



U.S. R&D Spending Suffered a Rare Decline in 2009 but Outpaced the Overall Economy

by Mark Boroush¹

Overall spending on research and development conducted in the United States in 2009 is estimated to have totaled \$400.5 billion (current dollars), somewhat below the 2008 level of \$403.0 billion, although still well above the \$377.0 billion spent in 2007 (table 1). The growth of U.S. R&D from 2007 to 2008 was 6.9%, considerably ahead of the 1.9% expansion of gross domestic product (GDP) during that period (table 2). Although the level of total R&D dropped in 2009 by 0.6%, the depth of the decline was much less than the 2.5% decline in GDP. After adjusting for inflation, the 2009 level declined \$6 billion from the 2008 level (down 1.7%) but was still \$10 billion higher than in 2007.² (Amounts cited throughout this InfoBrief are in current dollars unless stated otherwise.)

This R&D spending slowdown in 2009 primarily reflects a drop in business R&D (both current and constant dollars) in the face of the financial crisis and economic downturn that started in late 2008. Even so, R&D spending in other performing sectors continued to rise, which offset some of the business R&D decline. Part of this was the effect—notably for federal and

academic R&D and R&D infrastructure—of the one-time \$18.3 billion funding increase for R&D appropriated by the American Recovery and Reinvestment Act of 2009 (ARRA, Public Law 111-5, enacted February 2009).

The 2009 drop in U.S. R&D is only the second such decline (current dollars) since the early 1950s. Nonetheless, the broader perspective remains that year-to-year increases in national R&D have occurred largely uninterrupted since 1953, in both current and constant dollars (figure 1). Over the 2004–09 period, annual growth in total R&D spending averaged 5.8%, compared with 3.3% for GDP (table 2). Growth in total R&D spending similarly outpaces that of GDP when the averaging period is either 10 years or 20 years. The same relative findings prevail when the dollars are adjusted for inflation.

R&D Performers and Funders

The U.S. R&D system consists of a variety of performers and sources of funding, including businesses, the federal government, universities and colleges, other (nonfederal) government agencies, and nonprofit organizations.³

A mix of performing and funding roles exists across this diverse group of organizations. Organizations that perform R&D often receive significant levels of outside funding; those that fund R&D may also be significant performers.

R&D Performers

In 2009, the business sector continued, by far, to be the largest performer of U.S. R&D, conducting \$282.4 billion, or 70.5%, of the total (table 1, figure 2, figure 3). This predominance of the business sector in national R&D has long been the case, with its annual share ranging from 69% to 75% over the 20-year period 1989–2009. The 2009 level declined from the 2008 level of \$290.7 billion, the first year-to-year decline since 2002. Even so, business R&D performance grew on average at 6.3% annually from 2004 to 2009, outpacing the rates of growth of both U.S. R&D at 5.8% and GDP at 3.3% (table 2).

Universities and colleges performed \$54.4 billion, or 13.6%, of U.S. R&D in 2009, an increase of around \$3 billion over the 2008 level. Indeed, academic R&D spending has increased (in current and constant dollars) each year

TABLE 1. U.S. R&D expenditures, by performing sector and source of funds: 2004–09

Sector and sources	2004	2005	2006	2007	2008	2009
	Current dollars (millions)					
All performing sectors	302,503	324,993	350,162	376,960	403,040	400,458
Business	208,301	226,159	247,669	269,267	290,681	282,393
Federal government	37,685	39,568	41,611	43,906	44,674	46,151
Federal intramural ^a	24,898	26,322	28,240	29,859	29,839	30,901
FFRDCs	12,788	13,246	13,371	14,047	14,835	15,250
Industry administered ^b	2,485	2,601	3,122	5,165	6,346	6,446
U&C administered ^b	7,659	7,817	7,306	5,567	4,766	4,968
Nonprofit administered	2,644	2,828	2,943	3,316	3,724	3,835
Universities and colleges	43,122	45,190	46,955	49,010	51,650	54,382
Other nonprofit organizations	13,394	14,077	13,928	14,777	16,035	17,531
All funding sources	302,503	324,993	350,162	376,960	403,040	400,458
Business	191,266	207,680	227,057	246,679	258,626	247,357
Federal government	91,656	96,276	100,768	105,822	117,611	124,432
Universities and colleges	7,936	8,578	9,285	9,959	10,707	11,436
Nonfederal government	2,883	2,922	3,021	3,265	3,518	3,675
Other nonprofit organizations	8,761	9,538	10,031	11,235	12,578	13,559
	Constant 2005 dollars (millions)					
All performing sectors	312,548	324,993	339,202	354,864	371,184	364,951
Business	215,218	226,159	239,917	253,484	267,706	257,355
Federal government	38,937	39,568	40,308	41,332	41,143	42,059
Federal intramural ^a	25,724	26,322	27,356	28,109	27,480	28,161
FFRDCs	13,212	13,246	12,953	13,224	13,663	13,897
Industry administered ^b	2,568	2,601	3,024	4,862	5,844	5,875
U&C administered ^b	7,913	7,817	7,078	5,241	4,389	4,528
Nonprofit administered	2,732	2,828	2,851	3,121	3,429	3,495
Universities and colleges	44,554	45,190	45,485	46,137	47,568	49,561
Other nonprofit organizations	13,839	14,077	13,492	13,911	14,767	15,977
All funding sources	312,548	324,993	339,202	354,864	371,184	364,951
Business	197,617	207,680	219,950	232,220	238,184	225,425
Federal government	94,700	96,276	97,614	99,619	108,315	113,399
Universities and colleges	8,200	8,578	8,995	9,375	9,861	10,422
Nonfederal government	2,979	2,922	2,926	3,074	3,240	3,349
Other nonprofit organizations	9,052	9,538	9,717	10,576	11,584	12,356

