
Assessing the Benefits of Science in Terms of Dollars and Sense

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The United States Congress has a lot to worry about these days, such as massive budget deficits and signs of an impending economic recession. One thing Congress apparently is not very worried about is sustaining an adequate level of support for scientific research. But it should worry, because of the economic impact of R&D on the U.S. economy.

Nobelist Leon Lederman, president-elect of AAAS, recently discussed the science funding crisis in an address before the Science Policy Association at the New York Academy of Sciences. In providing strong evidence of the decline in American support of "little science," he referred to studies by Edwin Mansfield, a University of Pennsylvania economist whose work on the economic impact of basic research I've long admired.

Mansfield's studies support the conclusion that scientific research has a significant and direct impact on the economy, accounting for a large portion of U.S. economic growth and productivity. He has found that, in general, basic research is directly and significantly related to a company's rate of productivity.

In one study, Mansfield examined 17 industrial innovations,

detailing both their "social" and "private" rates of return. He concluded that the median social rate of return—lowered prices, energy and resource savings, and so forth—for all the innovations was a "handsome" 56 percent. The median private rate of return was 25 percent, before taxes. Most interesting, Mansfield found that for about a third of the 17 innovations, the private rate of return was so low that no firm, with the advantage of hindsight, would have invested in the R&D—although from society's point of view, the investments were worthwhile.

Other studies support similar conclusions: Julius Comroe of the University of California, San Francisco, and the late Robert Dripps of the University of Pennsylvania, for example, showed that many of the most important modern medical practices rely on basic research that went unrecognized for many years.

Lederman suggested that these studies, which take a scientific approach to quantifying the benefits of science, are exactly the kinds of dollars-and-cents analyses that Congress now needs.

We are all familiar with the tremendous benefits to society that

science provides. Yet simple, reliable numbers are what's required to convince hard-headed legislators that science deserves an adequate slice of the budget pie. While it may be true, for instance, that biomedical science helps save lives, that argument is no longer sufficient. Now, the bottom line is how far the nation's biomedical investment goes to help avoid lost incomes and medical costs.

Even members of Congress who are generally sympathetic to science may lack the conviction—which many scientists take for granted—that an investment in basic research has an economic payoff for society.

Of course, it's difficult to put reliable numbers into such estimates. Nathan Rosenberg of Stanford University has shown that the relationship between economic productivity and R&D is highly complex, and may depend on many nonscientific variables. Indeed,

Rosenberg and David C. Mowery of the University of California, Berkeley, amusingly point out in their recent book, *Technology and the Pursuit of Economic Growth* (Cambridge University Press, 1989), that the difficulties in measuring the benefits of basic research "are hard to exaggerate."

Fund raisers know very well that the public responds to emotional appeals, such as the drama of a lifesaving advance. But more sophisticated philanthropists—the 10 percent who provide 90 percent of the funding—require more explicit documentation. I believe that it's possible to create a document that makes a compelling economic case for supporting research and development, and that such a document is urgently needed.

Since Congress answers to the public, this document must be one that makes sense to both the public and members of Congress. ■