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Federal and Non-Federal Support of University Based Research

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Specialist in Science and Technology
Resources, Science, and Industry

Summary

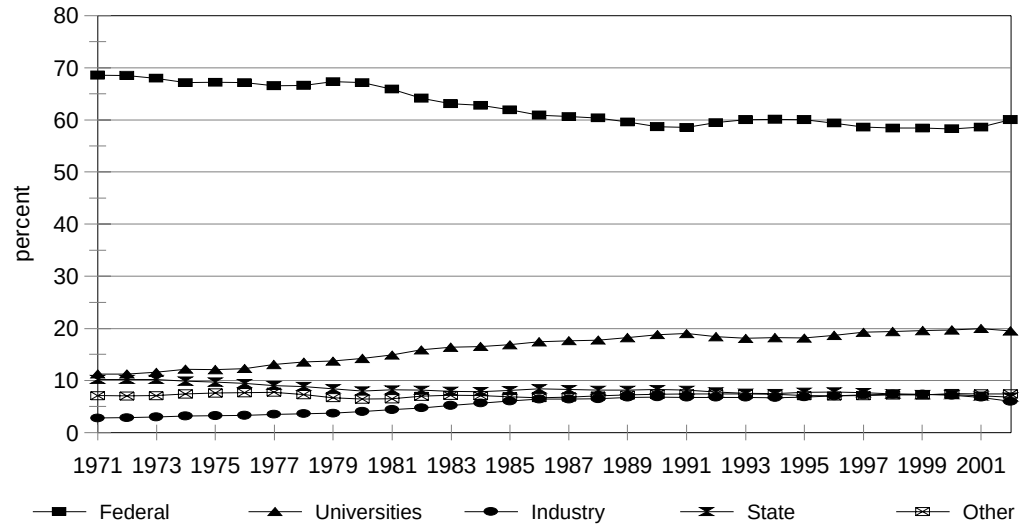
The most recent data of the National Science Foundation shows total national R&D expenditures for university based research reached $36.333 billion in 2002. Between 1971 and 2002 university self financing of research increased at an average annual rate of 5.9%, compared to an average annual rate of 3.6% for the federal government. The academic community and some Members of Congress are concerned that rising federal deficits will constrain the growth of future academic research expenditures. According to the *Chronicle of Higher Education*, in FY2003, congressionally directed (earmarked) funds to colleges and universities reached $2 billion, or 9.2% of total federal support, a 9.5% increase over the FY2002. This report will not be updated.

Introduction

While the federal government continues to be the primary supporter of university based research and development (R&D), the financial composition of support for university-based research has changed considerably over the past 31 years. The most recent data of the National Science Foundation (NSF) total show national R&D expenditures for university-based research reached $36.333 billion in 2002. This figure represents a 11% increase over 2001 levels. When adjusted for inflation, academic R&D increased 9%. This increase is in contrast to average annual increases of 4.4%, in real dollars, over the previous ten years. Of the $36.333 billion for university R&D expenditure, $21.834 billion (60%) came from federal sources; $7.109 billion (19.6%) was financed by universities; industry contributed $2.188 billion (6%); state and local governments provided $2.501 billion (6.9%); and other sources (foundations and private donors) contributed $2.701 billion (7.5%).[1]

[1] U. S. Academic R&D Continue to Grow as More Universities and Colleges Expand Their R&D Activities, by Brandon Shackelford, May 2004, NSF 04-319, page 3. Research and development expenditures, by source of funds, are reported annually to the NSF by universities and colleges. These numbers represent the most recent data NSF has reported on academic R&D expenditures.
(continued...)

Figure 1. Percent of University R&D
Expenditures by Source



As indicated in **Figure 1**, in 1971, the federal government accounted for 69% of university R&D expenditures. By 1991 the federal share had dropped to 58% of all university based R&D expenditures. Between 1971 and 1990, federal expenditures for university based research increased 80% in real dollars,[2] while all non-federal expenditures grew twice as fast, increasing 179% over that time period. (Unless otherwise indicated, all expenditures are in constant 2000 dollars.) This shift in the distribution of support for university R&D expenditures can be attributed to significant increases in other sources of support for academic R&D, specifically industry and self financing of R&D by academic institutions. Industries' share grew the fastest with funding expanding from $286 million in 1971 to $1.479 billion in 1990, a 417% increase, in real dollars (see figures 1 and 2). Concomitantly, as a percent of academic R&D expenditures, industries' share climbed from 3% of total expenditures in 1971 to 7% in 1988, and then declined to 6% in 2002, as industry reduced R&D funding due to the economic slow-down in 2001 and 2002.

