmanufacturing subsectors are not believed to perform substantial amounts of R&D.

Source(s):

National Center for Science and Engineering Statistics and Census Bureau, Business Enterprise Research and Development Survey, 2022; National Center for Science and Engineering Statistics and Census Bureau, 2023 Annual Business Survey: Data Year 2022.

Among businesses that perform or fund R&D, 53% of the R&D personnel, measured on either a headcount or FTE basis, are employed within nonmanufacturing industries. R&D employment intensity, though, was lower among nonmanufacturing industries (8%) than manufacturing industries (10%). Within nonmanufacturing industries, scientific research and development services (NAICS 5417) reported a notable R&D employment intensity (38%) and R&D sales intensity (30%). Within manufacturing industries, the semiconductor and other electronic components industry group (NAICS 3344) reported high R&D employment intensity (30%) and R&D sales intensity (24%).

Data Sources, Limitations, and Availability

The statistics on U.S. R&D presented in this report derive mainly from integrating the data on R&D expenditures and funding collected by NCSSES's annual national surveys of the organizations that perform and fund the vast majority of U.S. R&D. These surveys cover each of four sectors of the economy: higher education, government, business enterprise, and nonprofit organizations.¹⁸ In some cases, the primary data from these surveys are adjusted to enable consistent integration of the statistics across these separately conducted surveys. The 2023 business R&D data is based on respondents' projected R&D costs reported on the 2022 BERD Survey, preliminary information from the 2023 BERD Survey, and trends for business R&D performance. Every survey year some of the variation in BERD estimates is due to changes in individual respondent reporting practices. During the 2023 BERD data collection some respondents revised their reporting practices and eliminated expenditures that did not meet the definition of R&D. This has resulted in a meaningful decrease in estimated U.S. R&D performance compared to the amount of 2023 R&D performance that would have been estimated based on respondent reporting practices used in 2022 and earlier. The estimated 2023 business R&D expenditures reported here are adjusted to this lower and more accurate R&D expenditure amount. This change has affected the comparability of these estimates to 2022 and earlier years. This 2023 estimate will be revised when actual R&D costs are collected in the subsequent survey year. In addition, preliminary or otherwise estimated values may be used where final data from one or more of the surveys are not yet available but can reasonably be estimated. Estimates in this InfoBrief are based on census and sample survey data that are subject to nonsampling error. Sample-survey-based estimates are also subject to sampling error. All comparative statements in this InfoBrief have undergone statistical testing and are significant at the 90% confidence level except statements reliant on modeled estimates.

The R&D surveys include NCSES's annual surveys of business R&D (the BERD Survey for 2019–22, the preceding Business Research and Development Survey for 2017–18, the Business R&D and Innovation Survey for 2008–16, and the Survey of Industrial R&D for 2007 and earlier years). In addition, the business R&D totals include R&D expenditures reported by “micro” companies (defined as companies with fewer than 10 employees) through NCSES surveys fielded for 2016 and forward (the 2016 Business R&D and Innovation Survey—Microbusiness and the Annual Business Survey [ABS] since 2017).¹⁹ Other NCSES survey data sources are the Higher Education Research and Development Survey (for FYs 2010–22), the preceding Survey of R&D Expenditures at Universities and Colleges (FY 2009 and earlier years), the Survey of Federal Funds for Research and Development (FYs 2023–24 and earlier years), and the FFRDC Research and Development Survey (FY 2023 and earlier years). Amounts for the R&D performed by nonprofit organizations with funding from the nonprofit sector and from business sources are estimated based on data and parameters from the FYs 2020–22 Nonprofit Research Activities (NPRA) modules of the ABS, the 2016 NPRA Survey, and the 1996–97 Survey of R&D Funding and Performance by Nonprofit Organizations.

A full set of detailed statistical tables and methodology information for the *National Patterns* data are available at <https://nces.nsf.gov/data-collections/national-patterns/2022-2023>. For further information and questions, contact NCSES.

NCSES has reviewed this product for unauthorized disclosure of confidential information and approved its release (NCSES-DRN25-009).

