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The Research and Experimentation Tax Credit: Current Law and Selected Policy Issues for the 106th Congress

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Summary

Among economists, research and development (R&D) is widely seen as a cornerstone of technological innovation, which in turn serves as a primary engine of long-term economic growth. Nonetheless, firms are likely to invest too little in R&D relative to its economic benefits because it is impossible for them to appropriate all the returns to R&D. Thus, some government support for business R&D appears to be justified on economic grounds. However, how much support should be provided and in what manner are policy issues that stir ongoing debate in Congress.

The federal government supports business R&D in a variety of ways, direct and indirect. One notable indirect source of support is the research and experimentation (R&E) tax credit, which was enacted as part of the Economic Recovery Tax Act of 1981 and recently was extended to June 30, 2004. The credit is equal to 20% of a firm's spending on qualified research above a base amount. Such an incremental design is intended to give firms a robust financial incentive to keep increasing their R&D budgets from one year to the next and to avoid rewarding firms for R&D they would have undertaken in any event.

In its current design, the R&E tax credit appears to be a cost-effective policy instrument for increasing business R&D investment. Some recent studies suggest that one dollar of the credit's revenue cost leads to a one dollar increase in business R&D spending. Others point to the conclusion that the credit may be responsible for somewhere between 6.5% and 13% of business R&D spending.

Nonetheless, proponents of the credit maintain that its design contains certain flaws that reduce its effectiveness as a R&D tax subsidy. They cite three flaws in particular. First, because of certain rules governing the use of the credit, its maximum marginal effective rate is substantially lower than its statutory rate. Second, the credit has never been made a permanent feature of the federal tax code. And third, the credit confers uneven marginal benefits among firms performing qualified research and among qualified business R&D projects without justification in standard economic theory.

In the 106th Congress, a handful of bills has been introduced that would address some or all these concerns. The most far-reaching is a pair of identical bills in the House (H.R. 1682) and the Senate (S. 951) that would permanently extend the credit and create an alternative incremental credit that is more generous at the margin than the current credit. There is reason to believe that these proposed changes would fail to transform the credit into what most economists regard as an optimal R&D tax subsidy. Nonetheless, on the whole, critics of the credit view it as a form of corporate welfare that should be curbed or abolished. They contend that it serves to reward firms for doing what they would do in any event and often applies to R&D projects with little or no external benefits.

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In recent decades, economists have gained notoriety for their disputes over a variety of policy issues. But on one such issue, the proper role of government in the market for research and development (R&D), they tend to agree. Most economists subscribe to the view that R&D lays the foundation for technological innovation, which, in turn, is an important driving force in long-term economic growth – mainly through its impact on the productivity of capital and labor. Other key determinants of the rate and pattern of economic growth include investment in new plant and equipment and in worker education and training. Technological innovation embraces a complex and varied set of activities, ranging from the discovery of new scientific or technical knowledge to the widespread adoption of new technologies derived from this knowledge. But it also involves elements of serendipity and ingenuity that have little to do with the formal R&D process. The end result of this process is the generation of new or improved goods and services and new or improved practices, techniques, and designs for the production and distribution of goods and services. Over time, technological innovation makes physical capital and labor more productive and yields more benefits for the economy as a whole than the firms financing or performing the R&D that undergirds this innovation. Economists who have studied the sources of economic growth attribute between one-quarter and one-half of real growth in U.S. domestic gross product since 1945 to technological innovation.[1]

Even though R&D plays a central role in long-term economic growth and transformation, firms are likely to invest less in R&D on the whole than its potential economic benefits would warrant. This is because business R&D investments generate larger returns to society at large than to the firms financing the investments. Studies done by the late economist Edwin Mansfield and others indicate that, on average, the social rates of return on business R&D investments are substantially larger than the private rates of return.[2] The inability of firms to capture or appropriate all the returns to their R&D investments provides a cogent economic rationale for

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[1]Borrus, Michael and Jay Stowsky. "Technology Policy and Economic Growth." *Investing in Innovation*, edited by Lewis M. Branscomb and James H. Keller. Cambridge, MA, MIT Press, 1998. P. 41.

[2]Mansfield, Edwin. "Contributions of New Technology to the Economy." *Technology, R&D, and the Economy*, edited by Bruce L. R. Smith and Claude E. Barfield. Washington, the Brookings Institution and the American Enterprise Institute, 1996. P. 116-119; and Griliches, Zvi. "The Search for R&D Spillovers." *Scandinavian Journal of Economics 94*, Supplement (3), 1992. Table 1, p. 43.

government support of R&D beyond what is needed to support the government's critical missions.

The federal government supports business R&D in a variety of ways, direct and indirect.[3] One salient source of indirect support is an incremental tax credit for research expenditures. Since July 1981, firms have been able to claim a credit against their federal income tax liabilities for spending on qualified research conducted in the United States above a base amount under section 41 of the Internal Revenue Code (IRC). The credit – also referred to as the research and experimentation (R&E) tax credit – is intended to give firms a robust financial incentive to increase their R&D investments from one year to the next. It was enacted as a temporary provision of the Economic Recovery Tax Act of 1981, and since then it has been extended ten times (most recently by the Ticket to Work and Work Incentives Improvement Act of 1999, P.L. 106-170) and significantly revised five times (most recently by the Small Business Job Protection Act of 1996). In fact, since its enactment, the credit has been continuously available except for the period from July 1, 1995 to June 30, 1996, when it lapsed and subsequent extensions of the credit did not retroactively cover this period. The credit is due to expire on June 30, 2004.

This report examines the design of the current credit and some of the key policy issues it raises. More specifically, the report discusses whether the credit is justified on economic grounds, explains how the credit works, and summarizes what is known about its effectiveness and incentive effect. In addition, the report describes some of the key policy issues raised by the credit. It concludes with a discussion of legislative proposals introduced in the 106th Congress that address these issues and an assessment of their potential impact on business R&D investment.

Economic Rationale for the R&E Tax Credit

In theory, a properly functioning market economy can be expected to allocate resources efficiently, which is to say in a manner that achieves the highest possible level of social welfare. Under these circumstances, government intervention in the economy would be likely to result in less desirable outcomes. This is not to suggest, however, that government intervention can never improve social welfare. If any of the stringent conditions required for markets to allocate resources efficiently fails to materialize, then, according to standard economic theory, government intervention might achieve higher levels of social welfare. Most economists hold that a market economy may misallocate resources under certain conditions. One is the existence of excessive market power on the part of buyers and sellers. Another is the failure of markets for certain goods and services to emerge: for instance, the private market does not offer insurance for many significant risks facing individuals, such as loss of income because of unemployment. The presence of either condition would provide a cogent economic justification for government intervention in the economy.

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[3]See Library of Congress. Congressional Research Service. *Industrial Competitiveness and Technological Advancement: Debate Over Government Policy.* Issue Brief 91132, by Wendy H. Schacht, updated regularly. Washington, February 8, 2000. 14 p.

In effect, the R&E tax credit represents government intervention in the market for R&D, or the market for the creation and development of new technical knowledge and knowhow. Is such intervention justified on economic grounds? The answer depends largely on whether or not the credit addresses the conditions that contribute to inefficient uses of economic resources. Does the market for R&D exhibit any such conditions? In a word, yes. The market is subject to a failure that is tantamount to the nonexistence of a market: a positive externality.[4] An externality, positive or negative, arises when one economic actor's behavior affects the welfare of another in a way that is not reflected in market prices.

As noted earlier, the process of technological innovation embraces a wide range of sometimes related but often discrete activities, including the discovery of new scientific or technical knowledge, the application of this knowledge to develop new products and processes, and the widespread adoption of these new technologies by consumers and firms. A critical element in the process is R&D conducted by firms. In theory, a firm will invest in R&D up to the point where its expected after-tax return on the investment equals its cost of capital. Yet it is thought that many firms do not capture all the returns to their R&D investments and thus are disposed to invest less in R&D than its social returns would warrant. The reason lies in the primary output of R&D: new technical knowledge and knowhow. Knowledge and knowhow exhibit the chief traits of a public good: their consumption or use is nonexcludable and nonrival.[5] As a result, it is not possible for firms that invest in R&D to prevent other firms from exploiting its results, even in the presence of the patent protection. The results of R&D can spill over to other firms through several channels: rival firms can imitate new products through reverse engineering; or they can hire key R&D personnel away from innovating firms; or researchers from an innovating firm can quit and form a competing firm with funding from venture capitalists or banks. The existence of those spillover effects is evidence that the social returns to R&D exceed the private returns. In a recent paper, economists Charles I. Jones and John C. Williams estimated that the social rate of return to R&D was two to four times greater than the private rate of return on capital.[6] And other research suggests that this is true in the particular case of business R&D.[7] Such a gap produces inefficient outcomes

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[4]An externality is an inefficiency that arises because of the nonexistence of a market for the costs or benefits of certain activities. It materializes when the activities of one person or firm affect the welfare of others in ways that are not transmitted through market prices. Externalities can be positive or negative. A positive externality occurs when an entity does something that benefits others without receiving compensation for this welfare gain; and a negative externality exists when one entity's actions lowers the welfare of others without bearing the cost of this welfare loss.

[5]This means that it is practically impossible to exclude someone from the benefits of newly discovered knowledge, and that one person's use of such knowledge does not diminish the stock of knowledge available for others to use. For more details on the nature of public goods, see Stiglitz, Joseph E. *Economics of the Public Sector*. New York, W.W. Norton & Co., 1988. P. 119-123.

[6]Jones, Charles I. And John C. Williams. "Measuring the Social Return to R&D." *Quarterly Journal of Economics*, November 1998. P. 1119 to 1135.

[7]The late economist Edwin Mansfield estimated that the average social rate of return was more

(continued...)

because it means that firms' R&D investments fall short of the levels required to achieve maximum social welfare. These spillover effects constitute a classic example of a positive externality.

A classic remedy for such a market failure is a subsidy for the activity producing the external benefits. In the case of business R&D, the optimal subsidy would equalize the private and social returns to R&D investments at the level of R&D spending that engenders the highest possible social welfare. The R&E tax credit would play such a role if its average incentive effect were large enough to bridge the gap between the private and social returns to R&D. So one important policy issue raised by the credit is whether its average weighted incentive effect is capable of elevating business R&D investment to a socially optimal level.

