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Research Tax Credit: Current Status, Legislative Proposals, and Policy Issues

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Summary

Technological innovation makes important contributions to long-term economic growth, and research and development (R&D) is the lifeblood of innovation. In economies dominated by free markets, most R&D investment is undertaken by private firms striving to become more competitive and improve their prospects for future growth. Because firms generally cannot capture all the returns to their R&D investments, they are inclined to spend less on R&D than might be warranted by its overall economic benefits. As a means of offsetting this inclination and the economic losses it entails, the federal government supports R&D in a variety of ways, including a tax credit for increases in R&D spending above a base amount.

This report examines the current status of the credit, summarizes its legislative history, discusses key policy issues it raises, and describes legislation in the 109th Congress to modify or extend the credit. It will be updated as legislative activity warrants.

The research and experimentation (R&E) tax credit has never been a permanent component of the federal tax code. Since its enactment in 1981, the credit has been extended 11 times and significantly modified five times. In reality, the R&E tax credit consists of three separate and distinct credits: a regular credit, an alternative incremental credit (AIRC), and a basic research credit. Each is incremental in that the credit is equal to a certain percentage of qualified research spending above a base amount. The current credit is due to expire at the end of 2005.

The R&E tax credit seeks to stimulate increased private R&D investment by reducing the after-tax cost to firms of undertaking qualified research above a base amount, which is supposed to approximate what a business taxpayer would spend on R&D in the absence of the credit. Although most analysts and policymakers view the credit as an effective policy instrument, its current design has drawn some criticism. A major concern, in the view of critics, is that the design prevents the credit from being as effective as it should be. Critics say this problem arises from what they contend are five serious (but correctable) flaws in its design: (1) its lack of permanence; (2) its weak and disparate incentive effects; (3) its non-refundable status; (4) its inadequate and unsettled definition of qualified research; and (5) its poor record of targeting R&D projects that generate larger social returns than private returns.

Four bills to extend permanently the research tax credit have been introduced in the 109th Congress: H.R. 1454, H.R. 1736, S. 14, and S. 627. In addition, H.R. 1736, S. 14 and S. 627 would also raise the three rates for the AIRC to 3%, 4%, and 5% and establish a new alternative research tax credit known as the "alternative simplified credit." Moreover, the tax reconciliation measures passed by the House (H.R. 4297) and Senate (S. 2020) would extend the credit through the end of 2006 and make the same enhancements in the credit as H.R. 1736, S. 14, and S. 627.

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Economists may be notorious for their disagreements over a variety of important policy issues (e.g., the efficacy of large, permanent individual income tax cuts as a means of stimulating sustained long-term economic growth). But on the questions of how technological innovation affects economic growth in the long run, and what role government should play in the commercial development of new technologies, relatively little discord colors their views.

Most economists agree that technological innovation has accounted for a major share of the growth in per-capita income in the United States over time.[1] Technological innovation can be an elusive concept: reasonable people hold differing views of what it is and is not. Nonetheless, among economists, a consensus has formed around the view that innovation typically involves the acquisition of new scientific and technical knowledge, and its application to the development of new goods and services or methods of production through a process of experimentation. Learning-by-doing and learning-by-using often play vital roles in this process.

In free-market economies, this process is driven largely by the efforts of competing firms in a wide range of industries to gain, sustain, or reinforce competitive advantage by being the first to introduce new or improved products or services, more efficient production processes, or more effective methods of management, marketing and promotion, and customer service and support. Central to these efforts is public and private investment in research and development (R&D), whose principal output is new scientific and technical knowledge and knowhow.

At the same time, most economists maintain that the level of private R&D investment in the absence of government support is likely to be less than optimal from the standpoint of social welfare. This is because individual firms generally cannot capture all of the economic returns to their R&D investments, even in the presence of patents, trademarks, and other instruments of intellectual property protection. Numerous studies of the economic effects of technological innovation have concluded that the social returns to private R&D investments typically greatly exceed the private returns.[2] This pattern seems to prevail whether a firm invests in

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[1] Linda R. Cohen and Roger G. Noll, "Privatizing Public Research," *Scientific American*, Sept. 1994, p. 72.

