

DATA BRIEF

States Vary Widely in Their Rates of R&D Growth

by Richard J.
Bennof and
Steven Payson

New Hampshire had the highest growth rate in R&D in the 1987-97 period—14 percent per year, adjusted for inflation.

Research and development (R&D) activities in the United States are highly concentrated in a small number of states. In 1997, the 20 highest ranking states in R&D expenditures accounted for about 86 percent of the U.S. total, while the lowest 20 states accounted for only 4 percent. California, at nearly \$42 billion, had the highest level of R&D expenditures in the Nation; it alone accounted for just about one-fifth of the \$199 billion U.S. R&D total. California's expenditures, plus those of the five states with the next highest levels of R&D spending—Michigan, New York, New Jersey, Massachusetts, and Texas (in decreasing order of magnitude)—accounted for approximately one-half of the entire national R&D effort. The top 10 states—adding, in descending order, Pennsylvania, Illinois, Washington, and Maryland—accounted for nearly two-thirds of the national R&D (table 1).

Among these top 10 states, California's R&D effort exceeded, by nearly a factor of three, that of the next highest state, Michigan, with \$14 billion in R&D expenditures. After Michigan, R&D levels declined incrementally to approximately \$7 billion for Maryland.

State Distribution of Sector-Specific R&D

States that are national leaders in total R&D performance usually are ranked among the leading sites in industrial and academic R&D performance (table 1). For industrial R&D, nine of the top 10 states were among the top 10 for total R&D, with Ohio joining the top industrial R&D states replacing Maryland. For academic R&D, North Carolina and Georgia replaced New Jersey and Washington.

There was less commonality with the top 10 for total R&D among those states that performed the most Federal intramural research.

Only four states were found in both top-10 lists: Maryland, California, Texas, and New Jersey. The six additions to the Federal intramural list, in descending order of Federal R&D performance, were the District of Columbia, Virginia, Ohio, Alabama, Florida, and New Mexico. Maryland ranked first among Federal R&D performers, followed by the District of Columbia, Virginia, and California.

The placement of Maryland, the District of Columbia, and Virginia as the top three in Federal R&D performance reflects the concentration of Federal facilities and administrative offices within the national capital area. Alabama, Florida, and New Mexico rank among the highest in Federal R&D because of their relatively high shares of Federal space- and defense-related R&D.

Ten-Year State R&D Trends

States have varied widely in their rates of R&D growth in recent years. For example, the average annual change in real R&D (adjusted for inflation) between 1987 and 1997 ranged from a growth of 14 percent for New Hampshire to a decline of 6 percent for Alabama. Real R&D growth for the nation as a whole averaged 2 percent per year over the same period.¹

As shown in figure 1, among the 51 regions examined, eight states were found to have statistically significant, real annual growth rates of over 3 percent between 1987 and 1997:

¹ Because of the variability of estimates for many smaller area totals when data are acquired through survey sampling, the growth rates in R&D performance observed for some states are not precise enough for comparative use. Nevertheless, several useful observations can be made regarding cases in which there is statistical precision. For the purposes of this study, statistical significance was defined as occurring when there is no more than a 5 percent likelihood that differences were attributable only to randomness in survey sampling.

Electronic Dissemination

SRS data are available through the World Wide Web (<http://www.nsf.gov/sbe/srs/>). For more information about obtaining reports, contact paperpubs@nsf.gov or call 301-947-2722. For NSF's Telephonic Device for the Deaf, dial 703-292-5090

States Vary Widely in Their Rates of R&D Growth—page 2

Table 1. R&D performance by sector and R&D as a percentage of GSP, for the top 10 R&D performing states: 1997

Rank	Total R&D (in millions of dollars)	Top 10 states in R&D performance, by performing sector				Top 10 states in R&D intensity (states with the highest R&D/GSP ratio)		
		All R&D performers in the state ¹	Industry ²	Universities & colleges ³	Federal Government	Top 10 states	R&D/GSP (percent)	GSP (preliminary, in billions of dollars)
1	41,670	California	California	California	Maryland	New Mexico	6.7	45.2
2	13,991	Michigan	Michigan	New York	District of Columbia	District of Columbia	5.3	52.4
3	12,307	New York	New Jersey	Texas	Virginia	Michigan	5.1	272.6
4	12,067	New Jersey	New York	Massachusetts	California	Massachusetts	5.0	221.0
5	11,097	Massachusetts	Massachusetts	Maryland	Ohio	Maryland	4.8	153.8
6	9,487	Texas	Texas	Pennsylvania	Alabama	Washington	4.4	172.3
7	8,209	Pennsylvania	Washington	Illinois	Florida	Idaho	4.4	29.1
8	8,034	Illinois	Pennsylvania	Michigan	Texas	New Jersey	4.1	294.1
9	7,543	Washington	Illinois	North Carolina	New Jersey	California	4.0	1,033.0
10	7,395	Maryland	Ohio	Georgia	New Mexico	Rhode Island	3.7	27.8

¹ Includes in-state R&D performance of industry, universities, Federal agencies, and FFRDCs. For the tabulations, states include the District of Columbia.

