

May 2010

The Pivotal Role of Government Investment in Basic Research

The innovations that have improved the country's productivity and quality of life are ultimately grounded in the results of basic research. Basic research is the part of the research and development (R&D) that contributes to our fundamental stock of knowledge, yet is conducted without specific applications in mind. Despite its value to society as a whole, basic research is underfunded by private firms precisely because it is performed with no specific commercial applications in mind. Instead, businesses have an incentive to concentrate their R&D spending on the development of products or processes with direct commercial value.

Basic research—such as the process of uncovering the structure of DNA—is one of three components of R&D, the others being applied research and development. Applied research involves systematic study to gain the understanding necessary to meet a specific need or application (such as finding a link between a particular gene and Alzheimer's disease). Development leverages the knowledge generated by basic and applied research to create products that are useful to society (such as a genetic test for Alzheimer's disease).

If society were to rely on the private sector alone to fund R&D, many socially beneficial research projects would not be undertaken. This is especially true for basic research projects.

Report by the U.S. Congress Joint Economic Committee
Representative Carolyn B. Maloney, Chair
Senator Charles E. Schumer, Vice Chair

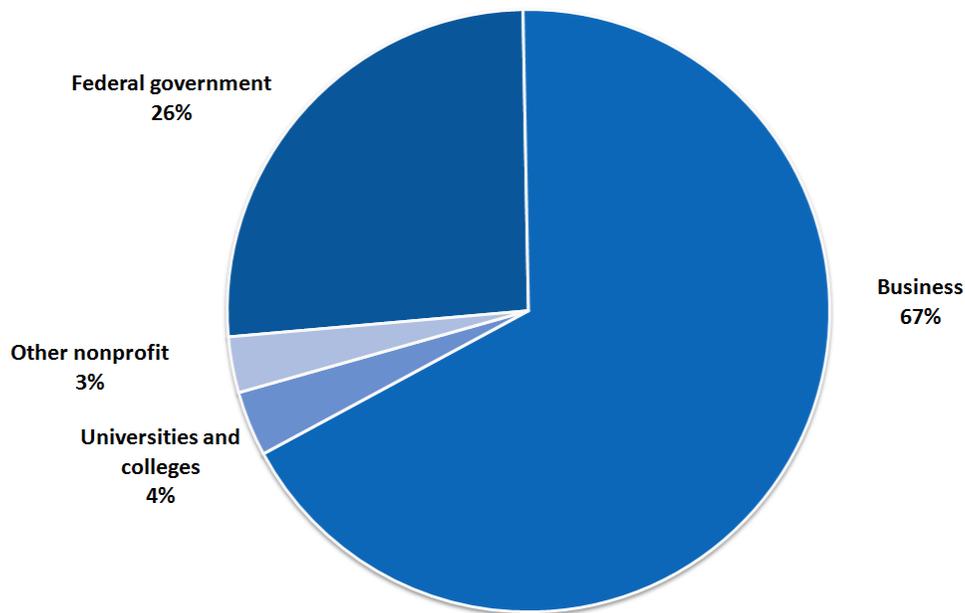
Prepared by the Majority Staff of the Joint Economic Committee

THE PIVOTAL ROLE OF GOVERNMENT INVESTMENT IN BASIC RESEARCH

The federal government has a critical role in funding R&D. To a large extent, the federal government devotes resources to R&D to fund projects that, despite their potential for improving economic growth and people's well-being, would be unattractive for businesses to pursue. Businesses tend to underinvest in R&D because the returns from their investment are often smaller than the returns to the economy as a whole. For example, the knowledge generated from a basic research project can often be used—without compensation—by other firms within and outside their industry. To make up for this underinvestment, the federal government has played a major role in funding R&D. Federal support for basic research is particularly crucial because the lack of direct commercial applications from basic research projects—as well as the uncertainty of project success—can deter businesses from performing basic research even though some studies have shown that it is the form of R&D that generates the greatest economy-wide returns.¹ To be sure, the private sector invests considerable resources in R&D—industry spending accounts for the bulk of overall spending on R&D (67.4 percent in 2008) [see Figure 1].