Ideally, the R&E tax credit would be available only for R&D projects with social returns in excess of their private returns. Unfortunately, such a targeted use of the credit is not feasible for two reasons. First, it is very difficult to measure accurately the social returns to R&D; second, it is impossible to know in advance which business R&D expenditures will produce greater social returns than private returns. In reality, the credit is available for all qualified business research, regardless of its social returns. As a result, there is no barrier to firms claiming R&E tax credits for R&D projects with private rates of return that exceed social rates of return. This limitation of the credit as an R&D subsidy raises another important policy issue: if an aim of federal R&D policy is to stimulate investment in R&D projects with substantial spillover effects, and assuming that public R&D spending does not displace private R&D spending, would targeted government spending on R&D be more effective than tax subsidies in accomplishing this goal?

Design of the R&E Tax Credit

Under IRC section 41, the R&E tax credit actually comprises three separate and distinct credits: a regular credit, an alternative incremental credit, and a basic research credit. They are alike in that each applies only to qualified research spending above a base amount. Yet, as is discussed in detail below, they can differ considerably in their marginal value to firms paying for such research. Furthermore, the R&E tax credit is part of the general business credit (IRC section 38) and thus subject to its restrictions. Firms that earn R&E credits in a particular tax year but cannot use them because of these restrictions or because they lacked taxable income may carry the unused credits back up to three years or forward up to fifteen years. The congressional Joint Committee on Taxation estimates that in FY1999 the three credits combined cost the U.S. government $1.6 billion in foregone tax revenues.[8]

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[7](...continued)
than twice the average private rate of return for a host of important industrial innovations: 56% versus 25%. See Mansfield, Edwin. "Microeconomics of Technological Innovation." *The Positive Sum Strategy: Harnessing Technology for Economic Growth.* Ralph Landau and Nathan Rosenberg, eds. Washington, National Academy Press, 1986. P. 307-325.

[8]U.S. Congress. Joint Committee on Taxation. *Estimates of Federal Tax Expenditures for* (continued...)

Regular R&E Tax Credit

The regular R&E tax credit is equal to 20% of a firm's qualified research spending above a base amount. Such an incremental design is intended to give firms a robust financial incentive to spend more on R&D than they otherwise would, thereby shrinking the gap between actual and socially desirable levels of business R&D investment. The base amount is supposed to approximate a firm's normal R&D expenditures.

Calculating the base amount entails a series of steps, and the formula is different for established firms and startup firms. For an established firm, which is defined as a firm with taxable income and qualified research expenses in three of the years from 1984 to 1988, the base amount equals the product of its fixed-base percentage and its average annual gross receipts in the four previous tax years. An established firm's fixed-base percentage is its ratio of total qualified research spending to total gross receipts between 1984 and 1988 – or its research intensity in that period. (See table 1 for a sample calculation of the regular R&E tax credit for an established firm.)

For a startup firm, which is defined as either a firm with fewer than three years of taxable income and qualified research expenses from 1984 to 1988 or a firm whose first year with taxable income and qualified research expenses was 1984 or later, the base amount is determined in the same manner but with one significant difference. Its fixed-base percentage is fixed at 3% during the firm's first five years with taxable income and qualified research expenses after 1993; at the end of that period, the percentage shifts gradually so that by the eleventh year with taxable income and qualified research expenses after 1993 it equals the ratio of qualified research spending to gross receipts in five of the previous six tax years chosen by the firm. A consequential effect of the 3% rule is that it increases the odds that a small fledgling firm will be able to claim the credit in a period when it is vulnerable to failure or cash flow problems. (See table 2 for a sample calculation of the regular R&E tax credit for a startup firm.)

Two rules for determining the base amount have a significant influence the credit's maximum marginal effective rate. One is that the base amount must equal 50% or more of a firm's qualified research spending in the current tax year; hereafter this rule will be referred to as the 50-percent rule. And the second rule is that a firm's fixed-base percentage cannot exceed 16%. The impact of these rules on the maximum marginal effective rate of the credit is discussed below.

As a general rule, a firm can claim the regular R&E tax credit only if its ratio of qualified research expenses in the current tax year to its average annual gross receipts in the past four tax years is greater than its fixed-base percentage. This holds true regardless of how much more a firm spends on qualified research in the current tax year than in the base period. In the sample calculation of the regular credit shown in table 1, the established firm's research intensity in its base period was 4%, but it rose

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[8](...continued)
Fiscal Years 1999-2003 (JCS-7-98) . Washington, December 14, 1998. P. 15.

to 5% in the period from 1994 to 1998. Thus, one desirable effect of the regular credit is that it encourages firms to become more research-intensive.

Alternative Incremental R&E Tax Credit

Firms performing qualified research may claim an alternative incremental R&E tax credit instead of the regular credit. This option has been available since July 1, 1996. In deciding whether to claim the alternative credit, two considerations are paramount. One is that once a firm claims the alternative credit, it must continue to claim it in succeeding tax years unless it receives permission from the Internal Revenue Service (IRS) to switch to the regular credit. The other important consideration is that the alternative credit consists of three linked rates, and the highest one is much lower than the statutory rate of the regular credit. Specifically, the alternative credit is equal to the sum of 2.65% of a firm's qualified research expenses in excess of 1% but not greater than 1.5% of its average annual gross receipts in the preceding four tax years, and 3.2% of its qualified research expenses in excess of 1.5% but not greater than 2.0% of this same amount, and 3.75% of its qualified research spending that exceeds 2.0% of this same amount. By contrast, the statutory rate of the regular credit is 20%. (See tables 1 and 2 for sample calculations of the alternative incremental R&E tax credit for an established firm and a startup firm.)

In general, a firm can claim the alternative credit if its qualified research expenses in the current tax year exceed 1% of its average gross receipts in the past four tax years. This clearly is the case for the established firm shown in table 1 and the startup firm shown in table 2. Furthermore, firms can expect to benefit more from the alternative credit than the regular credit if their qualified research expenses in the current tax year are only slightly greater than their base amounts under the regular credit. Such is not the case for the established and startup firms depicted in tables 1 and 2. The calculations in the tables prove that both firms would be better off claiming the regular credits.

Table 1. Sample Calculations of the Regular and Alternative Incremental R&E Tax Credits in 1998 for an Established Firm

($ millions)

Year	Gross Receipts	Qualified Research Expenses
1984	100	5
1985	150	8
1986	250	12
1987	400	15
1988	450	16
1989	620	20
1990	700	25
1991	660	35
1992	710	30
1993	800	35
1994	835	45
1995	915	50
1996	1,005	53
1997	1,215	60
1998	1,465	70
Calculation: **Regular R&E Tax Credit**		
Compute the fixed-base percentage:		
1. Sum the qualified research expenses for 1984 to 1988: $56 million		
2. Sum the gross receipts for 1984 to 1988: $1,350 million		
3. Divide the total qualified research expenses by the total gross receipts to determine the fixed-base percentage: 4.0%		
Compute the base amount for 1998:		
1. Calculate the average annual gross receipts for the 4 previous years (1994-1997): $992.5 million		
2. Multiply this average by the fixed-base percentage to determine the base amount: $39.7 million		
Compute the regular tax credit for 1998:		
1. Begin with the qualified research expenses for 1998 of $70 million and subtract the base amount ($39.7 million) or 50% of the qualified research expenses for 1998 ($35 million), whichever is greater: $30.3 million		
2. Multiply this amount by 20% to determine the regular R&E tax credit for 1998: **$6.06 million**		
Calculation: Alternative Incremental R&E Tax Credit		
1. Calculate the average annual gross receipts for the 4 previous years (1994-1997): $992.5 million		
2. Multiply this amount by 1% and 1.5% and 2%: $9.925 million, $14.887 million, and $19.850 million		
3. Begin with the qualified research expenses for 1998 ($70 million) and subtract 1% and 1.5% and 2% (respectively) of the average annual gross receipts for 1994 to 1997: $60.075 million, $55.113 million, and $50.150 million		
4. Multiply the difference between $60.075 million and $55.113 million by 0.0265: $0.131 million		
5. Multiply the difference between $55.113 and $50.150 by 0.032: $0.159 million		
6. Multiply $50.150 million by 0.0375: $1.881 million		
7. Sum the totals from steps 4, 5, and 6 to determine the alternative incremental R&E tax credit: **$2.17 million**		

Source: Congressional Research Service

Table 2. Sample Calculations of the Regular and Alternative Incremental R&E Tax Credits in 1998 for a Startup Firm

($ millions)

Year	Gross Receipts	Qualified Research Expenses
1990	30	35
1991	42	40
1992	56	48
1993	60	55
1994	210	65
1995	305	73
1996	400	82
1997	475	90
1998	600	105
Calculation: Regular R&E Tax Credit		
Compute the fixed-base percentage:		
1. By definition, the firm is a startup. And according to current law, a startup firm's fixed-base percentage is fixed at 3% for each of the 5 years after 1993 when it has both gross receipts and qualified research expenses. Thus, the fixed-base percentage for 1998 is 3%.		
Compute the base amount for 1998:		
1. Calculate the average annual receipts for the 4 previous years (1994-1997): $347.5 million		
2. Multiply this amount by the fixed-base percentage to determine the base amount: $10.4 million		
Compute the regular tax credit:		
1. Begin with the qualified research expenses for 1998 ($105 million) and subtract the base amount ($10.4 million) or 50% of the qualified research expenses for 1998 ($52.5 million), whichever is greater: $52.5 million		
2. Multiply this amount by 20% to determine the regular R&E tax credit for 1998: **$10.5 million**		
Calculation: Alternative Incremental R&E Tax Credit		
1. Calculate the average annual gross receipts for the 4 previous years (1994-1997): $347.5 million		
2. Multiply this amount by 1%, 1.5% and 2%: $3.475 million, $5.212 million, and $6.950 million		
3. Begin with the qualified research expenses for 1998 ($105 million) and subtract 1.0%, 1.5%, and 2.0% (respectively) of the average annual gross receipts for 1994 to 1997: $101.525 million, $99.788 million, and $98.05 million		
4. Multiply the difference between $101.525 million and $99.788 million by 0.0265: $0.046 million		
5. Multiply the difference between $99.788 million and $98.05 million by 0.032: $0.056 million		
6. Multiply $98.05 million by 0.0375: $3.779 million		
7. Sum the totals from steps 4, 5, and 6 to determine the alternative incremental R&E tax credit: **$3.78 million**		

Source: Congressional Research Service

Definition of Qualified Research Expenses

The preceding discussion makes clear that a crucial consideration in claiming the regular or alternative R&E tax credits is the definition of qualified research. Under IRC section 41(d), research expenses must satisfy three criteria in order to qualify for the credit. First, the expenses must relate to activities that can be expensed under IRC section 174. That section allows a firm to deduct expenses it incurs in performing research in the "experimental or laboratory sense" related to its business in the year they are incurred, or to amortize them over a period of sixty months. Qualified research under section 174 includes the development of a new product or process or the improvement of an existing one. Second, the expenses eligible for the R&E tax credit must pertain to research undertaken to discover information that is

"technological in nature" and useful in the development of a new or improved "business component," which is defined as a product, process, computer software, technique, formula or invention that is to be sold, leased, licensed or used by the firm performing the research. And third, the expenses eligible for the R&E tax credit must relate to activities that make up a process of experimentation whose ultimate aim is the development of a business component with "a new or improved function, performance or reliability or quality."