[2] See, for example, Edwin Mansfield, "Microeconomics of Technological Innovation," in *The Positive Sum Strategy*, Ralph Landau and Nathan Rosenberg, eds. (Washington: National Academy Press, 1986), pp. 307-325; and John C. Williams and Charles I. Jones, "Measuring the Social Return to R&D," *Quarterly Journal of Economics*, vol. 113, no. 4,

(continued...)

research projects closely related to its existing lines of business, or in basic research projects aimed at extending the boundaries of knowledge and understanding in a particular scientific discipline in ways that may have no obvious commercial applications. Economists refer to this excess as the spillover effects or external benefits of R&D. There are many channels through which the benefits from innovation may elude capture by the innovating firm and spill over to society at large, including reverse engineering by competing firms and the purchase of goods and services at prices below what most consumers would be willing to pay.[3] When seen through the lens of conventional economic theory, these so-called external benefits take on the appearance of a market failure in which too few resources are allocated to the activities leading to the discovery and commercial development of new knowledge and know-how. As a means of remedying this failure, most economists favor the adoption of public policies aimed at boosting private investment in R&D, especially R&D targeted at projects likely to generate large external economic benefits.

The federal government supports R&D in a variety of direct and indirect ways. Direct support mainly takes the form of research performed by federal agencies and federal grants for basic research, applied research, and development intended to support specific policy goals, such as protecting the natural environment, exploring outer space, advancing the treatment of various diseases, and strengthening national defense capabilities. Indirect support is less focused: the chief sources are federal financial support for higher education in engineering and the natural sciences, legal protection of intellectual property rights, special allowances under antitrust law for joint research ventures, and tax incentives for business investment in research.

Current federal tax law offers two such incentives: (1) an expensing allowance for qualified research spending under section 174 of the Internal Revenue Code (IRC), and (2) a non-refundable tax credit for qualified research spending under IRC section 41 — which is referred to by some as the research and experimentation (R&E) tax credit. The expensing allowance, which has been a permanent component of the IRC since it was enacted in 1954, encourages business investment in R&D by imposing a marginal effective tax rate of 0 on a portion of the returns to such investment. Similarly, the R&E tax credit, which has always been a temporary provision of the IRC since its enactment in July 1981, seeks to stimulate business R&D investment by lowering the after-tax cost of qualified R&D.[4] In FY2006, the

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[2] (...continued)
Nov. 1998, pp. 1119-1135.

[3] For a brief discussion of these channels, see Bronwyn H. Hall, "The Private and Social Returns to Research and Development," in *Technology, R&D, and the Economy*, Bruce L. R. Smith and Claude E. Barfield, eds. (Washington: Brookings Institution and American Enterprise Institute, 1996), pp. 140-141.

[4] For more information on the section 174 expensing allowance, see U.S. Congress, Senate Committee on the Budget, *Tax Expenditures*, committee print, 107th Cong., 2nd sess. (Washington: GPO, 2002), pp. 55-58.

budgetary cost of these incentives is projected to total $10.0 billion, while federal defense and non-defense R&D spending is projected to reach $132.3 billion.[5]

This report examines the current status of the R&E tax credit, its legislative history, several important policy issues raised by it, and legislative proposals in the 109th Congress to extend or modify the credit.

Design of the Current R&E Tax Credit

The R&E tax credit actually consists of three separate and distinct non-refundable credits: a regular research credit, an alternative incremental research credit (or AIRC), and a basic research credit. In any tax year, business taxpayers may claim the basic research credit and either the regular credit or the AIRC. All three credits are due to expire on December 31, 2005.

Regular Research Credit

Under IRC section 41(a)(1), the regular tax credit, which has been extended 11 times and significantly revised five times, is equal to 20% of a firm's qualified research expenses (QREs) above a base amount. Such an incremental design is intended to encourage firms to spend more on R&D than they otherwise would by lowering the after-tax cost of this added R&D spending. (In contrast, if the credit were flat in design, it would equal 20% of part or all of a firm's spending on qualified research.) Under the credit's current design, the U.S. Treasury effectively bears up to 20% of each additional dollar spent on R&D above a base amount.[6] Assuming that the amount spent on business R&D is sensitive to its cost, a decline in the after-tax cost of R&D should lead to a rise in total business R&D investment, all other things being equal.

In order to grasp the basic mechanism of the regular credit, it is useful to have a clear understanding of how the base amount is determined under IRC section 41(c) and which research expenses qualify for the credit under IRC section 41(b) and 41(d).