FFRDC = federally funded research and development center; U&C = university and college.

^a Includes expenditures of federal intramural R&D and costs associated with administering extramural R&D.

^b Los Alamos National Laboratory (approximately \$2 billion in annual R&D expenditures in recent years) became industry administered in June 2006; previously, it was U&C administered. Lawrence Livermore National Laboratory (more than \$1 billion in annual R&D expenditures in recent years) became industry administered in October 2007; previously it was U&C administered. These shifts in administration category are a main reason for changes apparent in R&D performer figures across 2006, 2007, and 2008.

NOTES: Data are based on annual reports by performers, except for nonprofit sector. Expenditure levels for academic and federal government performers are calendar-year approximations based on fiscal year data. Figures for other nonprofit organizations are estimated and may later be revised.

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

over the period 2004–09. The academic sector's share in U.S. R&D has ranged between 11% and 14% over the 20-year period 1989–2009.

The federal government conducted \$46.2 billion, or 11.5%, of U.S. R&D

in 2009 (including federal intramural, \$30.9 billion, and federally funded research and development centers [FFRDCs], \$15.3 billion). This was up by well over \$1 billion from the \$44.7 billion spent in 2008. In 1989, the federal performance share was 16%,

but it gradually declined in the years since, ranging marginally above and below 12% since 2004.

Other nonprofit organizations performed \$17.5 billion, or 4.4%, of U.S. R&D in 2009.

TABLE 2. Annual rates of growth in U.S. R&D expenditures, total and by performing sectors: 1989–2009

(Percent)

Expenditures and gross domestic product	Longer-term trend			Most recent years		
	1989–2009	1999–2009	2004–09	2006–07	2007–08	2008–09
Current dollars						
Total R&D, all performers	5.3	5.0	5.8	7.7	6.9	-0.6
Business	5.3	4.5	6.3	8.7	8.0	-2.9
Federal government	3.6	5.7	4.1	5.5	1.8	3.3
Federal intramural ^a	3.6	5.6	4.4	5.7	-0.1	3.6
FFRDCs	3.6	5.8	3.6	5.1	5.6	2.8
Universities and colleges	6.4	6.8	4.7	4.4	5.4	5.3
Other nonprofit organizations	8.1	7.9	5.5	6.1	8.5	9.3
Gross domestic product	4.8	4.1	3.3	4.9	1.9	-2.5
Constant 2005 dollars						
Total R&D, all performers	2.9	2.6	3.1	4.6	4.6	-1.7
Business	3.0	2.1	3.6	5.7	5.6	-3.9
Federal government	1.3	3.2	1.6	2.5	-0.5	2.2
Federal intramural ^a	1.3	3.2	1.8	2.8	-2.2	2.5
FFRDCs	1.3	3.3	1.0	2.1	3.3	1.7
Universities and colleges	4.0	4.3	2.2	1.4	3.1	4.2
Other nonprofit organizations	5.7	5.4	2.9	3.1	6.2	8.2
Gross domestic product	2.4	1.7	0.7	1.9	-0.3	-3.5

FFRDC = federally funded research and development center.