Between 1971 and 1990, university financed R&D expenditures experienced the greatest growth in funding, as indicated in Figure 2. University financed R&D increased from $1.150 billion in 1971 to $4.043 billion in 1990, an average annual increase of 6.8%. As a result, by 1990 university financed R&D accounted for 19% of academic R&D expenditures, up from 11% in 1971. During this time period state support of university research declined from 10% of university R&D expenditures in 1971 to 8% in 1990, even though average annual state funding increased 3% over this period. The share of funding

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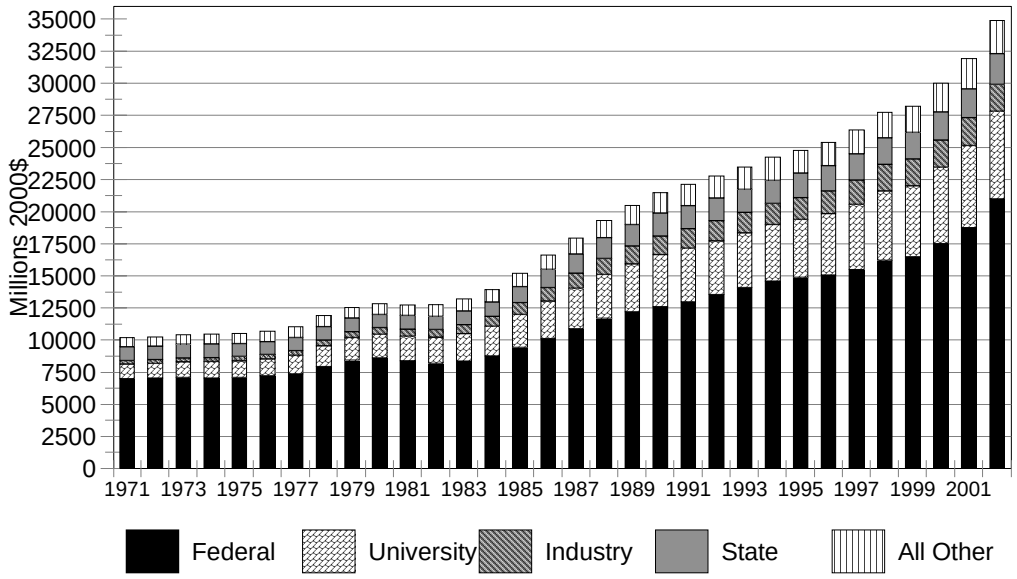
[1] (...continued)
For comparison purposes, NSF has converted fiscal year R&D data to calendar year expenditures.

[2] *Science and Engineering Indicators*, National Science Board, 2002 VOL. 2, Appendix Tables, p.5-2., National Science Foundation.

Figure 2. Academic R&D Expenditures
by Source of Funds



from "Other Sources" (foundations and private individual gifts) remained at 7% of total R&D expenditures, despite the fact that universities' receipts received from these sources increased 73% in constant dollars during the 1980s.

As indicated in **Figure 2**, most of this increase in non-federal expenditures for university based R&D occurred between 1981 and 1990. For example, during the 1980s, federal expenditures for university R&D increased 50%, while industry expenditures for university R&D increased 162%. University financed R&D expenditures more than doubled during the 1980s, increasing from $1.902 billion in 1981 to $4.043 billion by 1990. During the same period, state expenditures for university R&D increased 70%, while expenditures from "Other Sources" increased 90%.

While support for university based research experienced double digit growth rates during the 1970s and1980s, this rapid growth rate slowed significantly in the early 1990s. Between 1991 and 1995, federal R&D expenditures to universities increased 14.9%, in real dollars, while non-federal R&D expenditures to universities increased 8%. Between 1991 and 1995, total R&D expenditures to universities and colleges from all sources, increased from $22.127 billion to $24.780 billion, a 12% increase. This was the slowest rate of growth for university R&D expenditures since the early 1970s.

