use the credit also diminishes its overall effect, although this is mitigated somewhat in France by the fact that the credit is refundable after four years if unused.

Continuing Analytical and Policy Issues

Measured narrowly, in terms of R&D dollars induced, the R&E tax credit appears to be a relatively successful policy instrument. Broader and arguably more significant measures of effectiveness, such as assessments of the net social rate of return from R&D induced by the credit, have yet to be developed and ultimately may not be available due to fundamental data and methodological problems. This concluding section describes three areas in which significant analytical and policy issues remain unresolved, and in which additional research would be fruitful: 1) obtaining better data and using alternative methods for analyzing the amount and type of R&D spending induced by the credit; 2) determining whether and if so how to renew the R&E tax credit; and 3) comparing the R&E tax credit with other policy instruments.

Alternative Data and Methods for Analyzing the Amount of R&D Induced by the Tax Credit

The best available econometric research indicates that the R&E tax credit does generate additional R&D spending by private industry, at approximately one dollar in spending for every dollar in lost tax revenue. However, the exception of Altshuler, none of these studies have used what appears to be the most appropriate data set—individual corporate tax returns.[104] IRS data would allow researchers to focus directly on the responsiveness of qualified R&E expenditures, rather than having to rely on a proxy equal to some average eligibility rate times total (worldwide) R&D. Tax return data also would contain much better information on the actual tax status of the firms, their exposure to the Alternative Minimum Tax, and the amount of R&E credit they claimed, which would allow much more precise estimates of the responsiveness of qualified R&E spending to the tax credit. If appropriate IRS data were made accessible, it could be applied to a sample set of firms using existing econometric models, such as that developed by Hall, which would improve the estimates of both the induced R&E spending and the corresponding tax revenue loss.[105] Unfortunately, confidentiality requirements severely (and understandably) restrict the use of individual taxpayer data; consequently, should Congress decide to pursue this line of inquiry, it would have to direct the U.S. Treasury to conduct such a research program.

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[104] Altshuler (1989).

[105] Hall (1993).

A second area where internal government data would prove useful is in evaluating the administrative cost of the tax credit in the United States. The U.S. General Accounting Office has conducted some research in this area, but the information is incomplete and dated.[106] OTA interview evidence indicates that the IRS does experience some difficulties in auditing firm data for qualified expenditures, but there are no numerical estimates of the full administrative costs, nor are there apparently any appropriate IRS data available upon which to base such estimates. Moreover, there are no existing estimates of the administrative costs borne by firms. In both cases, relevant information could be generated through survey instruments.

An alternative method for assessing the effectiveness of the R&E tax credit would be to examine whether the private return to R&D fell for those firms that used the credit. The credit clearly is intended to induce firms to increase their R&D to a point beyond the level they would choose in the absence of the credit. If the credit is successful, the private rate of return should fall. However, aggregate measures are inappropriate for this exercise, since the *ex post* private return to R&D will vary over time for reasons unrelated to the presence of the credit. The best way to approach this question would be to compare the returns to R&D for firms in the same industry that do or do not receive the benefit of the credit because of their particular tax situation, such as whether they are subject to the Alternative Minimum Tax. The private rate of return could be computed based on established methods: using a sales productivity equation that adjusts for changes in capital and labor inputs, it would be possible to allow R&D to have a differential impact depending on the tax credit position of the firm; the estimated difference in the coefficient is a measure of the difference in the private returns to R&D for the two groups of firms.[107]

An additional approach would involve international comparisons, which hardly have been tapped. Currently, only macroeconomic estimation would be feasible, given the lack of public data at the individual firm level that adequately captures the information necessary to compute the tax credit for each firm—to say nothing of the detailed knowledge needed of each tax system. Serious work in this area would require the cooperation of researchers in several countries.

New and better data, using econometric models combined with survey and interview data, undoubtedly would improve existing estimates of the amount of R&D spending induced by the tax credit. Ultimately, however, new research is needed to determine what *type* of research the credit induces. This would be the first step toward addressing the vexing problem of weighing the social returns to tax-induced incremental R&D spending against the potential returns to using the foregone tax revenue for direct R&D subsidies or other public purposes. This type of information would have to be obtained through appropriately designed survey and interview instruments.

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[106] GAO (1989).

[107] As described and used in Hall (1993); and Mairesse and Hall (1995).

Whether and How to Renew the R&E Tax Credit

Arguably, existing data problems do not provide an adequate basis for calling the tax credit entirely into question. Although precise numbers may not be known, the available evidence indicates that the tax credit induces additional marginal R&D spending. To the extent that a positive R&D spending response satisfies the policy purpose, it would be logical to extend the credit or even make it permanent—depending, or course, on the acceptability of revenue cost projections. Congress could simply extend the credit in its current form. But if Congress indeed decides to retain the credit, as many expect, it eventually will have to address at least three substantive policy issues: 1) whether to make the credit permanent; 2) whether, and if so how, to make the credit available to a wider array of R&D-performing firms; 3) whether, and if so how, to manage ongoing problems in the definition of qualified research under section 41 of the Internal Revenue Code.