Section 41(d) also specifies that certain research activities do not qualify for the R&E tax credit. Arguably, it is more concrete about activities that do not qualify than those that do. At any rate, firms may not claim the credit for expenses incurred in the following activities:

- research whose aim is to alter the style or appearance of a business component;
- research done after the start of commercial production of a new or improved business component;
- research done to adapt a business component to a specific customer's needs;
- research done to duplicate an existing business component -- a practice known as reverse engineering;
- surveys or studies related to market research, management techniques, data collection, or testing and inspection for quality control;
- the development of computer software for internal use (with some exceptions);
- research conducted outside the United States, Puerto Rico, or a U.S. possession;
- research in the "social sciences, arts, or humanities;" and
- research funded by a grant.

Moreover, not all expenses incurred in qualified research are eligible for the credit. Under section 41, qualified research expenses cover the wages and salaries of employees engaged in qualified research, the costs of materials and supplies used in qualified research, rented or leased computer time used in qualified research, 75% of payments for qualified research performed by nonprofit scientific research organizations that are not private foundations, and 65% of payments for qualified research performed by certain other organizations. The credit does not apply to the following expenses: equipment and structures used in qualified research; the overhead related to this research, including utility costs, rent, leasing fees, administrative and insurance costs, and property taxes; and the fringe benefits of employees engaged in qualified research. While firms can deduct these expenses from their taxable income, their exclusion from the calculation of the credit can diminish its incentive effect. A recent study indicates that qualified research expenses account for anywhere from 50% to 73% of total business R&D spending as defined under current financial accounting standards.[9]

In spite of its critical role in the use and incentive effect of the R&E tax credit, the definition of qualified research has been criticized for a lack of clarity about the

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[9]Hall, Bronwyn H. and John van Reenen. *"How Effective Are Fiscal Incentives for R&D? A Review of the Evidence."* Working Paper 7098. Cambridge, MA, National Bureau for Economic Research, April 1999. P. 22.

kinds of activities that qualify for the credit. The three-part test for eligible research notwithstanding, current law and relevant IRS regulations provide little or no guidance on such key questions as how to determine if a specific research project discovers information that is "technological in nature," or how to determine if a project is part of "a process of experimentation for the purpose of (developing)....a new or improved function, or performance, or reliability or quality."

The Congress and IRS have taken some steps to clarify the boundaries of qualified research, but the issue remains a source of controversy and uncertainty within the private sector. The Tax Reform Act of 1986 mandated that the Treasury Department issue regulations clarifying the research that qualifies for the credit. In 1989, the IRS issued final regulations for research performed between 1981 and 1986. However, it has yet to do the same for research undertaken after 1986. In December 1998, the IRS issued proposed regulations (REG-105170-97) on the definition of qualified research under section 41(d). In particular, it proposed that research would meet the discovery test "only if the research activities are undertaken to obtain knowledge that exceeds, expands, or refines the common knowledge of skilled professionals in the particular field of technology or science and the process of experimentation utilized fundamentally relies on principles of physical or biological sciences, engineering, or computer science." The IRS further proposed that "the credit may be available where the technological advance sought by the taxpayer is evolutionary, and, in certain circumstances, where the taxpayer is not the first to achieve the same advance, ...and regardless of whether the taxpayer succeeds or fails in achieving the desired advance." But final action on these proposals is still pending. At a public hearing on the proposed regulations held by the IRS in late April 1999, several members of the business community voiced a variety of concerns about them and urged the IRS to reconsider much of its proposal.[10] The IRS is mulling over the criticisms, but it is not clear when final regulations will be issued.

Credit for Basic Research

In addition to the regular or alternative incremental R&E tax credit, firms may claim a tax credit for payments to certain organizations that perform basic research. The basic research credit is intended in part to foster close collaboration between the private sector and research universities. The credit is equal to 20% of basic research payments over a base amount. Basic research payments that are less than or equal to the base amount may be included in the research expenses eligible for the regular or alternative credits. IRC section 41(e) defines basic research as "any original investigation for the advancement of scientific knowledge not having a specific commercial objective." The credit does not apply to basic research performed outside the United States, or to basic research in the "social sciences, arts, or humanities." For basic research expenditures to be eligible for the credit, the research must be performed by the following organizations: educational institutions, nonprofit scientific research organizations that are not private foundations, and certain grant organizations.

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[10]Stratton, Sheryl and Barton Massey. "Major Changes to Research Credit Rules Sought at IRS Reg Hearing." *Tax Notes*, May 3, 1999. P. 623-625.

Determining the base amount for the basic research credit is a complicated procedure. A firm's base period is the three tax years preceding the first year in which it recorded taxable income after 1983. And a firm's base amount is equal to the sum of its "minimum basic research amount" and its "maintenance-of-effort amount" in the base period. The minimum basic research amount is equal to the greater of 1% of a firm's average annual in-house and contract research expenses during the base period, or 1% of its total contract research expenses during the base period; and a firm's minimum basic research amount must equal 50% or more of its basic research payments in the current tax year. The maintenance-of-effort amount is the difference between a firm's donations in the current tax year to qualified organizations (e.g., universities) for purposes other than basic research and its average annual donations to the same organizations during the base period for the same purposes, multiplied by the cost-of-living adjustment for the current tax year.

Expensing Allowance for Research Expenditures

As noted above, under IRC section 174, firms engaging in R&D may deduct their qualified research expenses from taxable income in the year when they are incurred, or they may amortize the expenses over 60 months. Without such a provision, firms would be required to recover their R&D expenses through depreciation allowances that reflect the economic lives of the assets created through the R&D; in the case of patents acquired by a firm, that period would encompass the twenty years after a patent is filed. The expensing allowance was enacted in 1954, and, unlike the R&E tax credit, it benefits nearly every firm that conducts R&D. The allowance applies to all R&D costs except the structures and equipment used in R&D; the costs of R&D equipment must be recovered over three years and those of R&D buildings over fifteen years at the rates permitted under current depreciation schedules. Expensing represents a significant R&D subsidy because it has the effect of taxing the returns to the share of an R&D investment that is expensed at a marginal effective rate of zero. The congressional Joint Committee on Taxation estimates that in FY1999 the expensing allowance cost the U.S. government $1.9 billion in forgone revenues.[11]

A firm that claims the R&E tax credit must subtract the value of the credit from the R&D expenditures it deducts under section 174. This has the effect of making the credit part of taxable income. Such a basis adjustment diminishes the marginal effective rate of the credit.

The Importance of the R&E Tax Credit Within the Context of Federal R&D Policy

The R&E tax credit is one of many tools employed by the federal government to spur technological innovation. Important direct policy tools include the funding of basic and applied research in a variety of academic disciplines; the protection of

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[11]Joint Committee on Taxation. *Estimates of Federal Tax Expenditures for Fiscal years 1999-2003*. P. 15.

intellectual property rights through patents, copyrights, and trademarks; efforts to facilitate the creation of joint research ventures involving firms and federal research laboratories; and grants for specific technology development projects. In addition, federal policies in the areas of environmental protection, technical standards, procurement, taxation, business regulation, antitrust law, and foreign trade and investment can indirectly shape the domestic climate for technological innovation. Nonetheless, the application of these tools is not always coordinated, and sometimes they appear to work at cross-purposes.[12]

Within the broad spectrum of federal support for R&D, the credit has played a relatively minor role in dollar terms since its inception in July 1981. This can be readily seen by comparing the cost of the credit (measured in equivalent federal outlays) to total federal spending on R&D.[13] In FY 1998, according to estimates by the U.S. Office of Management and Budget, the outlay equivalent of the credit totaled $3.3 billion, or 4.3% of federal R&D outlays that year. From FY 1993 through FY 1997, the outlay equivalent of the credit averaged 2.5% of federal R&D spending.

Incentive Effect of the R&E Tax Credit

The incentive effect of the R&E tax credit denotes the financial incentive it offers firms to spend an additional dollar on R&D. Basically, there are two ways to assess this effect. One is to analyze the credit's impact on the after-tax price of R&D. The credit lowers the cost to firms of performing research beyond their base amounts. This cost reduction presumably induces firms to spend more on qualified research, and the magnitude of the increase hinges on how responsive firms are to declines in the after-tax price of R&D. Another way to assess the credit's incentive effect is to measure its impact on the profitability of business R&D investments. The credit lowers the marginal effective tax rate on the returns to the R&D investments that qualify for it, which is to say that the credit increases the after-tax rate of return on the share of a R&D investment that qualifies for it relative to alternative uses of that capital. In this way, it is meant to encourage firms to invest more in R&D than they otherwise would. So how much of a subsidy to R&D does the credit represent?

Marginal Effective Rate of the Credit

The credit is equal to 20% of a firm's spending on qualified research above its base amount. In reality, however, the marginal effective rate of the credit on R&D

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[12]Congressional Research Service. *Industrial Competitiveness and Technological Advancement: Debate Over Government Policy.* Issue Brief 91132, by Wendy H. Schacht. Washington, February 8, 2000. 14 p.

[13]The outlay equivalent of the R&E tax credit is the federal dollars that would have to be spent to give firms the same after-tax benefits provided by the credit. In effect, it estimates how much the federal government would have to spend to duplicate the added research stimulated by the credit. See Office of Management and the Budget. *Budget of the United States Government, Fiscal year 2000: Analytical Perspectives.* Washington, U.S. Govt. Print. Off., 1999. P. 116-117.

expenditures above this amount turns out to be much lower than 20%. This reduction is due largely to three rules governing the use of the credit.

One such rule is the requirement that any credit must be subtracted from the research outlays that are expensed; hereafter this rule will be referred to as the basis adjustment. It has the effect of taxing the credit at a firm's statutory income tax rate. As most corporate income is taxed at a rate of 35%, this adjustment reduces the maximum marginal effective rate of the credit for many firms from 20% to 13% (20% x [1-.35]). Essentially, the basis adjustment treats the credit as a price reduction for a portion of research expenses. As a result, the value of the credit cannot be deducted.

