

THE COST TO THE NATION OF UNDERINVESTMENT IN EDUCATIONAL R&D

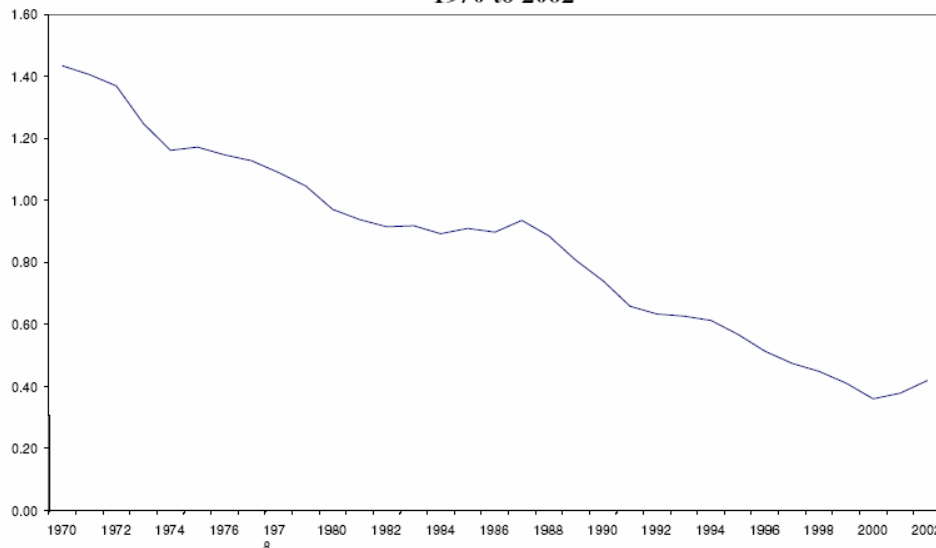
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Economic Rationale for a Federal Education Investment Trust

Economics implies that when the private returns of economic activities are less than their social returns, there is an underinvestment in economic activity. Social returns from the investment are the benefits to the overall society. Private returns are the profits to the investor. Thus, whether there is an appropriate level of investment in educational R&D depends on the degree to which firms can capture the returns from their investments. The lower the return from the investment, the weaker the incentive to undertake R&D.¹¹ Firms will find expenditures on R&D activities worthwhile if they can capture a sufficient return from the investment.

The fact that firms cannot fully appropriate the returns from R&D investment leads to an underinvestment in innovation. Even though the U.S. and many other countries provide patents, copyrights and trademarks as incentives to innovate, competitors tend to legally “invent around” patents,¹² making the patent system less effective than the designers of patents envisioned. Entrepreneurs receive only a small part of the social benefit of innovation. In part, this is because the information about their innovations is in the hands of their competitors within about 12 to 18 months, on average.¹³ If firms know that rivals can imitate new technology easily, the incentive to invest in R&D is attenuated. Imitation by competitors lowers returns and thus lowers, and in some cases eliminates, the incentive to invest in innovation.

Figure 4
Federal R&D Spending as a Percentage of Industrial R&D Spending from
1970 to 2002

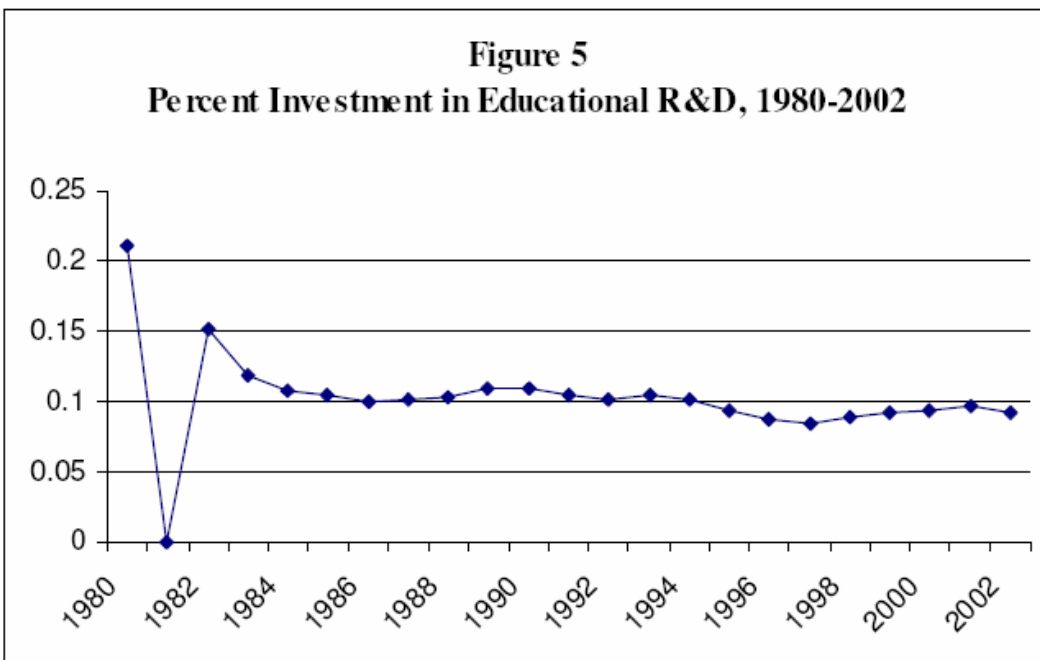


Source: National Science Foundation, Division of Science Resources Statistics, *National Patterns of R&D Resources*.

When firms know that they are unlikely to be able to capture much of the returns of their R&D investments, their incentive to spend resources in this area leads to an underinvestment in new technologies. This, in turn, leads to lower economic growth. As pointed out by Nobel Laureate Robert Solow, much of growth comes from new technologies and new ideas.¹⁴

The difficulty of appropriating returns from innovations is widespread. Innovators receive only a tiny fraction of the social benefits from technological advances. Over the 1948 to 2001 period, innovators captured only 2.2 percent of the total present value of their innovations.¹⁵ The vast difference between the total value and their share of the returns strongly suggests that many productive R&D activities are not undertaken because innovators can expect only a tiny fraction of the total returns of their inventions.

The degree to which intellectual property can be appropriated, and the ease with which innovation can be imitated, differs among industries. Innovation in educational technologies is a prime example of where it is difficult to obtain even a small fraction of the returns from the innovation. Innovative educational methods are readily observable and easily imitated. The ease of imitation of new methods is exemplified by the fate of many firms in the new technology economy in the 1990s. These firms quickly became bankrupt because their new business models, the software they developed and many of their other innovations were easily observable. The Internet makes the copying of these ideas and innovations especially easy. When competitors copy some or all of the new methods developed by other firms, the financial returns from the innovation can be very low. This provides only weak incentives to invest in the development of new methods. New information technologies are expensive to produce and inexpensive to reproduce. Private returns from investments to develop these technologies have always been far below their returns to society and the Internet has further reduced the cost of imitating, transmitting and distributing new information.



Source: National Science Foundation, Division of Science Resources Statistics, Survey of Federal Funds for R&D, Vol 50, (2002), and National Patterns of R&D Resources: 2002 Data Update, Table D.

Research that leads to new insights on how to use the power of new information technology includes: work designing new approaches to pedagogy using simulations; combining the skills of teachers and content experts with artificial intelligence systems to personalize instruction and answer questions; and using the new technology tools to evaluate complex sets of skills. These and other basic areas may pay high social returns, but the results will be particularly difficult to

protect as proprietary intellectual property. Underinvestment in research means that most educational applications of new technology fall far short of the capabilities provided to other major service enterprises.