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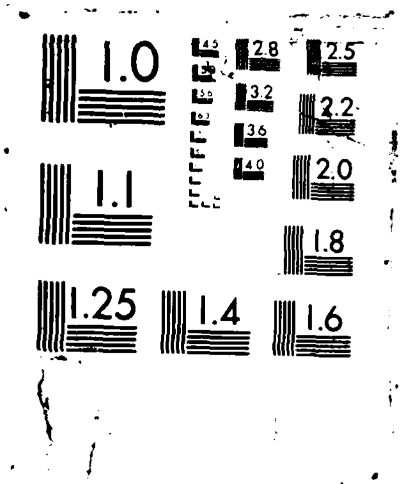
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MACHINERY & Allied Products INSTITUTE

MEMORANDUM

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INVESTING IN INNOVATION: THE NEED TO STRENGTHEN THE R&D TAX CREDIT

Making Incremental R&D Tax Credit Permanent Is Top Priority Despite Need To Reduce Federal Budget Deficit

MACHINERY AND ALLIED PRODUCTS INSTITUTE

MACHINERY & ALLIED PRODUCTS INSTITUTE AND ITS AFFILIATED ORGANIZATION, COUNCIL FOR TECHNOLOGICAL ADVANCEMENT, ARE ENGAGED IN RESEARCH IN THE ECONOMICS OF CAPITAL GOODS (THE FACILITIES OF PRODUCTION, DISTRIBUTION, TRANSPORTATION COMMUNICATION AND COMMERCE), IN ADVANCING THE TECHNOLOGY AND FURTHERING THE ECONOMIC PROGRESS OF THE UNITED STATES

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INVESTING IN INNOVATION: THE NEED TO STRENGTHEN THE R&D TAX CREDIT

Making Incremental R&D Tax Credit Permanent Is Top Priority Despite Need To Reduce Federal Budget Deficit

Given the degree of competition firms face both domestically and abroad, continued innovation and its rapid commercialization are necessary for survival of the U.S. industrial sector. The United States historically has been very successful at invention, but for too long we have been much less successful at quickly incorporating the new technology in products and processes. This factor has been an important contributor to the loss of U.S. market share in many industries. In the words of President Reagan's science adviser, William Graham, "Either we innovate or we'll be buying everything from abroad."[1] Considering the economic stakes, it is imperative that public policy, including tax policy, encourage the formation and adoption of new technologies.

Why the United States Needs an R&D Tax Credit

The 1981 Economic Recovery Tax Act (ERTA) included a provision for an incremental tax credit of 25 percent for certain qualifying research and development expenditures which exceed a base level. This tax credit provision was only temporary and scheduled to expire by 1986. With the passage of the 1986 Tax Reform Act (TRA), the R&D tax credit was extended for an additional two years, through 1988, albeit at a lower marginal rate (20 percent), to allow time for further evaluation.

Virtually all economists agree that without government incentives the private sector will not invest sufficiently in R&D since it is impossible for those conducting R&D to capture all of the benefits from successful R&D. It is recognized that even in an economy which relies primarily on competitive markets, government must provide an additional stimulus to increase investment to the optimal level that will maximize the long-run benefits of R&D both for the private sector and society.

The most appropriate government technique for supporting R&D investment varies with the type and purpose of the R&D activity. For example, if the purpose is simply to increase knowledge of scientific or human relationships with little concern about how that knowledge will be

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1. BNA's Daily Report for Executives, Bureau of National Affairs, October 14, 1987, No. 197, p. L-1.

applied, direct government funding would be the appropriate approach. Indeed, it makes little sense for the private sector to invest heavily in this type of basic research since such knowledge is made widely available to everyone as soon as it is discovered.

Similarly, the government has the primary role in funding research which will improve the efficiency of achieving an activity for which the government is responsible. For example, research associated with the control of disease within the population and the national security of the country justify direct government expenditures.

However, when it comes to funding research that is intended to result in the commercial application of knowledge, direct government funding has severe limitations. Civil servants have little understanding of what direction developmental and applied research should take, and government oversight, which is justified in the case of public sector investment, will not necessarily result in commercial success. Therefore, government support of the less basic avenues of research should rely as much as possible on the market for its direction. This is why a tax credit is the most appropriate technique for encouraging the private sector to increase investment in R&D to the socially optimal level.

Although the R&D tax credit as currently formulated is not perfect, the majority of the information and analysis to date indicates that even with its problems, the credit has been a relatively cost-effective stimulus to R&D spending.

MAPI strongly recommends that, even in a period when prompt action to reduce the federal budget deficit is necessary, other expenditures must be cut to maintain and indeed strengthen the current incremental R&D tax credit. We also believe that in 1988 Congress should enact a modified version of the R&D incremental tax credit on a permanent basis.

Manufacturing industries are the primary beneficiaries of the tax credit and it is no coincidence that these are the same industries that have substantially increased their rates of investment in R&D since 1981. Because these are also the industries that are facing intense competition from abroad, we believe that measures, such as the incremental R&D tax credit, that foster technological innovation in these sectors will have a strong positive effect on the national economy.