Figure 1: Private Business Is the Largest Source of R&D Investment

Sources of Funding for R&D in 2008

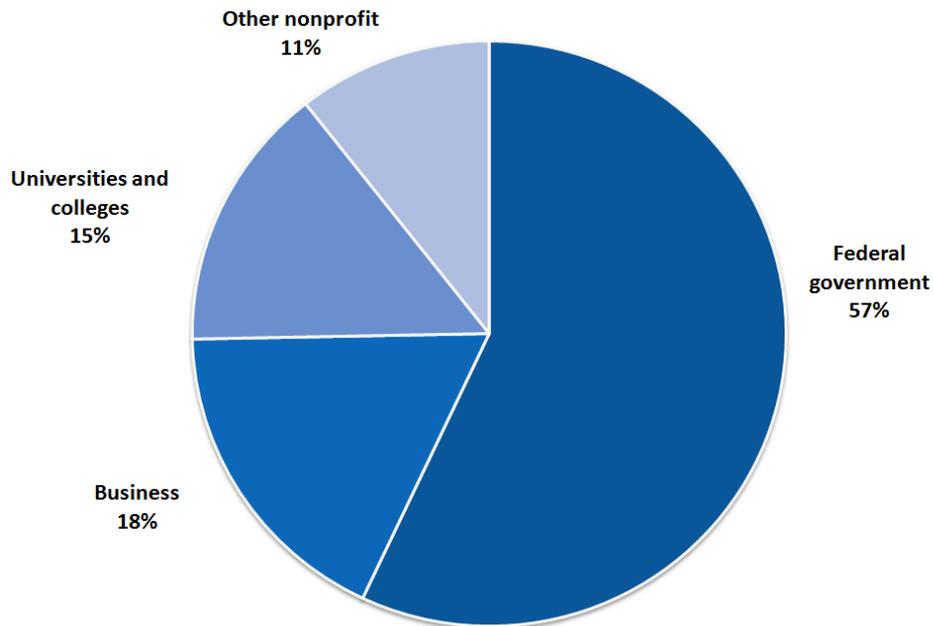


Source: National Science Foundation, *National Patterns of R&D Resources: 2008 Data Update*, Figure 4-2.

However, the majority of funding for basic research comes from the federal government (57 percent in 2008), since it is in a better position than the private sector to assume the risks associated with basic research [see Figure 2]. In contrast, businesses have a greater incentive to invest in development since there is less uncertainty over the commercial applicability of results from development. Indeed, industry devoted 75.3 percent of its R&D spending to development in 2008.²

Figure 2: U.S. Federal Government Funds Over Half of All Basic Research

Sources of R&D Funding for Basic Research in 2008



Source: National Science Foundation, *National Patterns of R&D Resources: 2008 Data Update*, Figure 4-2.

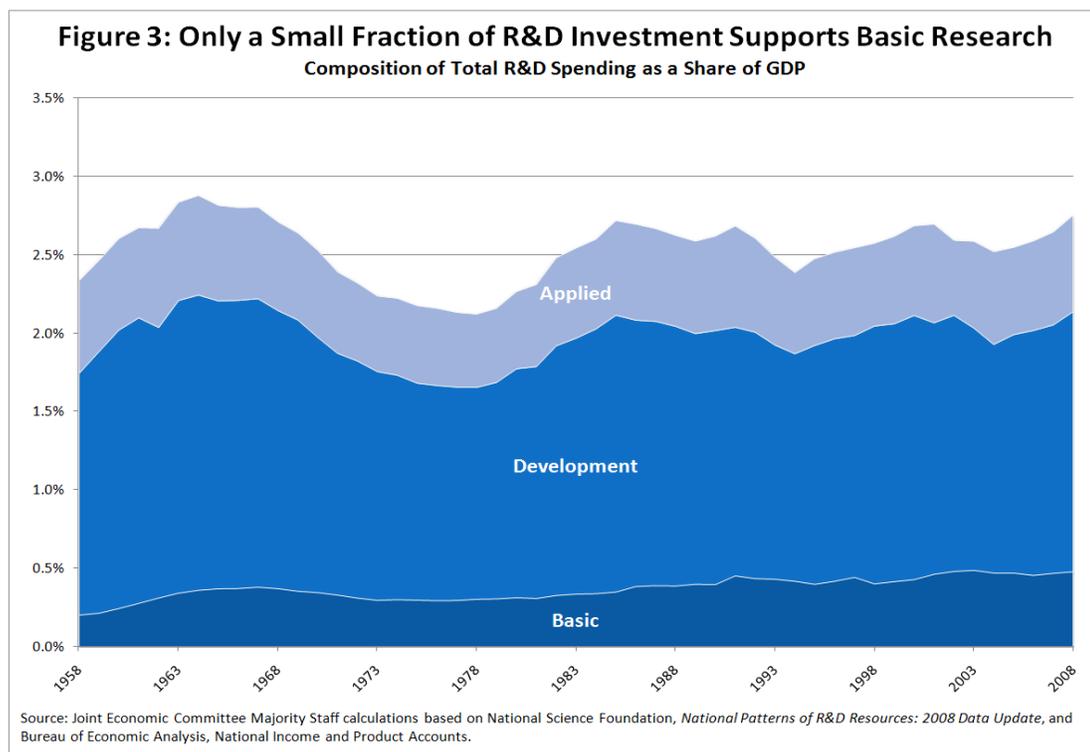
Investment in R&D generates significant economic benefits. Economists and policymakers have long recognized the importance of investment in R&D as a driver of technological development and U.S. economic growth. The technological progress supported by R&D has played a singular role in enhancing the productivity of businesses and workers and spawning new, job-creating industries, such as the biotechnology sector. However, economists have encountered difficulty in precisely measuring the full, economy-wide returns to R&D because of data limitations and the many channels through which R&D can benefit society. Despite these obstacles, there is a consensus that the economy-wide gains from R&D are, in general, greater than the gains from R&D for individual businesses.³ One study that attempted to quantify the impact of R&D on economic growth found that increases in the level of research intensity in the U.S. and four other developed countries may have accounted for close to 50 percent of U.S. economic growth between 1950 and 1993.⁴