Another rule that can dilute the marginal effective rate of the credit was mentioned earlier: the 50-percent rule. Under this rule, a firm's base amount cannot be less than 50% of its qualified research expenses in the current tax year. For a firm whose current spending on R&D relative to gross income (i.e., its research intensity) is more than double its fixed-based percentage, which is equivalent to its base-period research intensity, this rule further lowers the top marginal effective rate of any credit it can claim to 6.5% (and the price reduction for research above the base amount from 20% to 10%).

And further diminishing the incentive effect of the credit is a rule that excludes the cost of R&D equipment, structures, and overhead (including the fringe benefits of R&D personnel) from qualified research expenses. How this exclusion affects the credit's marginal effective rate depends on the share of an R&D investment that is ineligible for the credit.

A firm's past R&D investments can also diminish the incentive effect of the R&E tax credit, although this feedback effect is likely to be very small in most instances. To the extent a firm's current R&D investments boost its future gross receipts by making it more competitive in domestic or foreign markets, they could set the stage for smaller R&E tax credits in the future. Such a scenario would materialize if a firm's current R&D projects eventually lead to increased gross receipts in a future period, and if the added receipts boost the firm's base amounts for the calculation of the R&E tax credit, and if the firm's spending on qualified research grows at a slower rate than its gross receipts between the present and that future period. The likely outcome would be that the firm ends up claiming smaller credits because of past research successes. Although such a feedback effect would make it harder over time for a firm to claim the credit, the effect is smaller than it was under the original credit, which was revised in 1989 mainly to remedy this problem.[14]

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[14]The original credit, which was enacted as a temporary provision of the Economic Recovery Tax Act of 1981, was equal to 25% of the amount by which spending on qualified research in the current tax year exceeded average qualified research expenditures in the previous three years. Shortly after the credit went into effect in July 1981, its formula became a target of criticism. A key problem with the formula, in the view of analysts who studied it, was that it tended to undercut the incentive effect of the credit over time. This stemmed from the use of a moving base that depended in part on a firm's current spending on qualified research. For example, if a firm raised its spending on qualified research by $100 in 1983, it not only earned

(continued...)

The marginal effective rate of the credit is equivalent to the reduction in the after-tax price of an additional dollar of qualified research. Once the rate has been determined, all that is needed to estimate the additional R&D stimulated by the credit is a measure of the tax price elasticity of R&D. This elasticity shows the percentage change in R&D spending that would result from a 1% decrease in the price of R&D. Available studies that attempt to estimate the tax price elasticity for R&D come to basically the same conclusion: the tax price elasticity of U.S. R&D spending during the 1980s was around unity (1.0), maybe higher.[15] To estimate the R&D spending induced by the credit, all that is necessary is to multiply the estimated elasticity by the weighted average marginal effective rate of the credit. Assuming that the current tax price elasticity of R&D is unity, it is possible that the credit raises business R&D investment somewhere between 10% and 20%. But considering that the price responsiveness of R&D demand is unlikely to remain constant over long periods, such an estimate may be far off the mark in 2000.

Effect of the Credit on After-Tax Returns on Business R&D Investments

The incentive effect of the credit can also be analyzed from the perspective of its impact on the returns to business R&D investments. As Bill Cox of CRS made clear in a 1995 report, this impact depends on three factors: (1) the share of an R&D investment that qualifies for the credit; (2) the economic life of the technology assets created by the investment; and (3) the marginal effective tax rate on the income earned from these assets. In essence, the decision to invest in the creation of new technical knowledge or knowhow is an investment decision entailing the expenditure of funds in the present to create intangible economic assets that might yield profits sometime in the future. As with any investment decision, the decision to invest in R&D should be based in part on the user cost of capital, which is the amount needed to return the amount invested in an asset and pay a competitive return on that capital. Part of the user cost of capital is the income taxes paid on the returns to the intangible assets created through R&D, less depreciation allowances and credits. In effect, the R&E tax credit raises after-tax returns on the shares of R&D investments that qualify for it by reducing the user cost of capital. A key question is by how much does it reduce this cost.

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[14](...continued)
a tax credit of $25 for that year but it also increased its base amount for the credit by $33.33 in each of the next three years, thereby reducing the maximum credit it could earn in that period by a total of $25 ([$33.33 x 0.25] x 3).

Congress attempted to eliminate this flaw in the design of the credit by passing the Omnibus Budget Reconciliation Act of 1989 (OBRA89). Among other things, the Act altered the formula for calculating the credit so that the base amount was independent of a firm's current R&D spending. It established the current formula where a firm's base amount is equal to a product of its fixed-base percentage and its average annual gross income in the previous four years.

[15]Hall, Bronwyn H. *How Effective Are Fiscal Incentives for R&D? A Review of the Evidence.* P. 21.

In his 1995 report, Cox estimated the effects of the two main tax preferences for R&D – the R&E tax credit and the expensing allowance for qualified research expenditures – on the rates of return for a host of hypothetical research projects. He divided the projects into three groups based on the share of each project's total cost accounted for by depreciable structures and equipment: capital-intensive projects (50% of outlays), intermediate projects (30% of outlays), and labor-intensive projects (15% of outlays). In addition, the groups differed in the share of outlays that qualified for both expensing and the credit: 35% in the case of capital-intensive projects; 50% in the case of intermediate projects; and 65% in the case of labor-intensive projects. And within each group, Cox assumed that the economic lives of the technology assets produced by the projects lasted three, five, ten, or twenty years.

In Cox's analysis, the impact of the credit can be inferred from the difference between the ratios of after-tax returns to pre-tax returns for the projects under expensing alone and under both expensing and the credit. As one would expect, he found that the credit augmented the effect of expensing on the returns to the shares of R&D investments that qualified for both tax subsidies. In the case of capital-intensive projects, the weighted average ratio under expensing alone was 91.3% for all economic lives; when the credit was included, the weighted average ratio rose for all economic lives, ranging from 101.0% for projects with 20-year economic lives to 106.0% for projects with 3-year economic lives.[16] For intermediate projects, Cox estimated that under expensing alone the weighted average ratio of after-tax returns to pre-tax returns was 94.8%, regardless of the economic life of the project; but under both expensing and the credit, the weighted average ratio was higher for all economic lives, ranging from 108.7% for projects with 20-year economic lives to 115.8% for projects with 3-year economic lives. And for labor-intensive projects, the ratio under expensing alone was 97.4% for all economic lives, but the inclusion of the credit again increased the ratios for all economic lives, ranging from 115.5% for projects with 20-year economic lives to 124.7% for projects with 3-year economic lives. In short, the R&E tax credit boosted the after-tax returns relative to pre-tax returns for all hypothetical R&D projects by margins ranging from 11% for 20-year capital-intensive projects to 28% for 3-year labor-intensive projects.

What do these striking results say about the credit's incentive effect? The optimal R&D subsidy strives to increase the returns to R&D investments that firms would not make without the subsidy. Furthermore, in theory, the optimal R&D subsidy equalizes the private and social returns on these additional R&D investments. If the subsidy is delivered through the tax code, then the focus of concern necessarily shifts to after-tax returns to R&D investments. The optimal R&D tax subsidy would try to elevate after-tax returns to R&D investments beyond what firms would undertake without the subsidy to the levels that would result from taxing the social returns to R&D at the same rate. For example, let us assume that the average pre-tax social return to R&D is double the average pre-tax private return, as a number of studies have suggested. Then at a corporate tax rate of 35%, the optimal R&D tax subsidy would seek to raise after-tax returns to business R&D investments to 130%

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[16]For a summary of Cox's estimates of the effects of expensing and the R&E tax credit on the rates of return to R&D investments, see Cox, William A. *Tax Preferences for Research and Experimentation: Are Changes Needed?* Table 1 (p. 15) and the Appendix (p. 33).

of the pre-tax returns. Because after-tax returns would be 65% of the pre-tax returns without the tax subsidy, the optimal tax subsidy would attempt to boost after-tax returns to a level that is double pre-tax returns.

In Cox's analysis, the two tax subsidies had the largest impact on labor-intensive R&D projects yielding technology assets with a 3-year economic life. Specifically, they boosted after-tax returns to 124.7% of pre-tax returns in the case of the median project. (Without the R&E credit, after-tax returns were less than pre-tax returns by 2.6%.) By contrast, the two tax subsidies had the smallest impact on capital-intensive projects with a 20-year economic life: they raised after-tax returns to 101% of pre-tax returns. These results suggest that even in the best of circumstances, the current R&E tax credit may not be large enough to bridge the gap between after-tax private and social returns to business R&D investments. At the same time, because the social returns to R&D that qualifies for the credit cannot be known when the credits are claimed, it is unclear by how much the marginal effective rate of the credit should be increased. What is clear is that the credit confers varying marginal benefits on R&D projects, and, more specifically, it might provide excessive subsidies to projects with below-average external benefits and inadequate subsidies to projects with above-average external benefits.

Effectiveness of the R&E Tax Credit

An issue separate from the incentive effect of the R&E tax credit is its effectiveness. The credit's effectiveness signifies its efficacy in raising business R&D investment in a way that enhances economic welfare relative to alternative uses of the capital. Ideally, the credit's effectiveness would be assessed by comparing the social benefits from the added R&D stimulated by the credit with the social opportunity costs of the tax revenue forgone because of the credit. Under such an approach, the credit would be deemed effective if the social benefits arising from the R&D stimulated by credit outweigh the social benefits arising from alternative uses (e.g., increased federal spending on defense, education, or health care) of the revenue cost of the credit. However, no such analysis appears to have been done, and it is unlikely that one ever will be undertaken because of the formidable difficulties in measuring the social returns to R&D. Among the main difficulties are coming up with adequate price indexes for the cost components of R&D in different industries, establishing a reasonable time frame for measuring the productivity gains from R&D, and devising reasonable measures of the rate of depreciation for R&D capital stocks.[17]

Consequently, some analysts have focused on a more limited and manageable objective: estimating the amount of research expenditures induced by one dollar of the credit, or the credit's cost-effectiveness. Such an approach implicitly assumes that the spillover benefits of R&D are large enough to justify a subsidy such as the R&E tax credit. The central policy issues tackled by this approach are whether the current R&E tax credit is a cost-effective R&D subsidy, and whether other policy tools (e.g.,

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[17]Office of Technology Assessment. *The Effectiveness of Research and Experimentation Tax Credits.* P. 21-22.

government funding or performance of R&D) could spur the same increase in R&D investment at a lower cost.