² Includes R&D activities of industry-administered FFRDCs located within these states.

³ Includes R&D activities of university-administered FFRDCs located within these states.

KEY: GSP = gross state product

SOURCE: National Science Foundation/Division of Science Resources Studies, National Patterns of R&D Resources, annual series; GSP data are from the Department of Commerce/Bureau of Economic Analysis.

New Mexico has the highest R&D intensity (R&D/GSP): 6.7 percent.

Idaho, Montana, Nevada, New Hampshire, Oregon, Rhode Island, South Dakota, and Washington. Twenty-five other states had rates of real R&D growth that were positive with statistical certainty, but could not be said to be above 3 percent with statistical certainty. Another 13 states had growth or declines in real R&D, but which were not statistically different from no change in real R&D. Finally, five states had statistically significant declines in real R&D: Alabama, Missouri, New Mexico, North Dakota, and Vermont.

Among the top 10 states in R&D expenditures in 1997, Washington had the highest growth rate—5 percent. The next highest growth rate among the top 10 was 3 percent for New Jersey; California's R&D grew at a rate of 2 percent during the 1987-97 period—the same rate as that of the nation as a whole.

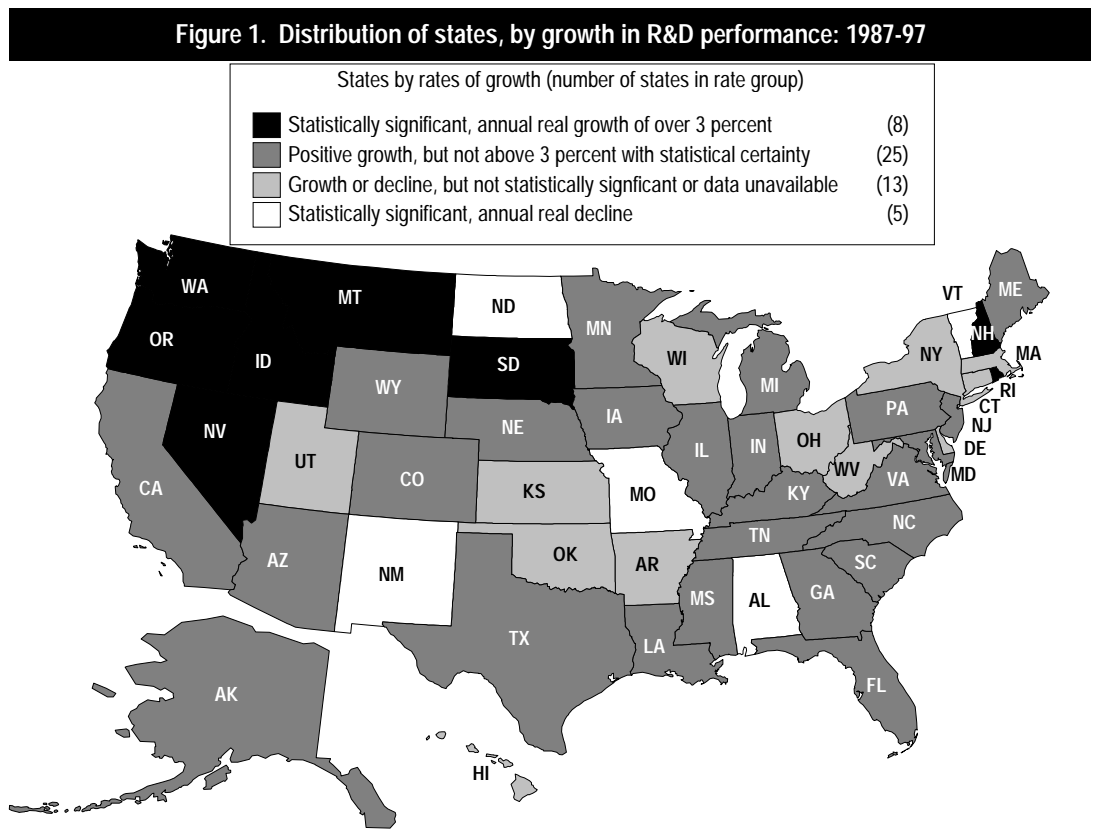
In most cases, these differences in rates reflect the sharp decline in Federal R&D support and the simultaneous dramatic rise in industrial R&D support that occurred during the period. For example, much of Alabama's decline in R&D

could be attributed to a drop in Federal support for industrial R&D: over the decade, this support dwindled from \$900 million (in current dollars) to \$189 million.² In New Hampshire, on the other hand, the sharp rise in R&D is due primarily to an increase in industrial R&D performance (which is funded predominantly by industry) from \$94 million to \$652 million.