Notes

1 *Research and experimental development* (R&D) comprises creative and systematic work undertaken in order to increase the stock of knowledge—including knowledge of humankind, culture, and society—and to devise new applications of available knowledge. *Basic research* is experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundations of phenomena and observable facts, without any particular application or use in view. *Applied research* is original investigation undertaken in order to acquire new knowledge; directed primarily toward a specific, practical aim or objective. *Experimental development* is systematic work, drawing on knowledge gained from research and practical experience and producing additional knowledge, which is directed to producing new products or processes or to improving existing products or processes. See Organisation for Economic Co-operation and Development (OECD). 2015. *Frascati Manual 2015: Guidelines for Collecting and Reporting Data on Research and Experimental Development*. The Measurement of Scientific, Technological and Innovation Activities, OECD Publishing: Paris. Available at <https://doi.org/10.1787/9789264239012-en>.

2 Estimated 2023 R&D performance is based in part on 2023 projected R&D reported on the 2022 Business Enterprise Research and Development (BERD) Survey, preliminary information from the 2023 BERD Survey, and trends for business R&D performance. Every survey year some of the variation in BERD estimates is due to changes in individual respondent reporting practices. During the 2023 BERD data collection some respondents revised their reporting practices and eliminated expenditures that did not meet the BERD definition of R&D. This has resulted in a meaningful decrease in estimated U.S. R&D performance compared to the amount of 2023 R&D performance that would have been estimated based on respondent reporting practices used in 2022 and earlier. The estimated 2023 business R&D expenditures reported here are adjusted to this lower and more accurate R&D expenditure amount. This change has affected the comparability of these estimates to 2022 and earlier years.

3 Myers K. and Lanahan L. 2022. Estimating Spillovers from Publicly Funded R&D: Evidence from the U.S. Department of Energy. *American Economic Review* 112 (7): 2393–2423.

4 Arora A, Belenzon S, and Sheer L. 2021. Knowledge Spillovers and Corporate Investment in Scientific Research. *American Economic Review*, 111 (3): 871–898.

Mezzanotti F and Simcoe T; National Bureau of Economic Research. 2023. *Research and/or Development? Financial Frictions and Innovation Investment*. Working Paper No. 31521.

Arora A, Belenzon S, Ferracuti E, and Nagar J; National Bureau of Economic Research. 2024. *Revisiting the Private Value of Scientific Inventions*. Working Paper No. 33056.

- 5 Pierre Azoulay P, Graff Zivin J, Li D, and Sampat B. 2019. Public R&D Investments and Private-sector Patenting: Evidence from NIH Funding Rules. *Review of Economic Studies* 86, 117–152 <https://doi.org/10.1093/restud/rdy034>. Myers K and Lanahan L. 2022. Estimating Spillovers from Publicly Funded R&D: Evidence from the U.S. Department of Energy. *American Economic Review* 112 (7): 2393–2423 <https://www.aeaweb.org/articles?id=10.1257/aer.20210678>. Dyevre A. 2024. *Public R&D and Productivity Growth*, London School of Economics, unpublished manuscript. https://www.ecb.europa.eu/press/conferences/ecbforum/shared/pdf/2024/EFCEB_2024_Dyevre_paper.en.pdf.
- 6 See Organisation for Economic Co-operation and Development (OECD). 2015. *Frascati Manual 2015: Guidelines for Collecting and Reporting Data on Research and Experimental Development*. The Measurement of Scientific, Technological and Innovation Activities, OECD Publishing: Paris. Available at <https://doi.org/10.1787/9789264239012-en> and discussed above.
- 7 This change has affected the comparability of 2023 estimates to those published for 2022 and earlier years, which are based on less accurate reporting practices.
- 8 All growth rate calculations are reported using compound annual growth rates unless otherwise noted.
- 9 Organisation for Economic Co-operation and Development (OECD), Ministry of Economic Affairs and Employment of Finland, and VTT Technical Research Centre of Finland. 2021. *R&D Intensity as a Policy Target: Main Takeaways from 11 International Case Studies*. Available at <https://www.vttresearch.com/sites/default/files/2021-05/OECD-TIP-RD-intensity-case-studies-synthesis-report.pdf>.
- Rakic R et al. 2021. *Fostering R&D Intensity in the European Union: Policy Experiences and Lessons Learned*. Case study contribution to the OECD TIP project on R&D intensity. Available at https://research-and-innovation.ec.europa.eu/document/download/a94f8cf5-bb20-4f75-bbca-592d151ad6d1_en?filename=ec_rtd_oecd-tip-rd-case-study.pdf.
- 10 Due to sample variability in the data for the business R&D component, the calculated R&D-to-GDP ratios for 1964, 2009, and 2017 are not significantly different from one another at a 90% confidence level. Additionally, non-U.S. R&D-to-GDP ratios are adjusted for net R&D capital accumulation.
- 11 See Organisation for Economic Co-operation and Development, *OECD Main Science and Technology Indicators Database*, September 2023. Available at <https://www.oecd.org/sti/msti.htm>.
- 12 The data on higher education R&D reported by *National Patterns* differ from the underlying survey data in several respects. First, *National Patterns* translates the Higher Education R&D (HERD) Survey's primary data in academic fiscal years to calendar year equivalents. Second, *National Patterns* reports higher education R&D expenditures that are adjusted to remove the double-counting of pass-through funding included in HERD Survey source data. For further details on this topic, see "Technical Notes" at <https://nces.nsf.gov/data-collections/national-patterns/2022-2023#technical-notes>.
- 13 The most recent data on nonprofit organization R&D come from the FY 2022 Nonprofit Research Activities (NPRA) module of the Annual Business Survey and the 2016 NPRA Survey. Data for nonprofit organization R&D, 2017–19 are estimated based on the 2016 and 2020 data as revised in the 2022 survey. The availability of NPRA data allowed for improved measurement of nonprofit R&D performance over the 2017–22 period, resulting in minor changes to previously published estimates. For 1998–2015, data for nonprofit organization R&D funded by the federal government come from the NCSSES annual Survey of Federal Funds for Research and Development; data for that funded by businesses and by the nonprofit sector itself are estimated, based on parameters from the 1996–97 Survey of Research and Development Funding and Performance by Nonprofit Organizations.
- 14 See the [full set of National Patterns data tables](#): table 3.
- 15 Estimates of the type of R&D by source of funding are based on survey responses for federal funding by type of R&D and modeled using nonfederal funding sources of total R&D and the total nonfederally funded R&D by type. Because of this estimation procedure, comparisons of R&D type by funding source are not supported by statistical testing. *National Patterns of R&D* uses the general term "estimates" to describe survey estimates, modeled estimates, and projections. Results that combine these techniques are also called estimates because survey estimates are their major component.