The Significance of Investment in R&D

While it is difficult to quantify, there is little doubt that the technological advances which result from research and development activities are an important source of productivity growth. Both labor productivity and multifactor productivity are increased as invention becomes commercialized innovation. As improvements in existing products and processes are realized and entirely new products created, the value of the firm's output for a given level of inputs is increased. These benefits may then be passed on as other firms use these "embodied" process and product innovations in new generations of machinery leading to more efficient production. The benefits of any particular innovation are usually not limited even to the industry in which the research is undertaken. As firms in other sectors use the products containing the advancements, they too will experience productivity gains. The invention of the jet engine produced significant productivity gains for the aircraft manufacturing industry. This then led to large productivity improvements in the transportation industry as airlines replaced their stock of propeller planes with jets. Innovations in computers increased productivity in the electronic equipment industry, and also served to increase productivity in most other sectors of the economy, including service industries.

Direct Return to R&D

Estimates of the real rate of return to R&D, in general, are relatively high, approximately 30 percent on a before-tax basis. A review of the relevant literature reveals fairly consistent results over a wide variety of industries and using two very different methodologies. The degree of consistency among the several studies increases the confidence which can be placed in the estimates. Even in those studies which indicate a rate of return to R&D lower than 30 percent, the estimated return to R&D is substantially greater than for other types of investment. This differential holds for rates of return to R&D and capital estimated for the Japanese and German manufacturing sectors as well.[2]

Societal Return to R&D

The above estimates cover only the direct or private returns to R&D, i.e., those benefits that accrue to the R&D performer. However, as discussed earlier, the results of R&D spill over to other firms and industries. The societal return to R&D, the combination of direct and indirect returns, has been estimated to be two to three times the direct return.[3] The existence of such a societal premium over the private rate of return provides a rationale for government support of R&D.

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2. M. Ishaq, Nadiri, Pierre A. Mohnen, and Ingmar R. Prucha, "R&D, Production Structure, and Productivity Growth in the U.S., Japanese, and German Manufacturing Sectors," National Bureau of Economic Research Working Paper No. 1264, January 1984.

3. See Martin Neil Baily and Robert Z. Lawrence, "Tax Policies for Innovation and Competitiveness," Council on Research and Technology (CORETECH), April 3, 1987, pp. 26-28, for a review of the relevant studies.

R&D and Productivity

Research activities are an important contributor to productivity growth. Recent studies estimate the direct contribution of R&D investment to aggregate productivity growth to be in the 0.1 to 0.2 percent range.[4] Given that multifactor productivity (capital and labor) between 1948 and 1982 has grown at an average annual rate of 1.2 percent, R&D has therefore been responsible for 8 to 16 percent of the increase in our productivity.[5]

Considering the relationship between R&D and productivity, it is not surprising that analysts examining the causes of productivity slowdowns look toward R&D as a possible culprit. During the 1973-79 business cycle in particular, productivity growth slowed significantly. Private nonfarm business labor productivity had an average annual growth rate of only 0.5 percent and multifactor productivity actually declined (-0.1 percent annually) over the cycle. And although higher, the growth rate of the current cycle has not been able to attain the level of growth achieved during the earlier periods. One exception is the manufacturing sector which, partially in response to its increased investment in R&D, is currently experiencing fairly robust rates of productivity increases.

Declining R&D Spending and the Productivity Slowdown

There are two possible ways in which R&D could have contributed to a productivity slowdown. Recognizing that there is a lag between incurring the R&D expenditure and realization of an innovation, the decline in R&D expenditures that began in the mid-1960s and continued through the 1970s may have reduced the amount of new technology available to increase productivity during the more current periods. A second and potentially more serious possibility is that the return to R&D may be declining over time. This would imply that technological advances are now "smaller," i.e., increasing amounts of capital must be expended to achieve a given rate of productivity improvement.

Estimates from the National Science Foundation indicate that there was a marked decline in the amount of money spent on R&D relative to the Gross National Product (GNP) after a peak in 1964. However, several