For states that have relatively small levels of R&D expenditures (e.g., states that are not among the top 10 in R&D), these growth rates tend to be influenced significantly by particular events, such as an individual company or government agency expanding or contracting its R&D activities. Therefore, caution should be used in interpreting differences among states. Variations in rates may not reflect differences among states in their policies toward R&D; specific circumstances (other than state policy) may have been more responsible for the observed differences. Likewise, one should not assume that the

² These Federal R&D totals are based on reports by the performers of R&D and not by the Federal funding agencies.

States Vary Widely in Their Rates of R&D Growth—page 3



NOTE: Growth rates for Delaware and the District of Columbia were not available.

SOURCES: National Science Foundation/Division of Science Resources Studies, *Academic Research and Development Expenditures: Fiscal Year 1997, Federal Funds for Research and Development FY 1997, 1998, 1999, and Research and Development in Industry: 1997.*

rates observed between 1987 and 1997 will necessarily continue in later years.

Ratio of R&D to Gross State Product

States vary widely in the size of their economies, owing to differences in population, land area, infrastructure, natural resources, and history. Consequently, variations in the R&D expenditure levels of states may simply reflect differences in economic size or the nature of their R&D efforts. A simple way of controlling for the size effect is to measure each state's R&D level as a proportion of its gross state product (GSP). That proportion is referred to as R&D "intensity" or "concentration."

Overall, the Nation's total R&D to gross domestic product ratio was 2.6 percent in 1997. The top 10 rankings for R&D intensity in 1997 were—in descending order—New Mexico (6.7 percent), the District of Columbia,

Michigan, Massachusetts, Maryland, Washington, Idaho, New Jersey, California, and Rhode Island (the last with an intensity of 3.7 percent). New Mexico's high R&D intensity is largely attributable to Federal (specifically Department of Energy) support of Federally Funded Research and Development Centers (FFRDCs) in the state.

R&D concentration is relatively high in the Northeast and East North Central regions, with the exceptions of Maine, New York, and Wisconsin which had R&D/GSP ratios below 1.9 percent. R&D concentration is also relatively low in the West North Central and Southern regions, with the exceptions of Minnesota, North Carolina, and Virginia which have R&D/GSP ratios above 1.9.

The Mountain and Pacific regions are quite mixed in R&D concentration. In the former

States Vary Widely in Their Rates of R&D Growth—page 4

region, New Mexico and Idaho have the highest R&D/GSP ratios, which are above 4.0; and Wyoming and Nevada have ratios below 1.0. Similarly, in the Pacific, California and Washington's ratios exceed 4.0, and Alaska's and Hawaii's ratios fall below 1.0.

User Notes

The National Science Foundation's Division of Science Resources Studies (SRS) collects and analyzes statistics on the geographic distribution of R&D expenditures in the United States among the 50 states, the District of Columbia, and Puerto Rico. These data are categorized by type of performer (industry, Federal Government, academia, FFRDCs, and other non-profit organizations) and by source of

funds (industry, Federal Government, and academia).³ The amounts of R&D funding from specific Federal agencies are also provided.

In 1997, total R&D expenditures in the United States were \$211 billion, of which \$199 billion could be attributed to expenditures within individual states, with the remainder falling under an undistributed, "other/unknown" category. The statistics and discussion in this Data Brief refer to state R&D levels in relation to the distributed total of \$199 billion. In addition to these state R&D statistics, SRS collects state-specific data in its surveys of science and engineering (S&E) personnel and institu-

³ Note that data on industry R&D—and therefore on total R&D—performance are not available for Puerto Rico.

tions. These data and those assembled from non-SRS sources (e.g., data on population, patents, and GSP) are included in a set of 52 one-page S&E profiles available in hard copy or on the World Wide Web at <http://www.nsf.gov/sbe/srs/sepro/start.htm>.

Data on U.S. and state R&D expenditures were assembled from ongoing National Science Foundation surveys. For information about, and copies of, S&E State Profiles, please contact:

Richard J. Bennof
Division of Science Resources Studies
National Science Foundation
4201 Wilson Boulevard, Suite 965
Arlington, VA 22230
rbennof@nsf.gov
703-306-1772 x-6938

NSF 00-325

BULK RATE
POSTAGE & FEES PAID
National Science Foundation
Permit No. G-69

RETURN THIS COVER SHEET TO ROOM P35 IF YOU DO NOT WISH TO RECEIVE THIS MATERIAL. OR IF CHANGE OF ADDRESS IS NEEDED. INDICATE CHANGE INCLUDING ZIP CODE ON THE LABEL. (DO NOT REMOVE LABEL).

OFFICIAL BUSINESS
 PENALTY FOR PRIVATE USE \$300

NATIONAL SCIENCE FOUNDATION
 ARLINGTON, VA 22230