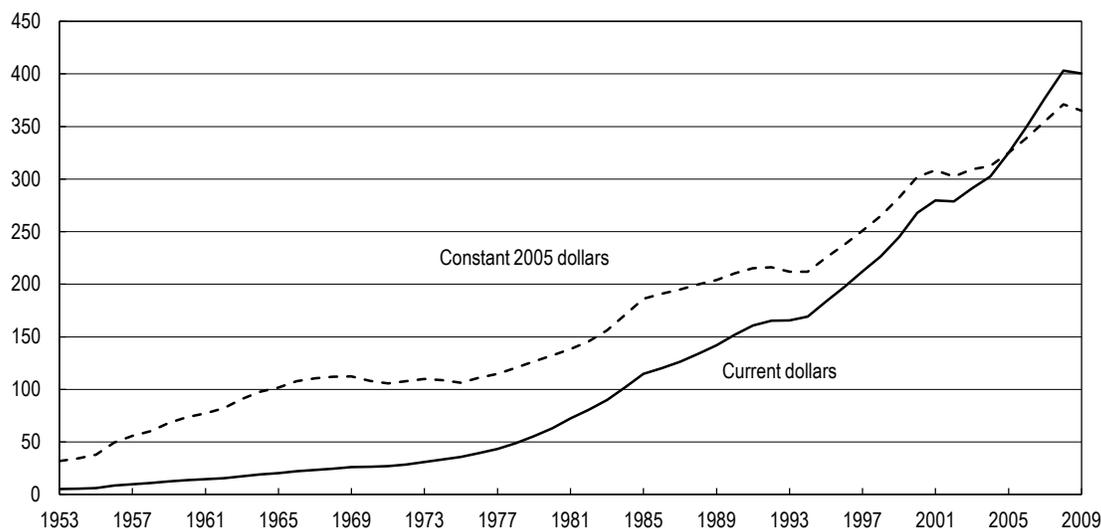
^a Includes expenditures of federal intramural R&D as well as costs associated with administering extramural R&D.

NOTE: Longer-term trend rates are calculated as compound annual growth rates.

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

FIGURE 1. U.S. R&D expenditures: 1953–2009

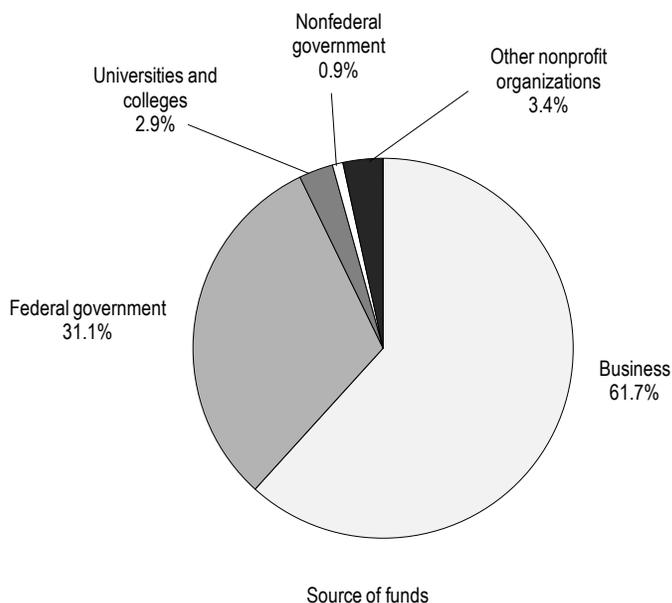
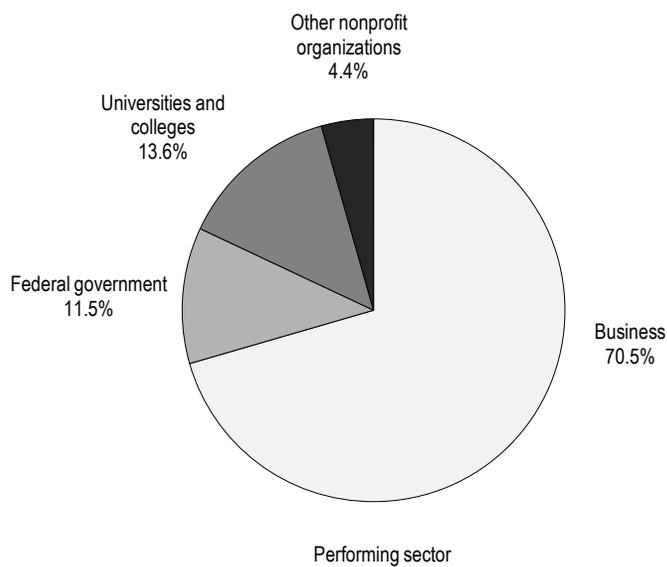
Dollars (billions)



NOTE: Some figures involve estimates and may later be revised.

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

FIGURE 2. Shares of U.S. R&D expenditures, by performing sector and source of funds: 2009



NOTES: Some figures involve estimates and may later be revised. National R&D expenditures are estimated to be \$400.5 billion in 2009. Federal performing sector includes federal agencies and federally funded research and development centers. State and local government support to business is included in business support for business performance.