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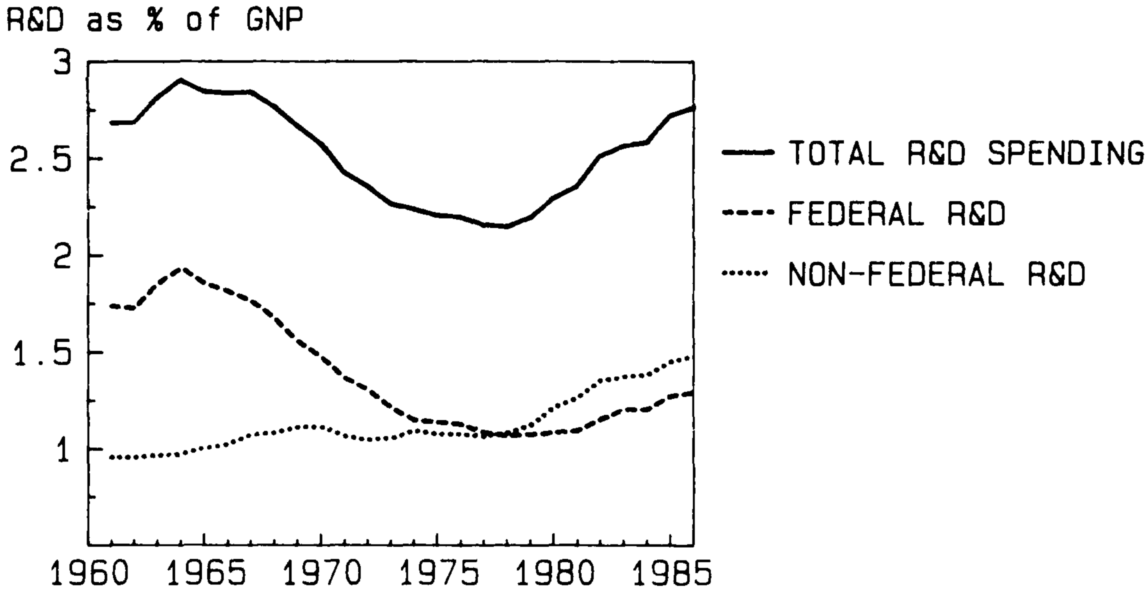
4. Leo Sveikauskas, "The Contribution of R&D to Productivity Growth," Monthly Labor Review, March 1986, pp. 16-20; and Zvi Griliches and Jacques Mairesse, "Productivity and R&D at the Firm Level," in Zvi Griliches, Ed. R&D, Patents, and Productivity (Chicago, National Bureau of Economic Research Conference Report, 1984); pp. 339-374.

5. These results are quite similar to estimates calculated using data from the French manufacturing sector. See Philippe Cuneo and Jacques Mairesse, "Productivity and R&D at the Firm Level in French Manufacturing," in Zvi Griliches, Ed. R&D, Patents, and Productivity (Chicago, National Bureau of Economic Research Conference Report, 1984); pp. 375-392.

studies indicate that it is R&D spending from nonfederal sources that actually has the major impact on productivity. As shown in Chart 1, which breaks down R&D expenditures by source, the decline in total R&D expenditures is due to the decline in federal expenditures--nonfederal expenditures as a percent of GNP increased during the period. Of course, it is not simply the yearly variations in the expenditure pattern that affect productivity growth. Technological innovation is the result of accumulated research expenditures. A recent Bureau of Labor Statistics (BLS) study reports a time series for nonfederal R&D stock, which takes into account the lag between expenditure and payoff and depreciation for both basic and applied research. This study indicates only a small decline in the R&D contribution to productivity growth during the 1973-79 cycle and concludes that R&D had no substantial effect on the slowdown.[6]

Chart 1

R&D Spending as a Percent of Gross National Product



Source: *National Patterns of Science and Technology Resources: (NSF 86-309) (Washington D.C., 1986)*

6. Sveikauskas, "The Contribution of R&D to Productivity Growth."

This BLS study may understate, however, the impact of R&D on the productivity slowdown because the author was not able to include the indirect effects in the analysis. Because of the probable large impact of these indirect effects and the longer lag time required for them to work their way through the economy, small changes in the R&D stock may be exerting a larger influence on the productivity growth rate over a longer period of time than the BLS analysis reflects.

An additional consideration is the absolute decline in industry R&D real expenditures for basic research that occurred during the 1970s. There is some evidence that basic research is more important as a determinant of productivity than other types of R&D.[7] If this is indeed the case, then the levels of R&D stock calculated for the BLS study overstate the R&D contribution to productivity.

Finally, the BLS study assumes that the return to R&D remains constant at 30 percent in calculating the time series of R&D stock for 1948-1982. While at least one study indicates that the R&D return may be below 30 percent in some industries,[8] the most recent empirical studies support the nondeclining rate-of-return view.[9]

Even though they have not been reflected in the empirical studies, changes in other variables have most likely exerted some impact on the relationship between R&D and productivity. In particular, the contribution of R&D needs to be examined in combination with the other factors that also are considered to be causes of the productivity slowdown.

One survey lists inadequate capital formation, changes in labor force composition, rising energy prices, changes in the composition of output, increased government regulations, and cyclical factors, in addition to reduced R&D expenditures, as possible contributors.[10] Not only do these

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7. Zvi Griliches, "Productivity, R&D, and Basic Research at the Firm Level in the 1970's," American Economic Review, March 1986, pp. 141-154.

8. Martin Neil Baily and Alok K. Chakrabarti, "Innovation and Productivity in U.S. Industry," Brookings Papers on Economic Activity (1) 1985, pp. 609-30. These authors found some evidence based on a review of trade journals that there has been a slowing of technological change for given levels of R&D investments, indicating a declining rate of return to R&D in the chemical industry, but not in the textiles industry. They are currently extending their work to other industries.