What do existing studies reveal about the cost-effectiveness of the R&E tax credit? For policymakers, the most useful studies are those that use industry data from 1985 and after to analyze the responsiveness of business R&D spending to the decrease in the tax price of research caused by the credit.[18] On the whole, those studies concluded that from the mid-1980s to the early 1990s, firms responded to the credit by raising their R&D spending between one and two dollars for every dollar of the credit claimed.[19] While these studies have flaws that limit their reliability, they do suggest that the current credit can be considered a cost-effective policy tool for boosting business R&D investments.[20] For instance, assuming that the one dollar of the credit generated one additional dollar of business R&D spending in 1996, the most recent year for which detailed corporate income tax return data are available, the credit may have raised business R&D investment by as much as $2.2 billion in that year. Assuming this estimate is reasonable, then it can be maintained that the credit was responsible for about 2% of U.S. business R&D spending in 1996, which totaled an estimated $121 billion.

Policy Issues Raised by the Credit

In the minds of most economists, the R&E tax credit can be justified on economic grounds. Moreover, available evidence suggests that it is capable of boosting business R&D investment in a cost-effective manner. But this is not to imply that, in its current state, it is an ideal policy instrument, or that it sparks no controversy. Some believe that it should be reduced or eliminated on principle. And supporters of the credit find fault with it for the following reasons: 1) its lack of permanence; 2) its weak and uneven incentive effect across the range of R&D projects and across firms performing qualified research; 3) its ambiguous definition of qualified research; and 4) its relative efficiency in boosting business R&D investment. Each policy issue is discussed in detail below.

Lack of Permanence

The R&E tax credit, which recently was extended from July 1, 1999 to June 30, 2004, has never been a permanent fixture of the federal tax code. In the view of some

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[18]For a summary of these studies, see Office of Technology Assessment. *The Effectiveness of Research and Experimentation Tax Credits.* P. 28.

[19]See Hall, Bronwyn H. and John van Reenen. *How Effective Are Fiscal Incentives for R&D? A Review of the Evidence.* NBER Working Paper No. 7098. Cambridge, MA, National Bureau of Economic Research, April 1999; Coopers & Lybrand L.L.P. *Economic Benefits of the R&D Tax Credit.* Washington, January 1998. P. 15-16; and Office of Technology Assessment. *The Effectiveness of Research and Experimentation Tax Credits.* Table 3, p. 28.

[20]Office of Technology Assessment. *The Effectiveness of Research and Experimentation Tax Credits.* P. 29-30.

analysts, this lack of permanence limits the credit's efficacy because it subtly encourages business managers to ignore or downplay the credit when considering whether (or by how much) to expand their R&D budgets.

Basically, there are two reasons for this subtle effect. One is that uncertainty about future tax policy toward R&D compounds the uncertainty that inevitably surrounds the expected returns on prospective R&D projects, and this heightened uncertainty may deter business managers from pursuing R&D projects that they would pursue if they could count on the credit being available in three, five, ten or fifteen years. A second reason is the high adjustment costs that R&D entails. In general, adjustment costs are the hidden costs firms confront when they alter their output in response to temporary conditions. In the case of R&D, the adjustment costs become a pressing managerial issue when R&D budgets are cut. A substantial share of the typical business R&D budget is composed of the wages and salaries of R&D personnel. For the most part, these employees are costly to train and difficult to replace when they resign or are let go. Moreover, R&D scientists and engineers represent valuable assets for their employers largely because of the specialized knowledge and knowhow they possess. When a group of them leaves one firm and is hired by another or forms a competing firm, they unavoidably transfer their knowledge and knowhow to their new employers. Technology transfers of this sort could end up benefitting the new employers or firms at the expense of the former employers.[21] Adjustment costs such as these make firms reluctant to cut their R&D budgets during periods of declining or stagnant revenues. By the same token, the adjustment costs associated with R&D may be large enough to deter business managers from undertaking R&D projects that are expected to earn acceptable after-tax rates of return in the presence of the R&E tax credit but carry a significant risk of earning unacceptable after-tax rates of return if the credit were to expire and not be renewed at some future date.

These considerations suggest that permanently extending the credit could make it a more effective policy instrument for boosting business R&D investment.

Inadequate and Uneven Incentive Effect Among Firms and R&D Projects

Another key policy issue raised by the current R&E tax credit is its apparently inadequate (or suboptimal) and uneven incentive effect among firms performing qualified research and among qualified research projects. In this context, an *inadequate* incentive effect denotes a marginal benefit from the credit that is less than the amount that would be needed to boost business R&D investment to levels warranted by its potential spillover benefits; by contrast, an *uneven* incentive effect signifies a marginal benefit from the credit that varies from one firm to the next or from one R&D project to the next, with no clear economic justification for the variation.

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[21]Himmelberg, Charles P. and Bruce C. Peterson. "R&D and Internal Finance: Panel Study of Small Firms in High-Tech Industries." *The Review of Economics and Statistics,* February 1994, p. 41.

As was noted earlier, the optimal R&D tax subsidy would seek to elevate the real after-tax private returns to R&D investments to the levels that would result from taxing their real social returns at the same rate. Some studies have indicated that the median private rate of return on business R&D is about one-half the median social rate of return.[22] Assuming this estimate is correct, then, in theory, the optimal R&D tax subsidy might seek to double after-tax private rates of return to business R&D investments in the absence of a subsidy. Because most corporate income is taxed at a rate of 35%, the optimal R&D tax subsidy would arguably try to increase after-tax private returns to a level equal to 130% of pre-tax returns [2 X (1-.35)]; without the subsidy, after-tax returns would equal 65% of pre-tax returns. It is likely, however, that the relationship between private and social returns varies markedly among R&D projects. This implies that a subsidy rate that is optimal for projects with average spillover benefits would end up oversubsidizing projects with below-average spillovers and undersubsidizing projects with above-average spillovers. At any rate, as Cox suggested in a 1995 study discussed earlier, a R&D tax subsidy rate of 130% of pre-tax private returns might offer policymakers a reasonable standard for evaluating the efficiency effects of current R&D tax subsidies.

Cox discovered in the 1995 study cited earlier that the weighted average ratios of after-tax returns to pre-tax returns under the expensing allowance and the R&E tax credit for the hypothetical R&D projects he examined ranged from 101% for capital-intensive projects yielding technology assets with a 20-year economic life to 124.7% for labor-intensive projects yielding technology assets with a 3-year economic life. This result raised the possibility that the combined effect of current R&D tax subsidies was insufficient to raise business R&D investment to levels commensurate with its potential social benefits. It also raised the possibility that an increase in the maximum marginal effective rate of the R&E tax credit may be justified on economic grounds. How much the credit rate should be increased was not clear from Cox's analysis.

That the R&E tax credit's incentive effect varies among firms performing qualified research in ways that cannot be justified on economic grounds is evident from another CRS report by Bill Cox, this one issued in 1996. Using data on net income and R&D spending reported to the Securities and Exchange Commission by publicly traded companies, Cox estimated the number of companies from a sample of about 900 U.S.-based companies with research budgets ranging from the gargantuan to the lilliputian that could claim the R&E tax credit in 1994. He found that 78% of the firms in the sample could claim the credit. And of those, he found that 56% received credits with a maximum effective rate of 6.5% and the remaining 44% received credits with a maximum effective rate of 13%. The firms in the former group had a lower rate because they were subject to the 50-percent rule. Furthermore, his analysis showed that some of the most research-intensive firms could claim either no credit or a credit with a maximum effective rate that was half as large as the rate received by firms with lower research intensities. These results were not surprising in light of the design of the credit, which gives firms a significant financial incentive to spend more on research relative to sales in the present than in their base periods.

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[22]See, for example, Mansfield, Edwin. "Microeconomics of Technological Innovation." *The Positive Sum Strategy,* edited by Ralph Landau and Nathan Rosenberg. Washington, National Academy Press, 1986. P. 309-311.

In practice, the credit rewards firms whose research intensity has grown since their base periods, but it may offer no rewards to firms whose research-intensities have stagnated or declined since their base periods. Such a haphazard and seemingly arbitrary pattern of subsidization cannot be defended on the grounds of economic efficiency because there is no evidence linking a firm's research intensity to the social returns to its R&D investments. Suggested remedies include abolishing or relaxing the 50-percent rule, making the credit refundable – especially for firms that are having difficulty raising funds in debt and equity markets – establishing a moving base period, and permitting all expenses related to qualified research (including overhead and capital expenditures) to qualify for the credit.

Ambiguous Definition of Qualified Research

Yet another problem with the current R&E tax credit is the current definition of qualified research. The definition is ambiguous to the point that it either deters firms from claiming the credit or compounds the administrative cost of the credit both for firms performing qualified research and for the IRS. In order to qualify for the credit, research expenses must satisfy three criteria: (1) they must relate to activities that are eligible for expensing under IRC section 174; (2) they must also relate to research done to discover information that is "technological in nature" and useful in the development of a new or improved "business component" (i.e., product, process, computer software, technique, formula, or invention); and (3) they must relate to activities that constitute a process of experimentation whose intended aim is the development of a business component with "a new or improved function, performance or reliability or quality." A costly ambiguity enters the picture when executives at firms that want to claim the credit are unsure whether specific research expenses meet the often vague criteria. For example, how is one to determine whether a specific research project passes the discovery test or whether it is part of a "process of experimentation" whose ultimate aim is to develop a product or process with a "new or improved function, or performance, or reliability or quality?" Lingering uncertainty over which research activities qualify for the credit has spawned numerous disputes between the IRS and firms over the amounts of the credit that are claimed. While there are no reliable estimates of the cost to either firms or the IRS of administering the credit, a 1995 report by the Office of Technology Assessment made clear that the legal disputes entail considerable costs for both sides.[23]

Under the Tax Reform Act of 1986, the IRS was given the task of issuing final regulations clarifying the definition of qualified research. In December 1998, the agency issued proposed regulations that have generated considerable comment and criticism from some representatives of the business sector. Given the contentiousness of the definition of research that qualifies for the credit, it is unclear whether the IRS can issue final regulations that will satisfy all concerned parties.

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[23]Office of Technology Assessment. *The Effectiveness of Research and Experimentation Tax Credits.* P. 15 and 17.