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

R&D Funders

With regard to R&D funding, the business sector was again the predominant source in 2009, providing an estimated \$247.4 billion, or 61.8%, of the total (table 1, figure 2, figure 3). The federal government accounted for \$124.4 billion, or 31.1%, of the funding total. Universities and colleges provided \$11.4 billion, or 2.9%; other nonprofit organizations, \$13.6 billion, or 3.4%; and nonfederal government agencies, \$3.7 billion, or 0.9%. In recent years, these shares have remained relatively stable.

R&D by Character of Work

Basic research activities accounted for \$76.0 billion, or 19.0%, of all U.S. R&D expenditures in 2009 (table 3). Applied research was \$71.3 billion, or 17.8%; development was \$253.2 billion, or 63.2%.

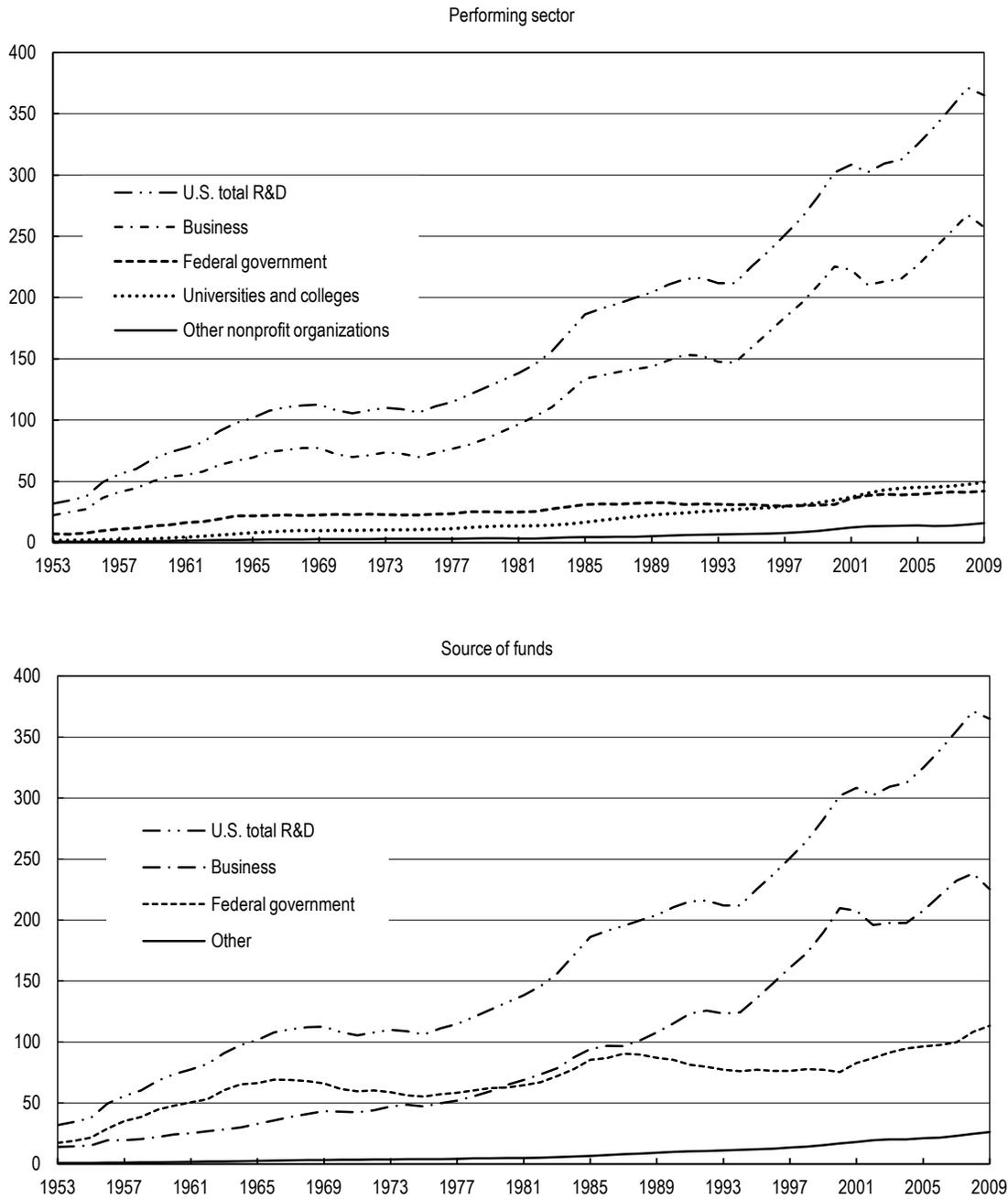
Universities and colleges were the predominant performers (53.4%) of the \$76.0 billion of basic research in 2009, with the federal government providing the largest share (53.2%) of the funding (table 3). The business sector performed more than half (57.6%) of the \$71.3 billion of applied research and was also the largest funder (48.1%). Business was even more predominant in development, where it both performed the vast majority (89.5%) and provided the largest percentage (77.6%) of the nation's \$253.2 billion of development expenditures in 2009.