9. Sveikauskas, "The Contribution of R&D to Productivity Growth," fn 12, p. 20; and Richard McHugh and Julia Lane, "The Role of Embodied Technological Change in the Decline of Labor Productivity," Southern Economic Journal (53) April 1987, pp. 915-924.

10. Edward N. Wolff, "The Magnitude of Causes of the Recent Productivity Slowdown in the United States: A Survey of Recent Studies," in Productivity Growth and U.S. Competitiveness, William J. Baumol and Kenneth McLennan, Eds. (New York Oxford University Press, 1985).

factors affect the rate of productivity growth directly, their effect may be magnified indirectly by acting in combination with R&D. For example, a decline in the rate of capital formation reduces the rate at which new technology is introduced and used in production. If there is less new technology embodied in new equipment in addition to less new capital being added, the average age of equipment remaining in production increases at a faster rate. This has a slowing effect on productivity growth.

Two external factors which occurred in the 1970s, the Arab oil embargoes and pollution abatement legislation, also listed as possible causes of the slowdown, affected the R&D/productivity relationship by changing the types of R&D undertaken. With the sharp increases in energy prices in the 1970s, the research emphasis shifted towards energy-saving innovation. The benefits that firms derived from this type of activity would not be reflected as increases in labor productivity or even labor and capital multifactor productivity. Pollution reduction research also began to account for a rising proportion of research expenditure during this same period in response to regulatory requirements. This type of research, again, would not result in increases in the standard productivity measurements.

Although the above discussion indicates that there has been some confusion over the role played by R&D in the productivity slowdown of 1973-79, it does not present any strong evidence that expenditures on R&D have become less effective over time in their ability to create economic growth.

Investment in R&D: Why Firms Underinvest

Given the high rate of return even to private R&D alone, why do firms tend to underinvest? The market is generally the best allocator of resources. As individuals and firms make decisions based on their perceptions of relative costs and benefits, resources tend to flow to their highest value use. While the adjustment is neither immediate nor costless, no central authority would be able to perceive and act upon new opportunities with the speed of the entrepreneur. Even though many business decisions turn out to be less than correct in retrospect, market pressure generally will not allow firms to continue along an incorrect path for very long. The same mechanism that guarantees rewards also provides for the eventual elimination of inefficient firms.

In general, government interference in this process results in more problems than it solves. However there are instances where the market does not provide the "correct" solution. Investment in R&D is one of these special cases. Firms, especially small firms, tend to underinvest in research and development because it is subject to several types of market failures, including (1) the inability to appropriate all returns, (2) private risk which exceeds societal risk, (3) asymmetries in information, and (4) capital barriers.[11]

Alternatives to a Tax Credit

Rather than using tax incentives to bypass these market failures, an alternative approach would be to try and correct the failures themselves. As will be discussed below, this generally is not possible.

Appropriation of R&D Returns

The total value of the R&D output to society is greater than that actually realized by the firm performing the research. Firms seldom are able to remain the only producers of products they create. Imitation by others occurs rapidly.

A strengthening of the patent system is one method of correcting this failure. Theoretically, an extension of patent rights through a lengthening of the patent period could permit companies to appropriate the full return thereby equalizing the private and societal rates of return. This is not possible in practice. Unfortunately, a significant extension of patent protection could lead to increased monopoly power with its own allocative inefficiencies. In addition, the cost and uncertainty of challenging imitation products or processes may be considerable. There is also the possibility that much broader patent protection could lead to firms undertaking excessive amounts of R&D, i.e., R&D could be undertaken to the point where private returns exceed the societal return.[12]

Private vs. Societal Risk

When planning a research project, the firm is never certain if or when positive results will be obtained. The more basic the type of research, the greater the uncertainty. While any business endeavor entails some degree of risk (after all "entrepreneur" does mean one who takes risks), the risk associated with R&D projects is substantially higher than that for other types of investment. Even though the "average" rate of return to R&D projects is very high, the failure of one large individual project or succession of projects could have serious consequences for the future of a firm.

The risk to the firm continues even after the successful completion of an R&D project. Even if the firm were able to appropriate all benefits from research to itself, there is still uncertainty as to the eventual demand for the resulting innovation as illustrated in the following example.[13] After expending $700 million in capital expenditures