Efficiency Effects of the R&E Tax Credit

A chief economic rationale for the R&E tax credit is that firms invest too little in R&D because they cannot appropriate all the returns to it. This raises the question of whether the credit is the most efficient means of elevating business R&D investment to the socially optimal level. The credit, of course, is but one of a variety of direct and indirect policy instruments used by the federal government to support commercial R&D. If it can be shown that one (or more) of these other instruments can boost business R&D spending to the same extent at a lower opportunity cost or of achieving a higher level of business R&D investment at the same opportunity cost, then a case can be made for replacing the credit with the more efficient policy instrument. Unfortunately, there appears to be no body of research that addresses this issue.

In the current state of knowledge, policymakers who must make decisions about the size and composition of federal R&D support are sometimes limited to what is known about the strengths and weaknesses of the alternative R&D policy tools. Most economists concur that this much can be ascertained about the effectiveness of the R&E tax credit and direct federal R&d spending. First, there is some evidence that the credit is as cost-effective as direct government spending on R&D in raising business R&D investment. In other words, one dollar in revenue cost of the credit is thought to raise this investment as much as an additional dollar of federal research grants. One reason for this is that government R&D spending might not crowd out privately financed R&D spending.[24]

Second, government R&D spending and the R&E tax credit both appear to have drawbacks that limit their efficiency. The preceding discussion has made clear that R&E tax credit exerts an uneven incentive effect on R&D projects and on firms performing or financing qualified research; that the credit appears to offer firms too weak an incentive to raise business R&D investment to socially optimal levels; and that the credit cannot be targeted at projects with the highest ratio of social returns to private returns. In addition, some critics contend that the R&E tax credit is a wasteful subsidy because there are no clear guidelines on the research that qualifies for it and this uncertainty can have the effect of rewarding firms for research with no external benefits and research that they would have done in any event.[25] Similarly, it has been pointed out that government R&D spending can have certain effects that may diminish its efficiency effects: 1) a lessening of private-sector competition to develop technologies targeted for government funding; 2) funding decisions that are guided more by political considerations than the potential economic merits of the research; 3) government management of research projects that may lack the flexibility

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[24]Stoneman, Paul. *The Economic Analysis of Technology Policy.* New York, Oxford University Press, 1987. P. 203-204; and David, Paul A., Bronwyn H. Hall and Andrew A. Toole. *Is Public R&D A Complement Or Substitute For Private R&D? A Review of the Econometric Evidence.* Working Paper 7373. Cambridge, MA, National Bureau of Economic Research, October 1999. P.6.

[25]U.S. Congress. House of Representatives. Committee on the Budget. *Unnecessary Business Subsidies.* Hearing, Serial No. 106-5. Washington, U.S. Govt. Print. Off., 1999. Prepared statement of Robert McIntyre, p. 316.

and creativity dictated by the uncertainty inherent in R&D efforts; and 4) the inability of government program managers and politicians to identify research projects with promising spillover benefits.[26]

Third, the two policy instruments differ in their targeting. The R&E tax credit applies to all qualified business research, whereas government research grants can be directed to support particular research efforts, especially those with promising spillover benefits that the private sector is inclined to ignore. Available evidence on the effects of both instruments, however, does not shed light on the question of which instrument is likely to lead to higher levels of economic welfare at the same revenue cost. The analysis of cost and benefit in government R&D policy is fraught with too much uncertainty. One approach would be to stick with the status quo: the federal government currently relies on a variety of policy instruments, including tax incentives and direct research funding, with the aim of creating an economic environment that is conducive to the commercial development and widespread diffusion of new technologies.[27]

Proposals in the 106th Congress to Extend Permanently or Modify the R&E Tax Credit

At the end of the first session, the 106th Congress passed legislation (H.R. 1180, P.L. 106-170) that retroactively extended the R&E tax credit from July 1, 1999 to June 30, 2004. Nevertheless, a number of bills to extend permanently the credit or extend its reach are still pending and could be considered in the second session. The bills are summarized in the following table.

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[26]Cohen, Linda R. and Roger G. Noll. "Research and Development." *Setting Domestic Priorities: What Can Government Do?* Edited by Henry J. Aaron and Charles L. Schultze. Washington, Brookings Institution, 1992. P. 227-228.

[27]For a discussion of the full range of policy instruments that might be employed to create such an environment, see Branscomb, Lewis M. and James H. Keller. "Towards a Research and Innovation Policy." *Investing in Innovation*, edited by Branscomb and Keller. Cambridge, MA, MIT Press, 1998. P. 462-496.

Table 3. Bills in the 106th Congress to Extend or Improve the R&E Tax Credit

Bill Number	Provisions Pertaining to the Credit
H.R. 760, H.R. 835, S. 195, S. 680, S. 1770, and S. 1803	! Permanently extends the credit, as of July 1, 1999.
H.R. 1328	! Establishes a flat 20% credit for payments made to qualified research consortia; ! Defines a qualified research consortium as a non-profit, tax-exempt, scientific research organization that is not a private foundation and has a minimum of fifteen supporting members, no three of whom may account for over 50 % of the total amount received by the organization for scientific research in a year, and no one of whom can account for over 25% of this amount; ! Makes 100% of payments to qualified research consortia eligible for the credit.

H.R. 1682 and S. 951	! Permanently extends the credit as of July 1, 1999; ! Replaces the alternative incremental credit with one that is equal to 20% of the amount by which qualified research expenses exceed the base amount as of January 1, 2000; ! Establishes the following rules for the base amount of the new alternative incremental credit: (a) the fixed-base percentage is equal to 80% of the ratio of aggregate qualified research expenses to aggregate gross receipts in the base period; (b) qualified research expenses may be less than 50% of the base amount; (c) the base period is the eight years preceding the one for which the credit is being claimed, or the period the firm has been in existence if it is less than eight years old; and (d) the gross receipts in any year in the base period for all taxpayers are at least equal to $1 million; ! Makes the following changes to the credit for basic research as of January 1, 2000: (a) credit is equal to 20% of qualified payments; (b) basic research in the social sciences is eligible for the credit; (c) specifies that basic research meets the criterion of not having a "specific commercial objective" if its results are made available to the general public before they are used for commercial purposes; and (d) makes payments for basic research conducted at federal laboratories eligible for the credit; ! Establishes a flat 20% tax credit for 100% of payments to qualified research consortia as of January 1, 2000; ! Redefines a qualified research consortium as a tax-exempt organization that conducts "scientific or engineering research" and that has at least five contributing members or clients, no one of whom can account for more than 50% of the money received by the consortium for scientific or engineering research in a calendar year; ! Directs the Secretary of the Treasury to assist small and startup firms in complying with the requirements for the R&E tax credit, and to reduce their compliance costs; ! Makes 100% of the amount paid to eligible small firms, universities, and federal laboratories for contract research eligible for the credit; ! Creates a flat 20% tax credit for all patent fees paid by small firms in carrying on a trade or business, as of January 1, 2000.

Likely Effects on Business R&D Investment of Selected Proposals in the 106th Congress to Extend or Improve the R&E Tax Credit

While it is difficult to estimate the impact of the bills listed in table 3 on business R&D investment, it is reasonable to expect that each could boost business R&D spending to the extent it enhances the credit's incentive effect. This prospect raises the questions of which bills are likely to do this, and to what extent. The key to answering these important questions lies in the intended purposes of the bills themselves. The purposes indicate how the bills would affect the credit's incentive effect.

On the whole, the bills would achieve one or more of the following aims:

- permanent extension of the credit (H.R. 760, H.R. 835, H.R. 1682, S. 195, S. 680, S. 951, S. 1770, and S. 1803);
- more favorable tax treatment of payments to research consortia (H.R. 1328, H.R. 1682, and S. 951);
- replacement of the current alternative incremental credit with one that offers firms a higher effective credit rate (H.R. 1682 and S. 951);
- more favorable tax treatment of payments for basic research (H.R. 1682 and S. 951); and
- special assistance for smaller firms (H.R. 1682 and S. 951).

Permanent Extension of the Credit

A total of eight bills in the 106th Congress address the credit's temporary status. The longest period that the credit has been in effect without interruption was the five and one-half years from July 1, 1981 to December 31, 1986. Moreover, the credit was extended for one year on four separate occasions; it was extended for thirteen months once, for eleven months once, and for six months once; and the credit has never been available for the period between July 1, 1995 to June 30, 1996. Since the early 1990s, a chief obstacle to making the credit permanent has been the budget rule requiring the federal government to offset the cost of new permanent tax preferences over five consecutive fiscal years.

More Favorable Tax Treatment of Research Consortia

Three bills in the current Congress would liberalize the tax treatment of payments for research performed by joint R&D ventures such as Sematech, the Partnership for a New Generation of Vehicles, and the Advanced Battery Consortium. Under current law, the R&E tax credit applies to *75%* of payments to qualified research consortia for qualified research done on behalf of two or more firms; qualified research consortia are defined as tax-exempt organizations (excluding

private foundations) whose primary purpose is to conduct "scientific research" (IRC section 41(b)(3)(c)). By contrast, the three bills would create a flat 20% credit for the *entire amount* of payments to qualified research consortia for qualified research done on behalf of the firm making the payments. Moreover, H.R. 1328 would alter the definition of a qualified research consortium to specify that it must have a minimum of fifteen supporting members, no one of which can account for over 25% of the consortium's annual research budget; and H.R. 1682 and S. 951 would redefine a qualified research consortium as a tax-exempt organization whose primary purpose is to conduct "scientific or engineering research" and that has at least five supporting members, no one of which can account for over 50% of the annual research budget of the consortium.

The three bills would likely give firms a stronger financial incentive to increase their payments to research consortia. Under current law, the maximum effective rate of the credit for these payments varies from 5% to 10%; but under the three bills, the rate would rise to a flat 20%. Furthermore, because H.R. 1328 would add this incentive while retaining the terms of the regular R&E tax credit, it would give firms a stronger financial incentive to conduct research through research consortia than through their own R&D facilities. Yet it is unclear to what extent firms participating in such consortia would raise their payments to them in response to this enhanced subsidy. The R&E tax credit is one of many factors influencing business R&D investment decisions.

Recent Growth in U.S. Research Consortia.