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 R&D effort and is widely used as an international benchmark for comparing countries' overall R&D systems.

FIGURE 3. U.S. R&D, by performing sector and source of funds: 1953–2009

Constant 2005 dollars (billions)



NOTES: Some figures involve estimates and may later be revised. Current dollar figures are converted to constant dollars based on the implicit gross domestic product price deflator. Federal performers of R&D include federal agencies and federally funded research and development centers. Other funding includes support from universities and colleges, nonfederal government, and other nonprofit organizations. State and local government funding to businesses is included in business support for business R&D performance.

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

TABLE 3. U.S. R&D expenditures, by performing sector, source of funds, and character of work: 2009

Performing sector and character of work	Source of funds (\$millions)					Total expenditures (% distribution)
	Total	Business	Federal government	Universities and colleges	Other nonprofit organizations	
R&D	400,458	247,357	124,431	15,111	13,559	100.0
Business	282,393	242,820	39,573	**	**	70.5
Federal government	46,150	**	46,150	**	**	11.5
Federal intramural	30,901	**	30,901	**	**	7.7
FFRDCs	15,249	**	15,249	**	**	3.8
Industry administered	6,446	**	6,446	**	**	1.6
U&C administered	4,968	**	4,968	**	**	1.2
Nonprofit administered	3,835	**	3,835	**	**	1.0
Universities and colleges	54,383	3,279	31,575	15,111	4,418	13.6
Other nonprofit organizations	17,532	1,258	7,133	**	9,141	4.4
Percent distribution by source	100.1	61.8	31.1	3.8	3.4	–
Basic research	75,970	16,486	40,451	10,800	8,233	100.1
Business	14,784	13,444	1,340	**	**	19.5
Federal government	11,373	**	11,373	**	**	15.0
Federal intramural	5,507	**	5,507	**	**	7.2
FFRDCs	5,866	**	5,866	**	**	7.7
Industry administered	2,550	**	2,550	**	**	3.4
U&C administered	1,808	**	1,808	**	**	2.4
Nonprofit administered	1,508	**	1,508	**	**	2.0
Universities and colleges	40,544	2,344	24,242	10,800	3,158	53.4
Other nonprofit organizations	9,269	698	3,496	**	5,075	12.2
Percent distribution by source	99.9	21.7	53.2	14.2	10.8	–
Applied research	71,330	34,344	30,101	3,535	3,350	100.1
Business	41,055	33,258	7,797	**	**	57.6
Federal government	12,665	**	12,665	**	**	17.8
Federal intramural	8,006	**	8,006	**	**	11.2
FFRDCs	4,659	**	4,659	**	**	6.5
Industry administered	1,930	**	1,930	**	**	2.7
U&C administered	1,289	**	1,289	**	**	1.8
Nonprofit administered	1,440	**	1,440	**	**	2.0
Universities and colleges	11,912	767	6,577	3,535	1,033	16.7
Other nonprofit organizations	5,698	319	3,062	**	2,317	8.0
Percent distribution by source	100.0	48.1	42.2	5.0	4.7	–
Development	253,161	196,527	53,882	776	1,976	100.0
Business	226,554	196,118	30,436	**	**	89.5
Federal government	22,115	**	22,115	**	**	8.7
Federal intramural	17,389	**	17,389	**	**	6.9
FFRDCs	4,726	**	4,726	**	**	1.9
Industry administered	1,967	**	1,967	**	**	0.8
U&C administered	1,872	**	1,872	**	**	0.7
Nonprofit administered	887	**	887	**	**	0.4
Universities and colleges	1,927	168	756	776	227	0.8
Other nonprofit organizations	2,565	241	575	**	1,749	1.0
Percent distribution by source	100.0	77.6	21.3	0.3	0.8	–

** = small-to-negligible amount, included in other funding sectors.

FFRDC = federally funded research and development center; U&C = university and college.

NOTES: Funding for FFRDC performance is chiefly federal, but any nonfederal support is included in federal figures. State and local government support to business is included in business support for business performance. State and local government support to U&C (\$3,675 million) is included in U&C support for U&C performance. Some figures for other nonprofit organizations are estimates and may later be revised.