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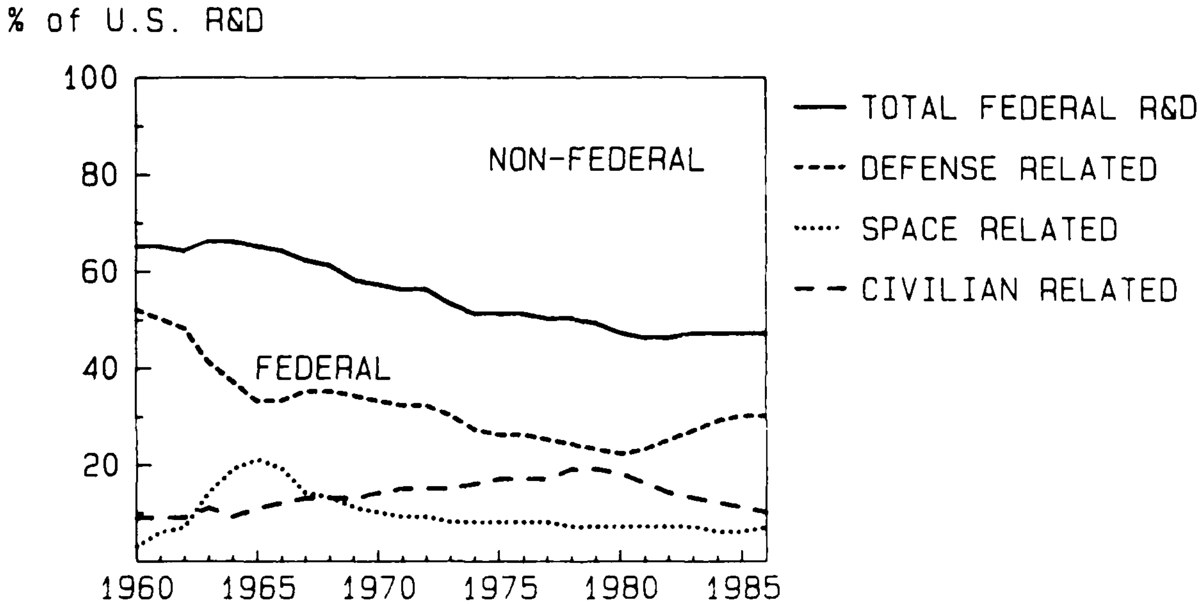
11. Jane G. Gravelle, "The Tax Credit for Research and Development: An Analysis," Congressional Research Service, January 25, 1985, pp. 5-8.
12. Ibid., p. 11.
13. Laurie Hays, Wall Street Journal, September 29, 1987, pp. 1,24.

over a period of 25 years and $200 million in operating losses, the du Pont Company succeeded in developing a lightweight fiber, Kevlar, that is five times stronger than steel. However, even given that the results met the research goals, the company is finding it difficult to generate sufficient demand for the new product. Where nylon and Dacron, two earlier du Pont discoveries, were adopted relatively quickly for a wide variety of uses, du Pont is having to search out areas of potential consumer need and create Kevlar products to respond to that demand. It has been a difficult task to convince customers that Kevlar is worth the premium price. Although in some product lines, bulletproof vests in particular, Kevlar is proving itself, other products have turned to alternative synthetic materials as, for example, in the case of tires.

The most straightforward way to eliminate private risk is for the government to perform the R&D either in its own labs or through direct grants. In 1986 the federal government funded 47 percent of the total R&D undertaken in this country. As shown in Chart 2, most of this total is defense-related, with only one-fifth of federal spending accounted for by civilian-type R&D. Instead of providing tax incentives to encourage private R&D expenditures, the government could simply increase its own spending. The money could then be directed to those projects which, in the opinion of some decision-making group, would produce the highest rates of return to society.

Chart 2

Federal R&D Spending by Type as a Percent of Total U.S. R&D Expenditures



Source: *National Patterns of Science and Technology Resources:* *(NSF 86-309) (Washington D.C., 1986)*

While this approach is appropriate for much of basic R&D, the developmental and applied areas need more specific knowledge of the markets than is usually found in government offices. As invention moves toward the applied innovation, it is important that the research be "market driven." Industry is generally a better judge of which potential products will have sufficient demand to warrant production.[14] Just as having government decide in which industries the country should invest is not the most efficient or effective way of maintaining a competitive society, the government is not the best source of predicting which R&D projects will have the highest payoff.

Asymmetrics in Information and Capital Barriers

Participants in the firm generally will have better information as to the viability of any given research project than those outside the firm or industry, including banks. While large firms may have available internally generated funds--or ready access to them--for their research projects, small firms are less likely to be in that position. And even for very large firms, increases in the cost and complexity of various types of research have made it infeasible for an individual firm to undertake some projects.[15]

One attempt to solve this particular problem is the "National Cooperative Research Act of 1984" (see MAPI Memorandum G-182, November 12, 1984). This law attempts to encourage cooperative research efforts by providing for joint R&D ventures to be judged on a "rule of reason" basis rather than by being considered illegal per se under the antitrust laws and by limiting recovery in antitrust actions to actual damages.