The base amount of the research tax credit is intended to approximate the amount a firm would spend on qualified research in the absence of the tax credit. This amount can be thought of as a firm's normal or preferred level of R&D investment. Two important rules govern the calculation of the base amount. First, it must equal 50% or more of a firm's QREs in a given tax year — a rule sometimes referred to as the 50-percent rule.[7] Second, a firm's base amount hinges on whether the firm is considered an established firm or a start-up firm. Established firms are

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[5] Office of Management and Budget, *Analytical Perspectives, Fiscal Year 2006* (Washington: GPO, 2005), pp. 66 and 317.

[6] For a variety of reasons, which will be discussed in a later section of the report, the actual or effective rate of the credit is much lower than 20%.

[7] In other words, the expenses against which the regular research credit may be claimed can equal no more than 50% of total QREs in a given tax year.

defined as those with gross receipts and QREs in three or more of the tax years from 1984 through 1988. Start-up firms are firms that meet one of the following two criteria: (1) the first tax year with both gross receipts and QREs occurred after 1983; and (2) there were fewer than three tax years with gross receipts and QREs from 1984 through 1988.[8] For all firms, the base amount is the product of a fixed-base percentage and average annual gross receipts in the previous four tax years. An established firm's fixed-base percentage is the ratio of its total QREs to total gross receipts from 1984 to 1988, capped at 16%. By contrast, a start-up firm's fixed-base percentage is set at 3% during the first five tax years in which it records both gross receipts and QREs; thereafter, the percentage gradually adjusts according to a firm's actual experience so that by the its eleventh tax year the percentage reflects the firm's total spending on QREs relative to receipts in the five previous tax years.

In general, the lower a firm's fixed base percentage, the better its chances of claiming the regular credit. Moreover, a firm can expect to benefit from the regular credit if its ratio of QREs in the current tax year to average annual gross receipts in the previous four tax years is greater than its fixed-base percentage. (See **Tables 1 and 2** for calculations of the regular credit for hypothetical established and start-up firms.)

By now it should be clear that a key factor in claiming the regular credit (as well as the AIRC) is the definition of QREs. In practice, there are two critical aspects to this definition.

One is the nature of qualified research itself. Under IRC section 41(d), research must satisfy four tests in order to qualify for the regular or alternative research tax credits. First, the research must relate to activities that can be expensed under IRC section 174 — which is to say that the activities must be "experimental" in the laboratory sense and aimed at the development of a new or improved product or process. Second, the research must be undertaken to discover information that is "technological in nature." Third, the research is intended to discover new technical knowledge that is useful in the development of a new or improved "business component," which is defined as a product, process, computer software technique, formula, or invention to be sold, leased, licensed, or used by the firm performing the research. Finally, the research must relate to activities substantially all of which constitute a process of experimentation whose goal is the development of a product or process with "a new or improved function, performance or reliability or quality." The third and fourth tests were added by the Tax Reform Act of 1986, which also directed the IRS to issue final regulations clarifying the definition of qualified research. There has been considerable controversy among business taxpayers, the courts, and the IRS over the interpretation of these tests in the real world of business R&D. Although the IRS issued final regulations clarifying the definition of qualified research in December 2003 (T.D. 9104), it is not clear whether they will put an end to most of these disputes.

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[8] The definition of a start-up firm has changed a few times since the research credit was enacted. Presently, it denotes a firm that recorded gross receipts and QREs in a tax year for the first time after 1993.

Certain activities fall outside the realm of qualified research, including research conducted after the start of commercial production of a business component, research done to adapt an existing business component to a specific customer's needs or requirements, research related to the duplication of an existing business component, research done to develop computer software for a firm's internal use (except as allowed in any regulations issued by the IRS), and research conducted outside the United States, Puerto Rico, or any other U.S. possession.

The other key aspect of the definition of QREs is the expenses covered by the credit. Under IRC Section 41(b), these expenses are limited to the wages and salaries of employees engaged in qualified research, the cost of materials and supplies used in this research, leased computer time used in this research, 75% of payments for qualified research performed under contract by non-profit scientific research organizations, and 65% of payments for qualified research done under contract by certain other organizations. The credit does not apply to the cost of structures and equipment used in qualified research, or to overhead expenses — such as heating, electricity, rents leasing fees, insurance, and property taxes — and the fringe benefits of research personnel. As will be seen, the exclusion of these costs has implications for the incentive effect of the credit. In the past, QREs have accounted for anywhere from 50% to 73% of total business R&D spending.[9]

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[9] U.S. Office of Technology Assessment, *The Effectiveness of Research and Experimentation Tax Credits* (Washington: 1995), p. 29.