Policy issues involved with making the credit permanent

Although industry positions differ substantially on the proper form of the R&E tax credit, most agree that the uncertain status of the credit limits its effectiveness. The case for making the credit permanent is straightforward and plausible: the frequently long-term nature of R&D projects requires planning horizons that often exceed the statutory length of the credit, which adds a degree of uncertainty regarding the cost of capital for R&D over the expected project duration.[108]

The lack of permanence does not affect all firms equally. Typically, those with longer planning horizons and more fixed types of R&D investment will be more sensitive to uncertainty in the credit's duration than those with shorter time horizons and more flexible forms of R&D investment. For instance, R&D projects in the biotechnology industry frequently involve five year or longer planning cycles and high fixed investment costs, which tends to heighten the effect of uncertainty in the provision of R&E tax credits (as well as other factors affecting the expected cost of capital). By comparison, R&D in the communications industry generally involves much shorter planning horizons, often one year or less, with investment costs typically concentrated in highly mobile R&D personnel (e.g. software programmers operating on contract). In the former case, the lack of permanence in the R&E tax credit can be a major aggravation, while in the latter it is mostly an inconvenience.

By their very nature, R&D projects tend to involve high levels of uncertainty on many fronts, from technological feasibility to various cost of capital considerations. Making the R&E tax credit permanent would likely improve R&D budgeting for some firms and some types of projects. However, there is no way to determine whether a permanent tax credit would substantially increase the level of marginal R&E spending. Again, analysis faces a counterfactual: what would firms do *if* the credit were permanent?

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[108] The basic argument for permanence has been articulated well and frequently in other sources. See, for example, Penner, Smith, and Skandersen (1994); pp.28-29.

Estimating the magnitude of any change is complicated by the fact that some firms already plan as if the credit were permanent, given Congress' history of renewing the statute.[109]

Although there is no direct evidence available for predicting the outcome, it is plausible to assume that making the credit permanent would have at least three beneficial effects: first, firms would be able to plan more effectively and consequently use the tax credit more efficiently; second, it would provide additional impetus for final resolution of the section 41 regulations; and third, to the extent that the first two changes occur, the administrative costs associated with the credit for both firms and the IRS would likely decline.

Simply put, if Congress decides that the R&E tax credit meets the policy's fundamental objectives, then there is no reason—other than the revenue cost implications—for not making the credit permanent.

If made permanent, the credit will have to include some sort of provision for reviewing and eventually altering the base period. The base period currently used cannot be retained indefinitely—as older firms go out of business and newer firms emerge, an increasingly larger share of firms will not be able to work with the fixed 1984-88 base period, while many ongoing firms will find the base period increasingly less representative of their current operations. The selection of a new base period almost certainly would be contentious, given the very different effect of alternative base periods on different firms in different industries.

Policy issues involved with making the tax credit available to more firms

The ink was hardly dry on the original R&D tax credit legislation in the United States when analysts began pointing out two weaknesses: first, the moving base weakened the incentive for incremental R&D, since increased R&D spending in any given year would raise the base level in subsequent years and, consequently, would reduce the future availability of the tax credit; and second, only firms with current or near term tax liabilities could use the credit.[110] The adoption of a fixed base period in 1989 alleviated the first problem, while the second remains as an important source of variation in availability of the credit in any given tax year.

Any tax credit that has a moving base and/or is tied to the existence of taxable income will create variations in the availability of the credit. This creates two general problems, one analytical and the other political. In terms of analysis, any estimate of the incentive and revenue effects of the tax credit that relies on aggregate data will be inaccurate because the aggregate response is unlikely to correctly characterize the responses of a group of heterogeneous firms. Nor are estimates likely to be robust over changes in the tax credit structure or mix of firms in the economy. In terms of politics,

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[109] As suggested in several OTA interviews.

[110] Collins (1983); Eisner, Albert, and Sullivan (1983); and Mansfield (1984).

variation in access to the credit creates distributional effects that may or may not conform to the policy objective.

Apart from the firm's taxable status in any given year, the availability of the credit to individual firms also can vary due to the combined effect of its R&D intensity during the base period as well as recent factors, such as business cycle fluctuations or industrial restructuring, that can affect the firm's current ratio of R&D to sales. Variation in access to the credit primarily is a matter of the credit's very design—it is incremental in structure, and consequently rewards only R&D conducted at the margin by firms with expanding R&D intensities.