Data on the amount invested in domestic research consortia are scanty, and what is available sheds little light on the share of U.S. business R&D spending that goes to joint research ventures. Nonetheless, it is clear that since the early 1980s, the number of firms participating in U.S. research consortia and the dollars they have spent on basic and applied research have soared. One indicator of this trend is the number of joint research ventures registered with the U.S. Department of Justice (DOJ) under the National Cooperative Research Act of 1984 and the National Cooperative Production Amendments Act of 1993; by registering, firms joining these ventures gain added protection from antitrust lawsuits. Between 1985 and 1996, a total of 665 joint research ventures were registered, with 212 of the registrations occurring in 1995 and 1996.[28] And as of late 1998, U.S.-based firms had entered into more than 5,000 cooperative R&D agreements (or CRADAs) with federal laboratories under the Federal Technology Transfer Act of 1986.[29]

This growth in cooperative R&D ventures is the product of a number of factors. Worldwide, large and small firms face growing pressure to collaborate with rivals,

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[28]National Science Board. *Science & Engineering Indicators - 1998.* Arlington, VA, national Science foundation, 1998. P. 4-30.

[29]See Library of Congress. Congressional Research Service. *Cooperative Research and Development Agreements (CRADAs).* Report No. 95-150 SPR, by Wendy H. Schacht. Washington, updated November 17, 1998. P. 1; and Congressional Research Service. *R&D Partnerships: Government-Industry Collaboration.* Report 95-499 SPR, by Wendy H. Schacht. Washington, November 17, 1998. 6 p.

suppliers, customers, and national and regional governments in the development of new technologies. This pressure arises from a variety of sources.[30] One is the rapid pace, expanding scope, increasing complexity, and rising cost of technological innovation in many industries. Another factor is the globalization of a wide range of markets and the increased international competition it brings. Yet another factor is the growing demands by consumers and governments in advanced economies that technology development achieve certain social or economic objectives, such as less industrial pollution or improved productivity or increased safety or security in the use of a wide variety of goods and services. In addition, firms can realize significant concrete benefits from participating in research consortia, such as access to expertise and knowledge that otherwise would be unavailable, risk pooling, cost sharing.

Tax Subsidies for Research Consortia and Federal R&D Policy.

The legislative proposals to liberalize the tax treatment of payments to research consortia raise certain policy issues. One concerns the incentive effect of the proposals. Granting firms a flat 20% credit for payments to research consortia could encourage firms to substitute joint research for their own research, leading to no net increase in business R&D investment. Another issue relates to the rationale for federal support for joint research ventures. These ventures can improve the domestic climate for technological innovation by reducing the market failure associated with R&D, cutting the costs of performing generic research with promising commercial potential, and speeding the diffusion of new technologies.[31] Yet the recent proliferation of research consortia involving U.S.-based firms and federal laboratories calls into question the need for additional federal subsidies for such ventures like the tax incentives proposed in H.R. 1682/S. 951. A third policy issue linked to the proposals deals with the economic rationale for federal support for R&D. The expansion of research consortia in the past decade arguably weakens a central economic rationale for federal support for research. If many or all the firms in an industry collaborate in the conduct of R&D, it is possible that most of the returns to that R&D will be appropriated, reducing the need for federal R&D subsidies. Another way to frame this issue is to ask whether industry research consortia partially or fully correct the market failure associated with R&D: the presence of substantial external benefits. The greater the degree of correction, the lesser the justification for federal R&D subsidies. Finally, economic theory indicates that an incremental tax credit would be more efficient that the flat credit contained in the legislative proposals.

Creation of a More Beneficial Alternative Incremental Credit

Identical bills in the House and the Senate (H.R. 1682 and S. 951) would create a new alternative incremental R&E tax credit that is more beneficial at the margin than

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[30]Roos, Daniel, Frank Field, and James Neely. "Industry Consortia." *Investing in Innovation*. Branscomb, Lewis M. and James H. Keller, eds. Cambridge, MA, MIT Press, 1998. P. 401-402.

[31]Cohen, Linda R. and Roger C. Noll. "Research and Development." *Setting Domestic Priorities*, edited by Henry J. Aaron and Charles L. Schultze. Washington, Brookings Institution, 1992. P. 244.

the current R&E tax credit. Under the bills, the calculation of the proposed alternative credit would be the same as the calculation of the current credit, with the following exceptions:

- the base period would be the previous eight tax years, or fewer in the case of firms that have been in existence fewer than eight years;
- the fixed-base percentage would be equal to 80% of the ratio of aggregate qualified research spending to aggregate gross receipts in the base period;
- the base amount could be less than 50% of qualified research expenses in the current tax year; and
- gross receipts for all firms, established and startup, could not fall below $1 million in each year of the base period.

This proposed alternative credit would address several key policy issues raised by the current credit. One was discussed earlier: the current credit subsidizes business R&D in a seemingly arbitrary and inequitable manner. Abolishing the 50-percent rule and permitting firms to select base periods that reflect their current R&D intensity would likely do much to make the credit's marginal effective rate more uniform among firms and industries.

Furthermore, the proposed credit would offer established and startup firms a stronger financial incentive to keep increasing their R&D spending than the current regular or alternative credits. Three aspects of the proposed credit would make it more beneficial at the margin: 1) the absence of the 50-percent rule under current law; 2) the 20% reduction in a firm's fixed-base percentage under current law; and 3) the use of a moving base period. The probable benefits of this enhanced incentive effect can be seen in the calculations given in the appendix, which estimates the R&E tax credits that two actual pharmaceutical firms, Merck and Cephalon, could claim in 1998 under current law and under S. 951/H.R. 1682. Under current law, Merck, a large, established, and perennially hugely profitable pharmaceutical firm, could claim no regular credit and an alternative credit of $39 million in 1998. By contrast, under S. 951/H.R. 1682, Merck could claim an alternative credit of $67 million. Cephalon, a small, startup, biopharmaceutical firm which as of 1998 had never earned a profit, would also be better off under the proposed alternative credit: under current law, it could claim a regular credit of $3 million and an alternative credit of $1 million in 1998; but under S. 951/H.R. 1682, it could claim an alternative credit of $6 million. Another way to illuminate the incentive effect of the proposed alternative credit is to compare the average credit rates for the three R&E tax credits; the average credit rate is defined here as the ratio of the R&E tax credit claimed to R&D spending reported to shareholders. In 1998, the estimated average credit rates for Merck were 0% for the regular R&E tax credit, 2.1% for the alternative incremental R&E tax credit, and 3.7% for the proposed alternative R&E tax credit; and for Cephalon, the same three rates were 7.0%, 2.5%, and 13.7%. The main point to be made here is not to demonstrate that either firm deserves a larger tax credit for the R&D they perform; that issue could be resolved only by estimating and comparing the after-tax private and social rates of return to their R&D investments. Rather, it is to compare the credit's incentive effect under current law and under the two legislative proposals.

More Favorable Tax Treatment of Basic Research Expenses

The same two bills would also make the tax treatment of basic research expenses more favorable. As a result, they would give firms a stronger incentive to conduct basic research. The National Science Foundation estimates that in 1999, firms spent $10.9 billion on basic research conducted in the United States; this amount is 88% more than they spent in 1992 and 27% of all basic research done in the United States in 1999. To encourage firms to spend more on basic research, the bills would replace the current incremental basic research credit with a flat credit that is equal to 20% of qualified basic research expenses. In addition, the bills would make basic research in the social sciences eligible for the credit, loosen the definition of basic research to cover research whose results are made available to the general public before they are used for commercial purposes, and make payments for basic research conducted at federal laboratories eligible for the credit.

The proposed changes in the tax treatment of basic research expenditures raise several policy issues. One is a perceived need for a more generous tax subsidy for business spending on basic research. Proponents of such a subsidy cite recent declines in real business investment in this research to justify their insistence that the federal government take additional steps to encourage firms to invest more in basic research; in support of this argument, they note that the social returns to this research tend to be relatively large. Recent trends in real industry spending on basic research lend inconclusive support to this view: according to figures published by the National Science Foundation, U.S. industry spent 14% less in constant 1992 dollars for this purpose in 1995 ($5.0 billion) than in 1992 ($$5.8 billion), but the trend reversed itself between 1995 and 1998 when industry spending on basic research rose from $5.0 billion to a preliminary $8.6 billion, a gain of 72%.

A second policy issue raised by the proposed enhanced tax subsidy for basic research concerns the impact of a more generous tax subsidy on business investment for this purpose. In the 1990s, a powerful constraint on this investment was an increased managerial emphasis on funding R&D projects that are likely to pay off in three years or less.[32] Arguably, this emphasis had its origins in the demise of the Cold War and the restructuring of major U.S. firms and the rise of formidable foreign competition that began in the late 1980s and continued through most of the 1990s. Nowadays, firms rely heavily on the public and nonprofit sectors to fund basic research, and the basic research they conduct is intended largely to address gaps left over from publicly funded research and further their own product development.[33] Thus, it is doubtful that an enhanced tax incentive like the one proposed in H.R. 1682 and S. 951 would be sufficient to trigger a surge in business spending on basic research.

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[32]Uchitelle, Louis. "Basic Research Is Losing Out As Companies Stress Results." *New York Times*, October 8, 1996, p. B6.

[33]Broad, William J. "Study Finds Public Science Is Pillar Of Industry." *New York Times*, May 13, 1997, p. C1 and C10; and Committee for Economic Development. *America's Basic Research: Prosperity Through Discovery*. New York, 1998. P. 16.

Yet another policy issue is that the proposed liberalized credit for basic research expenses would be flat instead of incremental. An argument against a flat credit is that it is more likely than an incremental one to subsidize research that firms would do in any event. Thus, in the view of many analysts, the more efficient option for giving firms a stronger financial incentive to increase their basic research expenditures is to offer a more generous incremental R&E credit.

Special Assistance for Smaller Firms

Lastly, H.R. 1682 and S. 951 would target special assistance to small firms engaged in research. Specifically, they would require the IRS to find ways to reduce the cost to small firms of complying with the requirements of the R&E tax credit, and they would create a flat 20% tax credit for patent fees paid by small firms. In addition, the bills would give larger firms a tax incentive to enter into research contracts with smaller firms by making the entire amount paid to smaller firms for contract research eligible for the R&E tax credit.

These proposals have unearthed several policy concerns, some of which have long been associated with the issue of tax subsidies for small firms. On the one hand, they raise the question of whether such assistance to smaller firms is justified on economic grounds. Supporters of the two bills contend that the costs associated with applying for patents and complying with the requirements of the R&E tax credit are especially burdensome for smaller firms, and as a result they spend much less on R&D than they otherwise would. This is a serious policy issue, in their minds, because small startup firms are the sources of many valuable technological innovations. Available evidence bearing on this claim appears to be inconclusive.