Table 1. Sample Calculations of the Regular and Alternative Incremental R&E Tax Credits in 2003 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	400	18
1990	450	18
1991	550	20
1992	600	25
1993	550	23
1994	620	20
1995	700	25
1996	660	35
1997	710	30
1998	800	35
1999	835	45
2000	915	50
2001	1,005	53
2002	1,215	60
2003	1,465	70

Source: Congressional Research Service.

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 2003:

1. Calculate the average annual gross receipts for the four previous years (1999-2002): $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 2003:

1. Begin with the qualified research expenses for 2003 of $70 million and subtract the base amount ($39.7 million) or 50% of the qualified research expenses for 2003 ($35 million), whichever is greater: $30.3 million.
2. Multiply this amount by 20% to determine the regular R&E tax credit for 2003: **$6.06 million**.

Calculation: Alternative Incremental R&E Tax Credit

1. Calculate the average annual gross receipts for the four previous years (1999-2003): $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 2003 ($70 million) and subtract 1% and 1.5% and 2% (respectively) of the average annual gross receipts for 1999 to 2002: $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**.

Alternative Incremental Research Credit

Firms undertaking qualified research that cannot claim the regular credit may be able to claim the alternative incremental R&E tax credit (or AIRC) under IRC section 41(c)(4). Under current law, however, firms are not free to claim whichever credit is more advantageous in a given tax year. Instead, if a firm elects the AIRC, it must continue to claim it in future tax years unless the firm receives permission from the IRS to switch to the regular credit. There is some concern that such a rule deters firms that may be better off under the AIRC from claiming it.

Calculating the AIRC is somewhat more complicated than calculating the regular credit. It is equal to 2.65% of a firm's QREs above 1% but less than 1.5% of its average annual gross receipts in the previous four tax years, plus 3.2% of its QREs above 1.5% but less than 2.0% of its average annual gross receipts in the previous four tax years, plus 3.75% of its QREs greater than 2.0% of its average annual gross receipts in the previous four tax years. In general, firms can benefit from the alternative credit if their QREs in the current tax year exceed 1% of their average annual gross receipts during the past four tax years. Moreover, the AIRC is likely to be of greater benefit than the regular credit for business taxpayers that have relatively high fixed base percentages, or whose research spending is declining, or whose sales are growing much faster than their research spending. (See **Tables 1 and 2** for calculations of the AIRC for hypothetical established and start-up firms.)

Table 2. Sample Calculations of the Regular and Alternative Incremental R&E Tax Credits in 2003 for a Startup Firm

($ millions)

Year	Gross receipts	Qualified research expenses
1995	30	35
1996	42	40
1997	56	48
1998	60	55
1999	210	65
2000	305	73
2001	400	82
2002	475	90
2003	600	105

Source: Congressional Research Service.

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 five years after 1993 when it has both gross receipts and qualified research expenses. Thus, the fixed-base percentage for 2003 is 3%.

Compute the base amount for 2003:

1. Calculate the average annual receipts for the 4 previous years (1999-2002): $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 2003 ($105 million) and subtract the base amount ($10.4 million) or 50% of the qualified research expenses for 2003 ($52.5 million), whichever is greater: $52.5 million.
2. Multiply this amount by 20% to determine the regular R&E tax credit for 2003: **$10.5 million**.

Calculation: Alternative Incremental R&E Tax Credit

1. Calculate the average annual gross receipts for the four previous years (1999-2002): $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 2003 ($105 million) and subtract 1.0%, 1.5%, and 2.0% (respectively) of the average annual gross receipts for 1999 to 2002: $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**.