- 16** Arora A, Belenzon S, and Sheer L. 2021. Knowledge Spillovers and Corporate Investment in Scientific Research. *American Economic Review*, 111 (3): 871–898.
- Mezzanotti F and Simcoe T; National Bureau of Economic Research. 2023. *Research and/or Development? Financial Frictions and Innovation Investment*. Working Paper No. 31521.
- Arora A, Belenzon S, Ferracuti E, and Nagar J; National Bureau of Economic Research. 2024. *Revisiting the Private Value of Scientific Inventions*. Working Paper No. 33056.
- 17** Pierre Azoulay P, Graff Zivin J, Li D, and Sampat B. 2019. *Public R&D Investments and Private-sector Patenting: Evidence from NIH Funding Rules*. *Review of Economic Studies* 86, 117–152.
- Myers K and Lanahan L. 2022. *Estimating Spillovers from Publicly Funded R&D: Evidence from the US Department of Energy*. *American Economic Review* 112 (7): 2393–2423.
- Dyevre A. 2024. *Public R&D and Productivity Growth*, London School of Economics, unpublished manuscript.
- 18** For further details on the correspondence between sectors used to measure R&D and those used in the System of National Accounts, please see the *Frascati Manual 2015: Guidelines for Collecting and Reporting Data on Research and Experimental Development* (<https://doi.org/10.1787/9789264239012-en>).
- 19** Estimates from the NCSSES business and nonprofit organization R&D surveys mentioned are all derived from sample data and thereby contain sampling error. Consequently, estimates of total U.S. R&D also contain sampling error. For more information on this topic and other surveys used in the *National Patterns* tabulations, see the “Technical Notes” at <https://ncses.nsf.gov/data-collections/national-patterns/2022-2023#technical-notes>.

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Contact Us

National Center for Science and Engineering Statistics
Directorate for Social, Behavioral and Economic Sciences
U.S. National Science Foundation
2415 Eisenhower Avenue, Suite W14200
Alexandria, VA 22314
Tel: (703) 292-8780
FIRS: (800) 877-8339
TDD: (800) 281-8749
E-mail: ncsesweb@nsf.gov