The Effectiveness of the Incremental R&D Tax Credit

As mentioned earlier, the TRA extends, with modifications, the incremental R&D tax credit established by the 1981 ERTA. Specifically, the Act:

> (1) extends the incremental research tax credit, with modifications, for an additional three years (for qualified research expenditures paid or incurred through December 31, 1988); (2) reduces the research credit rate to 20 percent; (3) repeals the present-law provision treating amounts paid for the right to use property in qualified research as eligible for the credit (other than payments for the use of computer time); and (4)

14. Baily and Lawrence, "Tax Policies for Innovation and Competitiveness," p. 30.

15. Gravelle, "Tax Credit for Research and Development," pp. 7-8.

makes the credit subject to the general limitation on business credits.[16]

These modifications to the research credit apply to taxable years beginning after December 31, 1985. The term "qualified research expenditures" is discussed in the Appendix.

The effectiveness of the incremental R&D tax credit has been limited by two components of its design. The firm-specific base used to calculate the incremental increase in expenditures and the temporary nature of the credit combine to reduce the effective value of the credit and may cause perverse effects as firms alter the timing of their expenditures to maximize the value of the credit.

Any analysis of the credit is made difficult by the short period of time it has been in effect. The credit applied only partially to 1981 expenditures and data on industry R&D expenditures are available only through 1985. This means that there are only four complete years to examine and during this period the credit was temporary.

Once the credit was fully in place (beginning in 1983), the 25 percent credit applied to qualifying expenditures exceeding the average of the previous three years. Under this incremental formula, an additional dollar spent by a firm in one year reduces the ability of that firm to benefit from future credits because that additional dollar becomes part of the base used in calculating future credits. Because a dollar increase in spending raises the base by 33 cents for each of the following three years the value of the credit is significantly reduced. The tax credit as currently designed only postpones taxes, it does not lower them. Therefore, its value to the firm is equal to the time value from receiving use of the money one to three years sooner. This implies an effective credit that is significantly smaller than 25 percent.[17]

The moving average firm-specific base causes the credit to affect individual firms' expenditures differently. As explained by the former director of the Congressional Budget Office, Rudolph Penner:

> The incentive provided by the credit can vary greatly from firm to firm. To one that steadily increases its R&D spending above its qualifying three-year average, the credit's value will be much reduced: at a nominal 15 percent discount rate, the credit would

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16. MAPI Memorandum (T-76) "Tax Reform Act of 1986," October 1986, p. 9. This publication provides detailed information on the major provisions of the new tax law.

17. Rudolph G. Penner, Director, Congressional Budget Office. Statement before the U.S. House of Representatives Subcommittee on Oversight, Committee on Ways and Means, August 2, 1984, p. 5.

be worth 6 percent to the firm, or less than one-fourth the statutory level. The full credit will be available only to a firm that increases research expenditures in one year and then returns to its base R&D spending level. In other circumstances, the credit can actually be negative. If, for instance, a firm's R&D spending is well below its qualifying base for the current year, incremental R&D expenditures would only serve to increase the firm's future tax liabilities. In this instance, the incremental expenditures would not qualify for the credit, but they would be counted in the firm's base for future credits. Of all firms in 1981, 15 percent fit into this category. (The credit is, of course, irrelevant for a firm expecting no tax liability.)[18]

The general consensus, based on three separate surveys of the available literature, appears to be that the R&D tax credit has had a small, but statistically significant, impact on R&D spending.[19] This is not surprising given the temporary nature of the credit, the limited amount of time it has been in effect, and its small and variable size. Similarly, looking at the other side, the credit has not resulted in much loss of tax revenue. During the latest tax year for which we have data, July 1984-June 1985, the amount claimed for the R&D credit was less than $1.6 billion. This amount is equal to 1.5 percent of the income taxes corporations paid before credits. If estimates of the price responsiveness of R&D spending are correct, then the tax credit appears to be a good investment given the high societal rate of return to R&D.[20]

One problem attributed to the R&D tax credit approach is that it is not targeted. Qualifying investments with different rates of societal and private return are impacted similarly by the tax credit. There is an efficiency tradeoff as tax dollars support increased spending on projects with both high and low societal benefits. Firms make decisions based on the expected private return, not on the potential benefits to society as a whole. However, the combination of the small size of the current R&D tax credit and the high estimates of societal returns to R&D, in general, make it likely that this tax credit is encouraging projects with high average total returns.[21]

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18. Ibid., pp. 5-6.
19. See Baily and Lawrence, "Tax Policies for Innovation and Competitiveness," pp. 37-42 for a review of these surveys.
20. Ibid., p. 20, fn7.
21. Gravelle, "Tax Credit for Research and Development," p. 14.