Basic Research Credit

Moreover, firms collaborating with certain non-profit organizations to perform basic research may claim a tax credit for some of their expenditures for this purpose under IRC Section 41(d). A primary aim of the basic research credit is to foster collaborative research between U.S. industry and universities. The credit is equal to 20% of payments for contract basic research above a base amount, which has nothing in common with the base amount for the regular R&E tax credit.[10] Under IRC section 41(e), basic research is defined as "any original investigation for the advancement of scientific knowledge not having a specific commercial objective." The credit does not apply to basic research done outside the United States, or to basic research in the social sciences, arts, or the humanities. In addition, the basic research credit applies only to payments for basic research performed under a written contract by the following organizations: educational institutions, non-profit scientific research organizations (excluding private foundations), and certain grant-giving organizations. Payments made to joint research consortia involving a cluster of firms or to federal laboratories for basic research are not eligible for the credit. A firm conducting its own basic research would not be able to claim the basic research credit for its expenditures for this purpose, but it could use these expenditures to claim the regular research credit.

Legislative History of the Research Tax Credit

The R&E tax credit was first enacted as a temporary provision of the Economic Recovery Tax Act of 1981 (P.L. 97-34). In establishing the credit, the 97th Congress was seeking to reverse a decline in real spending on R&D by the private sector relative to real U.S. gross domestic product that commenced in the late 1960s and continued into the late 1970s. Some analysts thought this decline played a significant role in the relatively slow productivity growth experienced by the United States and

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[10] Calculating a firm's base amount for the basic research credit is much more complicated than calculating its base amount for the regular credit. For the basic research credit, a firm's base period is the three tax years preceding the first year in which it recorded gross receipts after 1983. The 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 former is the greater of 1% of the 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; the firm's minimum basic research amount must equal 50% or more of its basic research payments in the current tax year. The latter is the difference between a firm's donations to qualified organizations in the current tax year for purposes other than basic research and its average annual donations to the same organizations for the same purposes during the base period, multiplied by a cost-of-living adjustment for the current tax year.

the dramatic loss of competitiveness by a range of U.S. industries in that period. Congress concluded that a "substantial tax credit for incremental research and experimental expenditures was needed to overcome the reluctance of many ongoing companies to bear the significant costs of staffing and supplies, and certain equipment expenses such as computer charges, which must be incurred to initiate or expand research programs in a trade or business."[11]

The initial credit was equal to 25% of the excess of qualified research spending above a base amount, which in turn was equal to average spending on this research in the three previous tax years or 50% of current-year spending, whichever was greater. Why a statutory rate of 25% was chosen is not clear from available primary source material. The choice, however, does not appear to have been based on an assessment of the gap between private and social returns to business R&D investment or the sensitivity of R&D expenditures to declines in the cost of R&D inputs. If a taxpayer claimed a credit but could not apply the entire amount against its current-year federal income tax liability, the firm could carry the excess back as many as three tax years or forward as many as 15 tax years. The credit was in effect from July 1, 1981, to December 31, 1985.

Congress made the first significant set of changes in the original credit with the passage of the Tax Reform Act of 1986 (P.L. 99-514). The act extended the credit through December 31, 1988 and made it part of the general business credit, thereby subjecting it to a yearly cap. In addition, it lowered the statutory rate to 20%, modified the definition of QREs so that the credit applied to research intended to produce new technical knowledge that would be useful in the commercial development of new products and processes, and created a separate 20% incremental tax credit for payments to universities and certain other non-profit organizations for the conduct of basic research under a written contract. The reduction in the credit's rate did not seem to be based on an assessment of the credit's effectiveness in its first five years. Rather, it stemmed from an apparent desire on the part of Congress to subject the credit to the overriding goals of the act — which were to lower income tax rates across the board, broaden the income tax base, and narrow the differences among the effective tax burdens on the returns to investment in most business assets — and a recognition that business R&D investment also benefitted from the IRC section 174 expensing allowance.[12]

The credits were further altered by the Technical and Miscellaneous Revenue Act of 1988 (P.L. 100-647). Specifically, the act extended the credits through December 31, 1989. In addition, it curtailed the overall tax preference for R&D by requiring taxpayers claiming the credits to lower any deduction for qualified research spending under IRC section 174 they claim by 50% of the combined amount of the regular and basic research credits. This change had the effect of reducing the

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[11] U.S. Congress, Joint Committee on Taxation, *General Explanation of the Economic Recovery Tax Act of 1981*, joint committee print, 97th Cong., 1st sess. (Washington: GPO, 1981, p. 120.