This trend of slower rate of increase for university based R&D expenditures began to reverse in the late 1990s. In fact, between 1996 and 2002 total university R&D expenditures from all sources increased 37%. Concomitantly, university self financing of R&D increased 44% in real dollars. Consequently, by 2002, university self financing of R&D accounted for almost 20% of their total R&D expenditures. Funding to universities from federal sources increased 39% during this time period, while R&D expenditures from industry and state resources continued to lag behind increasing 18% and 20% respectively over this six year period.

Much of the federal 37% increase in university R&D expenditures between 1996 and 2002 can be attributed to the doubling of the budget for the National Institutes of Health (NIH). The doubling of NIH's budget alone resulted in average annual increases in excess of $1 billion, for those select universities that receive NIH R&D funding. Between 1996 and 2002, total university R&D expenditures, from all sources, increased from $25.392 billion to $34.909 billion, an increase of $9.5 billion in real dollars. This represents an average annual increase of 5.5% over this six year period.

A number of experts have examined recent trends in rising university R&D expenditures; David Mowery, a professor at the University of California at Berkeley, has identified several reasons why university self financing of R&D expenditures has increased over the past 20 years. According to Mowery, the first reason is the Bayh-Dole Act of 1980 which allows universities to obtain patents and sign licensing agreements with commercial entities, with the expectation that these commercial entities will further develop and commercialize the technology, generating royalty payments to universities.[3] While universities were involved in licensing activities prior to 1980, data from the NSF illustrate how the 1980 law may have accelerated these activities. For example, in 1982 all academic institutions received 464 patents. By 2001, the number of patents awarded to universities increased to 3,203.[4]

Professor Mowery contends that the second major reason that non-federal sources for university R&D grew significantly has to do with industry's eight fold increase in basic research funding between 1980 ($2.557 billion) and 2000 ($16.223 billion) in constant dollars. As a result, according to Mowery, it seems reasonable to expect that universities would benefit from this increase. The NSF data show that total industry expenditures for university based research increased from $310 million in 1980, to $2.310 billion by 2000. Within the industry total for 1980, more than half, $273 million, was spent on basic research. However by 2000, industry support for university based basic research had increased to $1.421 billion, a 420% increase over 1980. This represents an average annual increase of 8.6% for industry sponsored university basic research between 1980 and 2000.[5]

Professor Mowery also acknowledges that a combination of one or two other factors may have contributed to the increase of university financed R&D expenditures over the last 20 years. The first is the growth of university endowments in the 1990s that enabled some universities to support more self financed research. Second, the growth of licensing income associated with the expansion of university patenting activities may have contributed additional self-financed R&D expenditures. Finally, Mowery notes that declines in the stock market value of companies that fund R&D and weak private sector business performance may have constrained the growth of these sources of R&D funding.

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[3] This act is contained in amendments to the Patent and Trademark Act of 1980, P.L. 96-516.

[4] *Science and Engineering Indicators 2004*, National Science Board, Vol. 2, p.A5-105

[5] *Science and Engineering Indicators 2002*, National Science Board, Vol. 2, p.A4-9&10, and A4-17&A18. It is also interesting to note that in 1980, industry accounted for 14.6% of total basic research expenditure in the U.S. However, according to NSF, by 2000 industries' share of total basic research expenditures had increased to 34%.

The 60% federal share of university based research funding in 2002, was down from 69% in 1971. During this 31 year period, federal funding to universities grew at an average annual rate of 3.6%, while concomitantly university self financing of research increased at an average annual rate of 5.9%. Over the same period, university financed R&D funding increased from 11% of the total expenditures in 1971, to nearly 20% of R&D expenditures in 2002.

Congressional Issues

Two issues regarding federal R&D funding for academic research are:1) the level of R&D funding, and 2) the recipients of the funds, which relates primarily to "earmarking" or congressional specification as to where university R&D expenditures should be spent.