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

The National Science Foundation (NSF) estimates that U.S. expenditures on R&D totaled 2.87% of GDP in 2009. This figure is somewhat higher than the ratios prevailing in the last several years (figure 4). Over the 10-year period from 1999 to 2009, the ratio has fluctuated to some degree year to year, between a low of 2.55% in 2004 and a high of 2.87% in 2009. The broader trend since the mid-1990s has been toward a rising ratio since a low point of 2.39% in 1994.

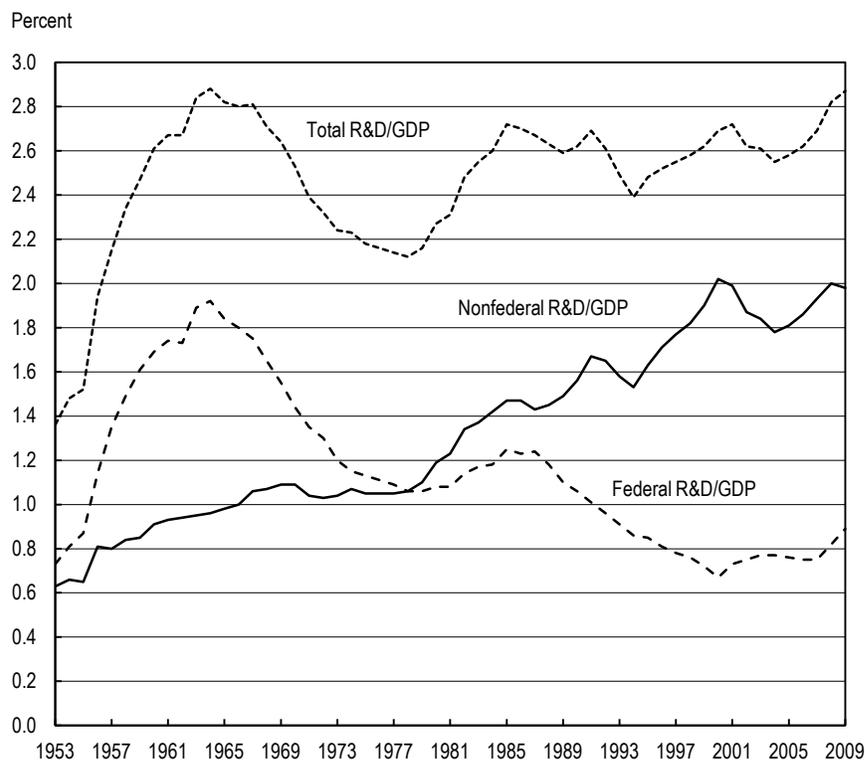
The federal and nonfederal components of U.S. R&D performance are plotted in figure 4. It is evident from this chart that most of the rise of the R&D/GDP ratio over the last several decades has come from the increase of nonfederal spending on R&D—particularly, that by the business sector. This reflects the growing role of business R&D in the national R&D system and, in turn, the growing prominence of R&D-derived goods and services in the national and global economies. By contrast, the ratio of federal R&D spending to GDP declined from the mid-1980s to the late 1990s—notably, from the continuing cuts in defense-related R&D. The trend since has been a gradual uptick, the result of increased federal spending on biomedical and national security R&D and the one-time incremental funding for R&D provided by ARRA in 2009.

International Comparisons

Worldwide R&D expenditures totaled an estimated \$1.276 trillion in 2009.⁴ The corresponding estimate 5 years earlier in 2004 was \$873 billion. Ten years earlier, in 1999, it was \$641 billion. By these figures, growth in total global R&D has averaged nearly 8% annually over the last 5 years and 7% over the last 10 years.

Many countries conduct R&D; however, global R&D performance is

FIGURE 4. Ratio of U.S. R&D to gross domestic product, roles of federal and nonfederal funding for R&D: 1953–2009



GDP = gross domestic product.

NOTES: Some figures involve estimates and may later be revised. Federal R&D/GDP ratios represent federal government as a funder of R&D by all performers; nonfederal ratios reflect all other sources of R&D funding.

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

concentrated in a relative handful of countries (table 4). Three countries account for more than half of global R&D. The United States is by far the largest R&D performer (\$402 billion in 2009), accounting for about 31% of the global total.⁵ China became the second-largest performer (\$154 billion) in 2009, accounting for about 12% of the global total. Japan moved down to third, at 11% (\$138 billion). The other established performers spend comparatively less: Germany (\$83 billion, 6%), France (\$48 billion, 4%), and the United Kingdom (\$40 billion, 3%). The most recent data available

for South Korea are for 2008, which showed the country had \$44 billion of R&D—in recent years, South Korea has typically been among the top seven R&D performing countries, representing from 3% to 4% of the global total. Taken together, these top seven countries account for about 71% of the global total. Russia, Italy, Canada, India, Brazil, Taiwan, and Spain make up the next rung, with national R&D expenditures ranging from \$20 billion to \$33 billion.