[12] U.S. Congress, *General Explanation of the Tax Reform Act of 1986*, joint committee print, 100th Cong., 1st sess. (Washington: GPO, 1987), p.130.

maximum effective rate of the regular research tax credit by a factor equal to 0.5 times a taxpayer's marginal income tax rate.

Mounting dissatisfaction with the design of the original credit culminated in the enactment of further important changes in the regular credit through the Omnibus Budget Reconciliation Act of 1989 (OBRA89, P.L. 101-239). Much of the concern was directed at the formula for determining the base amount of the credit. Critics rightly pointed out that under the formula — which involved a three-year moving average of a firm's annual spending on qualified research — an increase in a firm's research spending from one year to the next would increase its base amount in each of the following three years by one-third of the increase in research spending, making the credit harder to claim in that period. Some maintained that such an arrangement would be less cost-effective in spurring continuous increases in business R&D investment than one in which a firm's base amount is independent of its investment behavior.[13] To address this concern, OBRA89 modified the formula for determining a firm's base amount so that it was equal to the greater of 50% of its current-year QREs or the product of the firm's average annual gross receipts in the previous four tax years and its "fixed base percentage." This percentage was set equal to the ratio of a firm's combined QRE's to combined gross receipts in the four tax years from 1984 to 1988; the percentage was capped at 16%. OBRA89 also made the credit available on more favorable terms to start-up firms, which it defined as firms that did not have gross receipts and QREs in three of the four years from 1984 to 1988; these firms were assigned a fixed base percentage of 3%. In addition, the act effectively extended the credits to December 31, 1990 by requiring that QREs incurred before January 1, 1991 be prorated, permitted firms to apply the regular credit to QREs related to both current lines of business and lines of business they might want to enter, and required firms claiming the regular and basic research credits to reduce any deduction they claim under IRC section 174 by the entire combined amount of the credits.

In 1990 and 1991, Congress passed two bills that, among other things, temporarily extended the credits. The Omnibus Budget Reconciliation Act of 1990 (P.L. 101-508) extended the credits through December 31, 1991 and repealed the requirement that QREs made before January 1, 1991 be prorated. The Tax Extension Act of 1991 (P.L. 102-227) further extended the credits to June 30, 1992. A major obstacle to longer extensions of the credits in this period was the budgetary cost of doing so in the midst of rising federal budget deficits.

Although Congress passed two bills in 1992 that would have extended the credits beyond June 30, President George H. W. Bush vetoed both for reasons that had nothing to do with the credit. As a result, the credits expired and remained in a state of suspension from July 1, 1992 until the enactment of the Omnibus Budget Reconciliation Act of 1993 (OBRA93, P.L. 103-66) in August 1993. The act extended the credits retroactively from July 1, 1992 through June 30, 1995. It also modified the fixed base percentage for start-up firms. Under OBRA93, firms lacking

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[13] See U.S. Congress, Joint Economic Committee, *The R&D Tax Credit: An Evaluation of Evidence on Its Effectiveness*, joint committee print, 99th Cong., 1st sess. (Washington: GPO, 1985), pp. 17-22.

gross receipts in three of the years from 1984 to 1988 were assigned a percentage of 3% for the first five tax years after 1993 in which it had QREs. Starting in the firm's sixth year, the percentage gradually adjusted according to a formula so that by their eleventh year the percentage reflected their actual ratio of QREs to gross receipts in five of their previous six tax years.

Congressional inaction resulted in another expiration of the credits on June 30, 1995. They remained suspended until the enactment of the Small Business Job Protection Act of 1996 (P.L. 104-188) in August 1996. The act retroactively reinstated the credits from July 1, 1996 to May 31, 1997, leaving a one-year gap in the credit's coverage since it went into effect in mid-1981. It also expanded the definition of a start-up firm to include any firm whose first tax year with both gross receipts and QREs was 1984 or later, added an alternative incremental research credit (i.e., the AIRC) with initial rates of 1.65%, 2.2%, and 2.75%, and made 75% of payments for qualified research to non-profit organizations "operated primarily to conduct scientific research" eligible for the regular or alternative incremental credits.

The credits expired in 1997 before they were extended retroactively from June 1, 1997 to June 30, 1998 by the enactment of the Taxpayer Relief Act of 1997 (P.L. 105-34) in October 1997. And the revenue portion of the Omnibus Consolidated and Emergency Supplemental Appropriations Act of 1998 (P.L. 105-277) further extended the credits from July 1, 1998 to June 30, 1999.