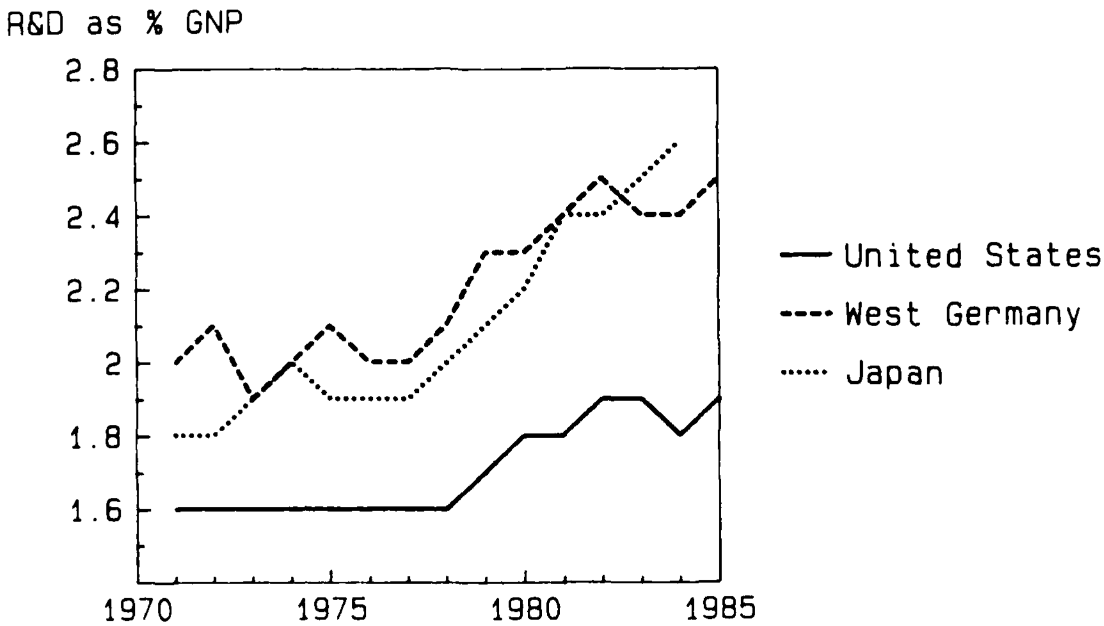
R&D and International Trade

The significance of a country maintaining a given level of R&D investment is to some extent a function of its trade position. If the United States were completely insulated from the rest of the world, then slower technological growth would simply translate into a slower rate of growth in our standard of living. However, given the strong competition U.S.-manufactured goods face in domestic and foreign markets and the already large size of the trade deficit, the continued loss of our technological edge through insufficient investment will eventually result in a diminished U.S. standard of living.

One measure of the relative strength of U.S. investment in R&D is the comparison of rates of R&D investment relative to GNP. While the United States, as of 1985, devoted a higher proportion of its resources to R&D than other countries for which we have R&D data, a considerable portion of this investment was in military R&D, as previously mentioned. A truer measure of the positions of these countries is their relative standings in civilian R&D expenditures since a good deal of the benefits from military R&D expenditures are nontransferable. The relative rankings change significantly when military expenditures are excluded. As shown in Chart 3, two of our major competitors have significantly higher rates of investment than does the United States.

Chart 3

Civilian R&D Expenditures as a percent of Gross National Product by Country



Source: National Patterns of Science and Technology Resources: (NSF 86-309) (Washington, D.C., 1986)

Most of our competitors stimulate their investment in R&D through a variety of tax incentives, many of which are more generous than the incentives available in the United States. The tax policies of the countries shown in Chart 3 are illustrative. Japan has a minimum of 19 different programs to encourage research and development. While most of these programs are aimed at smaller firms, the Research and Testing Credit and the Key Technologies Credit provide large tax credits for research to firms of all sizes. All stages of research are covered, with special focus on extending the applications of existing technology. These credits are very generous. For example, the Key Technology Credit includes credits for facilities and equipment equal to 7 percent of the acquisition cost or 20 percent of the corporate tax, whichever is greater.[22] The Federal Republic of Germany also provides substantial R&D support through the accelerated depreciation of R&D assets and a 20 percent direct cash payment on the first DM 500,000 plus 7.5 percent on the balance spent on depreciable assets in a given year.[23] The value to a firm of the Japanese and German credits is substantially higher than the value of the present U.S. incremental R&D tax credit.

Recommended Changes to the Incremental R&D Tax Credit

Because of the importance of R&D to productivity and therefore to maintaining international competitiveness, we believe the R&D tax credit should remain as a component of U.S. tax policy. However, the tax credit can be made more effective with the following changes.

Make the R&D tax credit permanent.--One reason for the apparent small effect of the tax credit on business R&D expenditures is the fact that in both the 1981 ERTA and 1986 TRA, the credit is provided only as a temporary measure. Most R&D projects have longer time horizons than either of these provisions. If a company is considering a new R&D program, a tax credit scheduled to expire at the point where expenditures begin to increase does not provide much of an investment incentive.

Change the base.--As discussed above, the current design of the base can lead to perverse effects, actually discouraging R&D investment that otherwise would have occurred. If a firm in any year is not going to invest in R&D at a level exceeding the average of the preceding three years, it will only be reducing the value of future credits by investing in R&D that year. The purpose of using the three-year moving average as a base is to encourage ever-increasing amounts of investment by the firm. We believe that this is not the correct goal. The credit should be designed to provide incentives to a firm to maintain its investment in R&D at a level higher than it would have absent the credit. To this end, the base

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22. J. P. Stern, "Technotax: HighTech Tax Credits in Japan," East Asian Executive Reports, April 1986, pp. 18-19.