With regard to R&D intensity, the U.S. R&D/GDP ratio was just under

TABLE 4. International comparisons of gross domestic expenditures on R&D and R&D share of gross domestic product, by selected country/economy: 2009 (or most recent year)

Region/country/economy	GERD (PPP \$millions)	GERD/GDP (%)	Region/country/economy	GERD (PPP \$millions)	GERD/GDP (%)
North America			Middle East		
United States ^a	401,576.5	2.88	Israel	8,810.1	4.28
Canada	24,551.3	1.92	Turkey	8,681.2	0.85
Mexico (2007)	5,719.6	0.37	Iran (2008)	6,465.2	0.79
South America			Africa		
Brazil (2008)	21,649.4	1.08	South Africa (2008)	4,689.3	0.93
Argentina (2007)	2,678.8	0.51	Egypt	997.3	0.21
Chile (2004)	1,227.7	0.68	Morocco (2006)	765.1	0.64
Europe			Tunisia		
Germany	82,730.7	2.78		1,048.5	1.21
France	47,953.5	2.21	Central Asia		
United Kingdom	40,279.5	1.85	Russian Federation	33,368.1	1.24
Italy	24,752.6	1.27	South Asia		
Spain	20,496.4	1.38	India (2007)	24,439.4	0.76
Sweden	12,494.9	3.62	Pakistan	2,055.2	0.46
Netherlands	12,273.8	1.82	East, Southeast Asia		
Switzerland (2008)	10,512.7	3.00	Japan	137,908.6	3.33
Austria	8,931.3	2.75	China	154,147.4	1.70
Belgium	7,684.9	1.96	South Korea (2008)	43,906.4	3.36
Finland	7,457.8	3.96	Taiwan	21,571.8	2.93
Denmark	6,283.8	3.02	Singapore	5,626.5	2.35
Norway	4,734.1	1.76	Malaysia (2006)	2,090.9	0.64
Poland	4,874.9	0.68	Thailand (2007)	1,120.8	0.21
Portugal	4,411.0	1.66	Australia, Oceania		
Czech Republic	4,094.8	1.53	Australia (2008)	18,755.0	2.21
Ireland	3,164.6	1.79	New Zealand (2007)	1,422.5	1.17
Ukraine	2,485.7	0.86	Selected country groups		
Hungary	2,333.8	1.15	EU-27	297,889.6	1.90
Romania	1,471.5	0.47	OECD (2008)	965,629.1	2.33
Greece (2007)	1,867.9	0.59	G-20 countries	1,181,263.7	2.01
Belarus	813.3	0.65			
Slovenia	1,043.6	1.86			
Croatia	743.1	0.84			
Luxembourg	708.5	1.68			
Slovak Republic	595.5	0.48			

EU = European Union; G-20 = group of finance ministers and central bank governors from 19 countries plus European Union; GDP = gross domestic product; GERD = gross expenditures (domestic) on R&D; OECD = Organisation for Economic Co-operation and Development; PPP = purchasing power parity.

^a Figures for United States in this table may differ slightly from those cited elsewhere in this InfoBrief. Data here reflect international standards for calculating GERD, which vary slightly from National Science Foundation's protocol for tallying U.S. total R&D.

NOTES: Foreign currencies converted to dollars through purchasing power parities. Countries with annual GERD of \$500 million or more. Countries are grouped according to regions described by Central Intelligence Agency's World Factbook, <https://www.cia.gov/library/publications/the-world-factbook/index.html#>, accessed 13 July 2011. No countries in Central America/Caribbean region had annual GERD of \$500 million or more. Data for Israel are civilian R&D only. See sources below for GERD statistics on additional countries.

SOURCES: OECD, Main Science and Technology Indicators (Volume 2011/1); United Nations Educational, Scientific and Cultural Organization (UNESCO), Institute for Statistics, <http://stats.uis.unesco.org/unesco/TableViewer/tableView.aspx?ReportId=2655>, table 25, accessed 13 July 2011.

2.9% in 2009 (table 4). At this level, the United States is eighth among the economies tracked by the Organisation for Economic Co-operation and Development and the United Nations Educational, Scientific and Cultural Organization. Israel continues to have the highest ratio, at 4.3%, although Finland is not far back, at 4.0%. Sweden, Japan, and South Korea all have ratios well above 3%; Switzerland and Taiwan are slightly above the U.S. figure.