Increased federal funding for basic research may be warranted. Even though the federal government has stepped in to make up for the private sector's underinvestment in R&D, overall R&D spending may still be too low. One study estimated that actual R&D expenditures may be less than half of the optimal level.⁵ Underinvestment in basic research may be greater than that, since basic research can have a much larger impact than applied research or development. With this in mind, the level of funding for basic research may be worrisome. From 1958 to 2008, total expenditures on R&D as a share of gross domestic product (GDP) have generally hovered around 2.5 percent [see Figure 3]. Perhaps more importantly, overall spending on basic research has been substantially smaller, reaching 0.3 percent of GDP in 2008.

THE PIVOTAL ROLE OF GOVERNMENT INVESTMENT IN BASIC RESEARCH

Funding for development accounted for approximately 60 percent of overall R&D expenditures in 2008 and was over six times the total amount spent on basic research. Although spending on development—largely conducted by the private sector—is important in translating the knowledge generated by basic research into the tangible products that drive productivity, expanding the stock of knowledge even further can lead to the development of an even larger array of technologies that will support economic growth and job creation. The federal government is best positioned to take on the risks of funding basic research projects, which suggests that it may be prudent for the government to increase its expenditures on basic research significantly.

As the economy recovers from the worst recession since the Great Depression, the United States needs to look under every stone to identify and support the next generation of innovations that will create new industries, spur job creation, and fuel economic growth. Basic research plays a critical role in sparking innovation. Now, more than ever, basic research is needed to chart the course forward.



1. Griliches, Zvi. 1986. "Productivity, R&D, and Basic Research at the Firm Level in the 1970's." *American Economic Review*, vol. 70, no. 1 (March), pp. 343-348. Even though it may be straightforward to quantify the private returns to R&D, it is difficult to quantify the economy-wide returns to R&D (and even more difficult to quantify the returns to basic research). For example, it is hard to trace the impact that one firm's R&D spending has on the productivity of another firm or even another industry, and the returns to R&D investments that result in the improvement of product quality may be difficult or impossible to measure.
2. National Science Foundation, *National Patterns of R&D Resources: 2008 Data Update*, Table 4-2.
3. Griliches, Zvi. 1992. "The Search for R&D Spillovers." *Scandinavian Journal of Economics*, vol. 94 (Suppl.), pp. S29-S47.
4. Jones, Charles I. 2002. "Sources of U.S. Economic Growth in a World of Ideas." *American Economic Review*, vol. 92, no. 1 (March), pp. 220-239. Research intensity is defined as "the fraction of the labor force that works to produce ideas." The four other nations used to construct the research intensity measure are France, West Germany, Japan, and the United Kingdom.
5. Jones, Charles I. and John C. Williams. 1998. "Measuring the Social Return to R&D." *Quarterly Journal of Economics*, vol. 113, no. 4 (November), pp. 1119-1135. One should note that the authors' results depend, in part, on the assumption that the economy-wide rate of return to R&D is 30 percent while the private rate of return is between 7 and 14 percent. In many ways, measuring the degree of underinvestment in R&D in the United States is more difficult than measuring the economy-wide rate of return to R&D.

Prepared by the Majority Staff of the Joint Economic Committee