If Congress revisits the tax credit and determines that equal access to the credit is an important policy goal, then it will have to consider different ways to change the structure of the credit so that it becomes accessible to all R&D performers. Many of the proposals brought forward to address the equity issue involve some sort of flat tax, either across the board or in combination with an incremental credit. In general terms, a flat credit would have the advantage of simplicity and uniform access, and it would send a strong signal of support for industrial R&D broadly construed (simply making the credit permanent may have this effect as well). However, a flat credit undoubtedly would subsidize a lot of research that would take place in the absence of the credit, and would result in a far larger tax revenue cost than the current incremental credit.[111] If made revenue-neutral, an across-the-board flat credit would have to be approximately 2 percent, which many argue would make the credit relatively insignificant to most firms.

The equity issue could be addressed through other, less drastic methods, such as changing the base period or other rules by which the credit is calculated. Unfortunately, current studies and available evidence provide little basis for predicting the effects of fundamental changes in the credit's structure. If Congress pursues this issue, a serious attempt should be made to evaluate the potential effects of redesigning the credit on its consequences for the benefit-cost ratio, at least as conventionally computed. One possible method for doing this would be to assemble a sample set of firms with accurate tax and R&D spending data, with which it would be possible to simulate the effects of changing the base to, for example, one indexed by the industry R&D-to-sales ratio.[112] This could be done by recomputing the credit faced by each firm, computing the implied R&E spending at that credit rate, and using these numbers to determine both the increase in R&D and the potential tax revenue loss.

Finally, the accessibility of the credit may be affected by the administrative costs of using it, particularly for small firms. Unfortunately, there is no available data on the

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[111] See, for example, Cox (CRS, 1995).

[112] Again, selecting an appropriate base period is likely to be politically contentious. In this case, selecting an industry R&D intensity ratio would require a commonly accepted definition of industrial groupings as well as an accepted method for distributing the R&D activities of any given firm across the different industries in which it operates. Each of these definitional requirements could become a source of dispute between the IRS and taxpayers.

administrative costs incurred by firms, and how they may vary by size or other characteristics of the firm. New survey research could be helpful in this area.

Policy issues involved in the definition of qualified research

As currently defined, qualified research under the R&E tax credit covers approximately 60 percent of all R&D actually conducted, as defined for financial accounting purposes. The primary expenditure categories that do not qualify are property, plant, and equipment costs as well as depreciation on R&D capital goods. Some analysts and corporate representatives have advocated expanding the definition of qualified R&D to cover these costs, as they represent a large portion of corporate R&D expenditures.[113] As with any substantial change in the structure of the credit, Congress would have to reconsider the scope and purpose of the R&E tax credit before legislating a fundamental definitional change of this sort. A broader definition certainly would cover more R&D, but by picking up overhead and depreciation costs it also would be more likely to grant a credit for expenditures that would take place regardless of the credit's presence. In addition, a broader definition of qualified research necessarily would entail a higher revenue cost.

Quite apart from the statutory scope of qualified research, the lack of final regulations that clearly define qualified research under the current tax credit code remains an important source of industry and policy concern. It is unclear what Congress can do on this front other than to make the credit permanent, which presumably will heighten the importance of issuing final regulations for the 1986 amendments to section 41.

Coordinating the R&E Tax Credit with Other Policy Instruments

Despite the obvious importance of research and development to the economy, and the virtual consensus that private sector R&D is prone to market failure, policymakers still have a poor understanding of where market failures are most likely to occur and what sort of policy mechanisms may provide the best remedies. By nature, direct R&D subsidies can be targeted to specific market failures, yet such mechanisms often may be relatively inefficient due to the effects of non-market forces. Indirect methods for subsidizing R&D, such as the R&E tax credit, arguably have the advantage of respecting market signals yet, for that very reason, may not be appropriate mechanisms for addressing certain types of market failure.

In short, on logical grounds alone, the R&E tax credit and other tax methods for subsidizing R&D are functionally distinct from either funding R&D directly or performing R&D in the public sector. Policy choices regarding the use and coordination of different R&D subsidy instruments undoubtedly would benefit from further research into the social

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[113] See, for example, Cox (1995).

rate of return to different forms of public and private R&D, as well as into the extent and nature of R&D market failures in the United States.

Assuming that the purpose of the R&E tax credit is simply to encourage more private R&D, some firms interviewed by OTA for this project argued that it would be more effective to focus on policy instruments that have a wider potential for reducing the cost of investment capital, such as deficit reduction and other policy measures that effectively lower interest rates, or perhaps various tax reforms that could increase the incentive for individuals to save and for corporations to invest in new plant and equipment (reduction of the capital gains tax being one frequently offered option). One obvious shortcoming of these suggestions is that they do not necessarily encourage firms to invest in R&D per se, and in this respect are far less refined a policy instrument than the R&E tax credit. Middle ground may be found in targeting indirect incentives to particular activities or sectors, or by changing the criteria used to allocate public R&D resources. However the choices are construed, the broader debate over these policy mechanisms clearly raises questions about the particular role and significance of the R&E tax credit to corporate R&D in the United States, and begs further research on the rather poorly understood matter of capital formation for innovation.