23. Baily and Lawrence, Appendix A.

for the credit should be the average of the firm's R&D expenditures for the three-year period, 1975 through 1978, adjusted annually for inflation.

Restore the credit to 25 percent.--As discussed earlier, even with the credit set at a 25 percent level, the United States will be giving less preferential treatment to R&D than does its major trading partners.

Conclusion

A high rate of R&D investment since World War II has contributed significantly to U.S. technological advancement and economic growth. This commitment to long-term investment in technological progress by industry and by government has given the United States the benefit of a relatively high standard of living and the ability to improve the social well-being of most Americans. During the late 1960s and most of the 1970s this commitment to invest for future growth weakened somewhat as the share of our GNP devoted to R&D declined. While this downward trend has been reversed we still spend a smaller proportion of our resources on R&D than we did in the mid-1960s. The high rate of return from R&D investment makes it essential that as a nation we must devote even a greater share of our resources to R&D than we did in the 1960s.

The need for a higher rate of investment in R&D is also justified since the markets for industrial products have become much more competitive, forcing more U.S. businesses to compete with foreign businesses in both international and U.S. domestic markets. In the long run, if the United States is to maintain its technological leadership position, the U.S. rate of R&D investment must at least keep pace with that of its competitors.

At present we are spending about the same share of GNP on R&D as our major competitors. But a much higher proportion of their R&D expenditures are for projects designed to produce innovations that will improve their competitive position in global markets. Other countries devote a higher proportion of their R&D expenditures for commercial application because their governments provide stronger incentives for industry to invest in R&D and, in part, because other countries have relatively small defense budgets, whereas much of our R&D expenditures are required to support our extensive defense and national security obligations. To remain competitive the United States must commit more resources to the type of R&D that is likely to lead to greater economic performance throughout the industrial sector.

MAPI's recommendations to strengthen tax incentives to increase industrial R&D in the United States and maintain our long-run competitiveness in world markets would result, of course, in a revenue loss to the federal government. Since reducing the federal budget deficit is also important to improving the competitive position of U.S. industry, this poses difficult fiscal policy choices for both Congress and the Administration.

Sacrificing greater incentives for R&D investment in the name of reducing the federal budget deficit is a shortsighted strategy. If the United States is to benefit from having strong long-run economic growth, politicians must be prepared to curtail entitlement programs that subsidize current consumption in favor of stronger incentives for private sector R&D investments that promise a greater economic return to society in the future.[24] Unless we increase our investment in R&D and in new plant and equipment that diffuses successful R&D throughout the economy, the competitive position of our industrial sector will continue to be threatened.

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24. See "The Effect of Fiscal Policies on U.S. Competitiveness," MAPI Statement to the Subcommittee on Taxation and Debt Management, Senate Finance Committee, October 28, 1987.

APPENDIX

Defining Qualifying Research and Development Expenditures*

This provision of TRA extended the incremental research tax credit, with modifications, for an additional three years for "qualified" research expenditures paid or incurred through December 31, 1988. Because of perceived abuses in the application of the 1981 act, the definition of qualifying expenditures was tightened in TRA. Under the current act, Sec. 174 of the Internal Revenue Code defines qualifying expenses to include "all such costs incident to the development of an experimental or pilot model, a plant process, a product, a formula, an invention, or similar property, and the improvement of already existing property of the type mentioned." The costs of obtaining a patent are also included. Excluded are expenditures "for the ordinary testing or inspection of materials or products for quality control, advertising or promotions." Also excluded are "the costs of acquiring another's patent, model, production or process, nor does it include expenditures paid or incurred for research in connection with literary, historical, or similar projects."

As discussed in an earlier MAPI memorandum, these expenditures for research or experimentation are eligible for the credit only if the research is undertaken for the purpose of discovering information:

> (1) that is "technological in nature" (as defined), and (2) the application of which is intended to be useful in the development of a new or improved "business component" (as defined) of the taxpayer. Further, research is eligible for the credit only if "substantially all" (as defined) of the activities of the research constitute elements of a "process of experimentation" (as defined) for a functional purpose (i.e., relating to a new or improved function, performance, reliability, or quality).

The revised credit repealed the ERTA provision which allowed the credit to be applied to amounts paid for the right to use property in qualified research as eligible for the credit, except in the case of payments for the use of computer time. TRA also includes a "specific rule" applicable to internal-use software. Under this rule software development costs are eligible for the credit only if the software is used in (1) qualified research (other than the development of the internal-use software itself) undertaken by the taxpayer; or (2) a production process (e.g., robotics software) that meets the requirements of the credit.

*Source: MAPI Memorandum T-76, "Tax Reform Act of 1986," October 1986, pp. 9-10.

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