On the other hand, the proposals give rise to a couple of concerns. One is that they would reward some larger firms for doing what they already do: perform joint research with smaller startup firms. Unless it can be shown that these ventures are likely to yield extraordinarily large spillover benefits, it is difficult to make a cogent economic argument for a more generous tax subsidy for joint research between small and large firms. Another concern is that the proposals fail to address an important financial issue for managers at many small startup firms: they are unable to claim the R&E tax credit during periods when it could substantially boost their cash flow because they are unprofitable and the credit is nonrefundable.

Conclusions

Government support for business R&D can be justified on economic grounds. According to standard economic theory, when firms invest in R&D, the total (or social) returns are likely to far exceed the returns captured by the firms. Because of this discrepancy, firms are likely to invest less in R&D than would be warranted by its economic benefits. Thus, in theory, economic performance is better when firms receive a subsidy that boosts their returns on R&D investments to the level of social returns. Unfortunately, in this case economic theory is a poor guide for policy because of the formidable problems involved in measuring the social returns to R&D.

The federal government supports domestic R&D in a variety of ways, direct and indirect. One indirect subsidy is a tax credit for research and experimentation (R&E). Under IRC section 41, a firm may claim a tax credit equal to 20% of its spending on qualified research above a base amount. The credit has an incremental design largely to give firms a robust financial incentive to spend more on R&D in a given year than they otherwise would, thereby shrinking the gap between actual and socially desirable levels of business R&D investment. For a firm, R&D is essentially an investment decision. This means that a firm is likely to invest in a particular R&D project if its expected real after-tax rate of return exceeds its real cost of capital. The R&E tax credit seeks to stimulate increased business R&D investment by lowering the user cost of capital.

It appears that the R&E tax credit can be a cost-effective instrument for spurring increases in business R&D investment. Several studies have estimated that by the end of the 1980s one dollar of the credit leads firms to raise their spending on R&D by approximately one dollar, maybe more. These results suggest that, dollar for dollar, the credit is as effective as federal research spending programs in boosting business R&D investment.

Nonetheless, although the R&E tax credit apparently has a positive effect on business R&D investment, there is reason to believe that the effect is too modest to generate the level of this investment warranted by its likely economic benefits. In a 1995 CRS report, Bill Cox estimated that the combined effect of the two current R&D tax subsidies, the expensing allowance for research expenditures and the R&E tax credit, on the after-tax returns a variety of hypothetical R&D projects fell short of the level of subsidy needed to achieve an optimal amount of business R&D investment. Nevertheless, his findings provide little guidance for policymakers about how much larger the rate should be. Because the social returns to a particular business R&D project are difficult to estimate and certainly cannot be known in advance, the credit's incentive effect cannot be tailored to specific projects. Even if it were possible to do this, there is no guarantee in advance that a firm can use the R&E tax credits it earns because the credit is not refundable.

The credit exhibits two other problems that limit its effectiveness as a R&D subsidy: a lack of permanence and a variable impact among business R&D projects and firms performing research. The lack of permanence dampens the credit's potential for spurring continuing rises in business R&D investment by increasing the already substantial uncertainty surrounding the expected returns to prospective R&D projects. The varied benefit of the credit among firms conducting research and among business research projects appears to lack justification on economic grounds and creates the impression that, in its current design, the credit subsidizes business R&D in an inequitable and arbitrary manner.

Legislation extending the R&D tax credit through June 30, 2004 (H.R. 1180, P.L. 106-170) was enacted in the first session of the 106th Congress. In addition, a total of eight bills pending in the current Congress would permanently extend the credit. Two of these bills (S. 951 and H.R. 1682) would also liberalize the tax treatment of payments to research consortia and basic research expenditures and create an alternative R&E tax credit that is more beneficial at the margin than the current R&E tax credit. These proposals would remove what many analysts see as

a significant flaw in the current credit – its lack of permanence. In addition, S. 951 and H.R. 1682 would attempt to increase the current credit's incentive effect and to reduce the unevenness of its marginal benefit to firms conducting research and to specific R&D projects.

Some see no need for the changes in the credit that these proposals would make. In fact, many of these same critics see no need for an R&E tax credit on the ground that it rewards firms for doing what they must do in any event to remain competitive in domestic and foreign markets and for undertaking research that has little or no external benefits. To them, it constitutes a form of corporate welfare that should be repealed.

Nonetheless, on economic grounds, a case can be made for going beyond the measures contained in eight R&E tax credit bills pending in the current Congress. At its core is the contention that the price reduction in R&D engineered by the current credit is insufficient to expand business R&D investment to the socially optimal level. The analysis presented here suggests that at least six policy measures might significantly boost the credit's incentive effect, and thus make it a more efficient R&D tax subsidy. In evaluating their desirability, it is important to compare their projected revenue costs with the potential gains in economic output that could arise from the added business R&D investment spurred by the measures. The suggested measures are as follows:

- raising the statutory rate of the credit to 25% or maybe higher;
- getting rid of or relaxing the 50-percent rule;
- getting rid of or easing the basis adjustment;
- expanding the range of expenses that is eligible for the credit;
- clarifying the definition of qualified research in a manner that reduces the prospect of prolonged legal disputes between the IRS and firms claiming the credit; and
- making the credit refundable, especially for smaller, newer firms suffering from cash flow troubles.

Appendix: Estimation of R&E Tax Credits Earned by a Startup Firm and An Established Firm Under Current Law and H.R. 1682/S. 951

One approach to evaluating the likely impact of a legislative proposal to enhance the R&E tax credit's effectiveness is to estimate the R&E tax credits that actual firms could claim in a recent year under current law and under the proposal. In the 106th Congress, identical bills with that aim have been introduced in the House (H.R. 1682) and the Senate (S. 951). To assess the implications of those proposals for the credit's effectiveness, this section presents estimates of the credits that two pharmaceutical firms, Merck & Co. and Cephalon Inc., could claim in 1998 under current law and under H.R. 1682/S. 951. Basically, the two firms were chosen for three reasons: 1) they both are based in the United States; 2) they both invest heavily in R&D relative to sales; and 3) for the purpose of claiming the R&E tax credit, Merck is an established firm, and Cephalon a startup firm. From the standpoint of market power, however, the two firms could not be more different. Merck is one of the leading discoverers, developers, manufacturers, and sellers of prescription drugs in the world, and for years it has also been one of the most profitable pharmaceutical firms worldwide. Cephalon, by contrast, is a smaller and younger firm that is dedicated to the discovery, development, and selling of drugs to treat neurological disorders and certain cancers and had never earned a profit as of 1998.

Table 5 summarizes the results of the comparative analysis. In interpreting them, it is important to keep in mind the assumptions that undergird them. Specifically, it was assumed that each firm's gross receipts were equal to their operating revenues as reported to shareholders and that each firm's qualified research expenses were equal to 70% of their R&D expenditures as reported to shareholders. These assumptions seem reasonable in view of the fact that the IRS defines gross receipts as the "gross operating receipts (of firms) reduced by the cost of returned goods and allowances," and that anywhere from 50% to 73% of a firm's R&D expenditures as defined under current financial accounting standards qualify for the R&E tax credit. In addition, the calculation of the alternative credits Merck and Cephalon could claim under current law reflects the terms of the credit as modified by the Ticket to Work and Work Incentives Improvement Act of 1999 (P.L. 106-170), not the terms that were actually in effect in 1998. Therefore, the estimated tax credits for Merck and Cephalon shown in the following table should be viewed as approximations of the actual credits the two claimed (if any) in that year; it is unclear what the margin of error is in the estimates.

The results point to several conclusions. First and foremost, H.R. 1682/S. 951 would be likely to bolster significantly the credit's marginal benefit to both established and startup firms performing qualified research. For example, if the legislative proposals had been in effect in 1998, Merck could have claimed an R&E tax credit that was 71% larger and Cephalon's credit would have been 100% larger. Second, under current law, Merck would earn no regular R&E tax credit in 1998, whereas Cepahlon could claim a regular credit of $3.1 million on a R&D budget that was about 98% smaller than Merck's. Given the economic rationale for the credit, such an outcome can be deemed undesirable, as there is no apparent reason why the future economic effects of Cephalon's R&D in 1998 should prove more valuable than the

future economic effects of Merck's R&D in the same year. And third, while Cephalon earned credits under current law and under the legislative proposals in 1998, it was not able to take advantage of them because it lost money in that year; the best it could have done was to carry the credits forward for up to fifteen years.

Table 4. Selected Financial Data for Merck & Co. and Cephalon Inc. From 1988 to 1998

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Operating Revenue (millions of dollars)											
Merck	5939	6550	7671	8603	9662	10498	14970	16681	19829	23637	26898
Cepha-lon	NA	.06	.09	5	9	17	22	47	21	23	16
Pre-Tax Income (millions of dollars)											
Merck	1871	2283	2699	3167	3564	3103	4415	4797	5541	6462	8133
Cepha-lon	NA	-2	-3	-5	-10	-21	-39	-43	-69	-65	-59
R&D Expenditures (millions of dollars)											
Merck	669	750	854	988	1112	1173	1231	1331	1487	1684	1821
Cepha-lon	NA	2	3	8	16	33	52	74	62	52	44
Qualified Research Expenditures[a] (millions of dollars)											
Merck	468	525	598	692	778	821	862	932	1041	1179	1275
Cepha-lon	NA	1.4	2.1	5.6	11.2	23.1	36.4	51.8	43.4	36.4	30.8

[a] For both firms, qualified research expenses are equal to 70% of the R&D expenditures reported to shareholders.

Source: Compiled by the Congressional Research Service From Company Annual Reports.

Table 5. Estimated R&E Tax Credits in 1998 for Merck & Co. and Cephalon Inc. Under Current Law and Under H.R. 1682/S. 951

Current Law	H.R. 1682/S. 951
Fixed Base Percentage (%)	
Merck: 8.0	Merck: 5.0
Cephalon: 3.0	Cephalon: 2.4
Base Amount (millions of dollars)	
Merck: 1,502	Merck: 939
Cephalon: 0.85	Cephalon: 0.7
Estimated R&E Tax Credit (millions of dollars)	
Merck: 0 (regular)	Merck: 67.2
Cephalon: 3.1 (regular)	Cephalon: 6.0
Merck: 39.2 (alternative)	NA
Cephalon: 1.1 (alternative)	NA
Average Credit Rate[a] (%)	
Merck: 0 (regular)	Merck: 3.7
Cephalon: 7.0 (regular)	Cephalon: 13.6
Merck: 2.1 (alternative)	NA
Cephalon: 2.5 (alternative)	NA

[a] The amount of the credit as a percent of R&D expenditures reported to shareholders.

Source: Congressional Research Service.