Data Sources and Availability

The statistics on U.S. R&D presented here are derived chiefly from integrating the data on R&D expenditures and funding collected from NSF's major national surveys of the organizations that perform the bulk 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. Estimated values may be used where final data from one or more of the surveys are not yet available and can reasonably be prepared.

The main R&D surveys utilized include NSF's new Business R&D and Innovation Survey (for 2008 and 2009; see the preceding Survey of Industrial R&D for 2007 and earlier years), the Survey of R&D Expenditures at Universities and Colleges (FY 2009 and earlier years), the Survey of Federal Funds for R&D (FY 2009–11 and earlier years), and the Survey of R&D Expenditures at Federally Funded R&D Centers (FY 2009 and earlier years). Figures for R&D performed by other nonprofit organizations with funding from within the nonprofit sector and business sources are estimated, based on parameters from the Survey of R&D Funding and Performance by Nonprofit Organizations, 1996–97.

Data from the Business R&D and Innovation Survey are reported on a calendar-year basis and are used directly in the integration of the National Patterns totals. Those from the Federal Funds and FFRDC surveys are reported on a federal fiscal-year basis and are adjusted to calendar year for the integration. The data from the Survey of Universities and Colleges are reported on an academic fiscal-year basis and converted to calendar year.

The data on federally funded R&D discussed in this report were derived from surveys of organizations that perform R&D, such as companies, universities, and FFRDCs. These amounts can differ substantially from the R&D that federal agencies have reported funding. In FY 2009, federal agencies reported obligating \$133 billion for R&D funding to all R&D performers (including \$53 billion to the business sector), compared with an estimated \$124 billion in federal funding reported by all performers of R&D (\$40 billion by businesses). Although NSF has not found a definitive explanation for this divergence, the National Academies' Committee on National Statistics (CNSTAT) notes that comparing federal outlays (as opposed to obligations) for R&D to performer expenditures results in a smaller discrepancy.⁶ For FY 2009, federal agencies reported R&D outlays of \$127 billion to all R&D performers.

A full set of detailed statistical tables associated with the National Patterns estimates will be available in the report *National Patterns of R&D Resources: 2009 Data Update*, accessible at <http://www.nsf.gov/statistics/natlpatterns/>.

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

Notes

1. Mark Boroush, Research and Development Statistics Program, National Center for Science and Engineering Statistics, National Science Foundation, 4201 Wilson Boulevard, Suite 965, Arlington, VA 22230 (mboroush@nsf.gov; 703-292-8726).

2. Adjustments for inflation reported in this InfoBrief are based on the GDP implicit price deflator. GDP deflators are calculated on an economy-wide rather than an R&D-specific basis. As such, they should be interpreted as measures of real resources engaged in R&D rather than in other activities, such as consumption or physical investment. They are not a measure of cost changes in performing R&D. The GDP deflators used in this chapter come from the Bureau of Economic Analysis, Survey of Current Business, 29 July 2011.

3. The National Science Foundation (NSF) identifies the main categories of R&D performers to be the following: businesses, federal agency intramural R&D facilities, federally funded research and development centers (administered by businesses, universities/colleges, or nonprofit organizations), universities and colleges, and other nonprofit organizations. With regard to R&D funding, NSF identifies businesses, the federal government, other nonfederal government agencies, universities and colleges, and other nonprofit organizations as the main sources.

4. The figures cited here for total global R&D in 1999, 2004, and 2009 are all NSF estimates. R&D expenditures by all countries are denominated in U.S. dollars, based on purchasing power parities. These estimates are based on data from the Organisation for

Economic Co-operation and Development (OECD), *Main Science and Technology Indicators* (Volume 2011/1) and from R&D statistics for additional countries assembled by the United Nations Educational, Scientific and Cultural Organization (UNESCO), Institute for Statistics (as of August 2011). At present, there is no database on R&D spending that is comprehensive and consistent for all nations performing R&D. The OECD and UNESCO databases together provide R&D performance statistics for over

100 countries, although the data are not current for all. NSF's estimate of total global R&D reflects the 78 countries that account for most all of current global R&D.

5. The \$402 billion cited here for U.S. R&D spending in 2009 reflects the OECD statistical conventions for calculating total national R&D (minor differences with the NSF approach) and results in a slightly higher figure than listed earlier in this report. For international comparisons and to ensure

consistency, NSF reports the statistics for all countries based on the OECD conventions.

6. National Research Council. 2005. *Measuring Research and Development Expenditures in the U.S. Economy*. Panel on Research and Development Statistics at the National Science Foundation; Brown LD, Plewes TJ, Gerstein MA, editors. Committee on National Statistics, Division of Behavioral and Social Sciences and Education. Washington, DC: National Academies Press.

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