In a reprise of 1997, the credits again expired in 1999 before Congress passed a bill later in the year reinstating them retroactively. Under the revenue portion of the Ticket to Work and Work Incentives Improvement Act of 1999 (P.L. 106-170), the credits were extended from July 1, 1999 to June 30, 2004. The act also increased the three rates of the AIRC to 2.65%, 3.2%, and 3.75% and expanded the definition of qualified research to include qualified research performed in Puerto Rico and the other territorial possessions of the United States.

On October 4, 2004, President Bush signed into law the Working Families Tax Relief Act of 2004 (P.L. 108-311), which included a provision extending the research tax credit through December 31, 2005.

Beginning in the mid-1990s, a cycle began to emerge every time the credits were about to expire, one that seemed to persist through the end of the decade. As one analyst has noted, the cycle would start with supporters of the credit in Congress and influential business lobbyists clamoring for a permanent extension of the credit and denouncing what they saw as the inexcusable folly of repeated temporary extensions.[14] Then leaders in both houses of Congress would begin serious negotiations on tax legislation that included a permanent extension. But in the end, Congress and the President would agree to limit the extension to one or two years. The main barrier to a permanent extension never has been staunch opposition to the credit on the part of Congress or the President, but what has proven to be the

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[14] Martin A. Sullivan, "Research Credit Hits New Heights, No End in Sight," *Tax Notes*, vol. 94, no. 7, Feb. 18, 2002, p. 801.

insuperable difficulty of reconciling the revenue cost of such an extension with the clashing budget priorities of the President and congressional leaders.

Effectiveness of the Research Tax Credit

A policy question posed by the credit concerns how effective the research tax credit has been in the 22 or so years of its existence. There are two basic approaches to coming up with a plausible answer to this important question.

Among economists, the preferred approach to assessing the credit's effectiveness is to compare the potential social benefit from any added R&D generated by the credit with the credit's potential social cost. Making such a comparison involves measuring the marginal return to society of the added R&D spending and the marginal returns to society of using the social cost of the credit for other public purposes (e.g., corporate income tax rate cut, deficit reduction, or pollution abatement). The social cost of the credit is equivalent to the net loss of tax revenue because of the credit and the public and private costs of administering the credit, and the latter benefits can be thought of as the social opportunity cost of the credit. Unfortunately, this approach to assessing the effectiveness of the research tax credit cannot be pursued because of certain insurmountable barriers to measuring the social returns to R&D.[15]

As a result, economists have been forced to rely on a second approach: estimating the additional R&D (if any) stimulated by the credit and comparing that amount to the tax revenue lost because of the credit. Such an approach rests on two implicit assumptions: (1) that the social returns to R&D far exceed the private returns; and (2) that the optimal size of the subsidy for R&D is known. Under these assumptions, the principal policy question to be addressed is whether the subsidy should be offered as a tax credit or as a direct payment (e.g. research grant or subsidized loan). A ratio of greater than one suggests that the tax credit is a more cost-effective way to achieve a certain desired level of R&D subsidy than a direct payment; but if the ratio turns out to be less than one, then it would be more cost-effective for the federal government to fund R&D projects directly.[16]

Such a benefit-to-cost ratio is only loosely connected to the magnitude of the gap between the social and private returns to R&D investment. This point can be illuminated by considering the circumstances in which a ratio of less than does not necessarily mean that the research credit is undesirable as a R&D subsidy, and in

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[15] The barriers to measuring the social returns to R&D include developing adequate price indices for the cost elements of R&D for specific industries, specifying the time period in which to assess the productivity gains from R&D, and determining the depreciation rate for a society's stock of R&D assets. For a detailed discussion of these issues, see Bronwyn H. Hall, "The Private and Social Returns to Research and Development," in *Technology, R&D, and the Economy*, Bruce L. Smith and Claude E. Barfield, eds. (Washington: Brookings Institution, 1996), pp. 141-145.