Future University R&D Funding Trends. The academic sector has relied on a variety of funding sources that has helped it sustain real dollar increases in R&D funding between 1971 and 2002. However, growing federal budget deficits, coupled with industry's recent reduction in support of university based research, may well constrain the growth of future academic R&D funding. American Association for the Advancement of Science (AAAS) estimates that with the completion of doubling the NIH budget between FY1999 and FY2003, federal R&D expenditures to academic institutions are likely to remain flat, in real dollars. The President proposed that the FY2005 budget for basic and applied research would remain at FY2004 levels. Since basic and applied research accounts for 96% of federal R&D expenditures to universities, it is likely that federal funding to universities could decline in FY2005. Further, the President's FY2005 out-year funding projections for NIH, NSF, and the Department of Energy's (DOE) basic research programs show declines of 5% in constant dollars between FY2005 and FY2009.

On February 11, 2004 the House Science Committee held a hearing on the President's proposed FY2005 science budget. As part of the Committee's written statement, entitled "Views and Estimate" on the proposed FY2005 R&D budget, the Committee stated that the proposed 2% reduction in DOE's basic research budget of $3.4 billion was "inadequate and significantly less that the $4.2 billion called for in the Energy Act of 2003, H.R. 6." The Committee also referred to the President's proposed FY2005 NSF budget as "insufficient ... being $1.6 billion below the $7.378 billion called for in the NSF Authorization Act of 2002." The Senate FY2005 Budget Resolution (S. Con. Res. 95) increases funding in the General Science, Space and Technology budget function $541 million above the President's request, in an attempt to increase funding for NSF and DOE's basic energy science program in FY2005.

Congressional Earmarking of University Research. According to the *Chronicle of Higher Education*, in FY2003, congressional earmarks to colleges and universities reached $2 billion, a 9.5% increase over the FY2002 $1.84 billion.[6] The AAAS estimates that Congress approved $1.8 billion for "congressionally designated

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[6] *The Chronicle of Higher Education*, defines an earmark as an appropriation to a university or college for a research activity that a) was not requested by the funding agency, b) was directed to a specific university or universities, and c) was not rewarded through the traditional scientific peer review process; September 26, 2003, page A18.

research and development projects, in FY2004, a 32 percent increase over FY2003."[7] According to the Bush Administration, research earmarks "are in general the assignment of money for R&D project(s) for use only by a specific organization or project, during the legislative process and are counter to the merit-based competitive selection process."[8]The Administration further noted that between FY1996 and FY2003, academic research earmarks increased from 2.5% to 8% of total federal academic R&D expenditures. Referencing an article from the *Chronicle of Higher Education*, the Administration stated in its FY2005 budget request to Congress that "often only a minor portion of earmarks go to states with the smallest share of federal research funds while earmarks help some rich institutions become richer."[9]

Some agency personnel contend that earmarks can hamper an agency's ability to fulfill its mission responsibilities. Norine E. Noonan, former chief of the Environmental Protection Agency's Research Office, noted that earmarks may force agencies to cut peer reviewed mission oriented research.[10] In contrast, John R. Silber, Chancellor and former president of Boston University, contends that peer review is understandably and inevitably biased in favor of established programs whose faculty dominates the review process. He indicated that Congress provides earmarks for carefully considered projects that meet important national interests and build the recipients' ability to compete for peer reviewed grants."Peer review is good, earmarking is good, and both are capable of abuse."[11] Members who support earmarking state that without them some worthy projects would not receive funding. They contend that competitively awarded research grants go disproportionately to a small group of elite institutions. Many universities, primarily smaller schools, seek earmarks for research infrastructure (buildings and research labs) because the federal government has not sponsored a program for funding "bricks and mortar" since the early 1970s. Other Members oppose earmarks, for example Senator McCain said on the floor, that appropriations committees that accept earmarks have "effectively usurped the power of the authorization committees and act as one all-powerful funding machine."[12] Other congressional opponents point out that earmarks can distort agency R&D priorities.

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[7] The American Association for the Advancement of Science, *Science and Technology in Congress,* December, 2003 p. 4.

[8] Fiscal Year 2005, Analytical Perspectives of the U. S. Government, Research Earmarks, p. 51.

[9] Ibid. p. 52.

[10] *Boston U. Chancellor and Washington Insider Spar on Whether Earmarking Does Good*. Chronicle of Higher Education., May 18, 2002, Jeffrey Brainard. p. A30.

[11] Ibid, p. 37.

[12] Congressional Record, November 6, 2003, p. S14154.