[16] This argument assumes that government research grants to the private sector do not lead firms receiving the grants to reduce their own R&D spending by similar amounts.

which a ratio of greater than one does not necessarily mean that the credit is a desirable option. On the one hand, if the average social returns to business R&D investment are much higher than the average private returns, it is possible for social welfare to be enhanced through the use of the credit even if the revenue cost of the credit exceeds the added research it brings forth. In this case, the credit could be considered a desirable and effective policy instrument for raising business R&D investment. On the other hand, if the average social returns to business R&D investment are only slightly higher than the average private returns, then use of the credit might encourage firms to engage in too much R&D, even if the amount of R&D induced by the credit exceeds its revenue cost. In this case, social welfare might be greater if the federal government were to use the tax revenue lost because of the credit for purposes with greater social returns, and the credit could be seen as a less than desirable policy instrument.

What do existing studies of the credit's effectiveness say about its benefit-to-cost ratio? In essence, these studies are an exercise in counterfactual analysis. They seek to answer the question: "how much more R&D did firms undertake as a result of the credit than they would have undertaken if there had been no credit?" Because this added R&D cannot be observed or directly measured, researchers resort to a variety of methods of estimating the amount of R&D undertaken with and without the credit. These methods were examined in detail in a 1995 study by economist Bronwyn Hall.[17] She found that the studies based on data from 1981 to 1983 differed markedly from those based on data from years after 1983. The earlier studies came up with estimates of the amount of additional R&D undertaken per dollar of the credit that were considerably lower than those of the later studies. Taking into consideration the strengths and weaknesses of both sets of studies, Hall concluded that there seemed to be no doubt that the credit (as of 1995) led to a "dollar-for-dollar increase in reported R&D spending on the margin."[18] This meant that the benefit-to-cost ratio was one. (In other words, each dollar of the credit claimed induced one additional dollar of R&D.) She also noted that the available evidence suggested that it took some time for firms to adjust their R&D budgets to the credit, so the response was somewhat weaker in the early years of its existence.

In theory, the credit seeks to stimulate increased business R&D investment by lowering the after-tax cost of undertaking another dollar of R&D beyond some normal (or base) amount. Thus, two key considerations in evaluating the effectiveness of the credit are (1) the responsiveness of business R&D investment to decreases in its after-tax cost, and (2) the extent to which the credit lowers the after-tax cost of conducting R&D. Combining the two factors makes it possible to estimate how much greater business R&D spending might be because of the credit.

There is little empirical evidence on how responsive business R&D investment is to shifts in its marginal after-tax cost, as measured by the price elasticity of R&D

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[17] See Bronwyn H. Hall, *Effectiveness of Research and Experimentation Tax Credits: Critical Literature Review and Research Design*, report prepared for the Office of Technology Assessment, June 15, 1995, pp. 11-13, available at [http://emlab.berkeley.edu/users/bhhall/papers/BHH95%200Artax.pdf].

[18] Ibid., p. 18.

spending. The few available studies have come up with estimates of the long-run price elasticity ranging from -0.2 to -2.0. These results implied that a decline in the after-tax cost of R&D of 1% can be expected to yield a rise in R&D spending in the long run of anywhere from 0.2% to 2%. Seeking to shed further light on the price sensitivity of the demand for R&D, a recent analysis by the Joint Tax Committee noted that "the general consensus when assumptions are made with respect to research expenditures is that the price elasticity of research is less than -1.0 and may be less than -0.5."[19]

The effectiveness of the credit also depends on the extent to which it reduces the after-tax cost of R&D. The simple truth for firms able to claim the credit is that one dollar of the credit reduces the after-tax cost of QRE by one dollar. By offering a tax credit for qualified research, the federal government (or U.S. taxpayers) effectively shares the cost of this research. Consequently, a measure of the overall reduction in the after-tax cost of domestic R&D arising from the credit is the credit's average effective rate, which can be approximated by the ratio of the total amount of claims for the credit in a year to some measure of domestic business research spending, such as QRE.

From the figures in **Table 3**, this rate can be computed for both QRE and industry R&D spending. In 1996 to 2001, the average effective rate of the credit was 3.3% for industry R&D spending and 5.8% for QRE. This implies that the credit lowered the after-tax cost of industrial R&D performed in the United States by 3.3% and the after-tax cost of research that qualified for the credit by 5.8% over that period.

The gap between the rates reflects the differences between QRE and industry R&D spending as estimated by the National Science Foundation (NSF). On average, QRE was about 58% of industry R&D spending from 1996 to 2001. The NSF estimate is intended to measure all R&D both performed in the United States by firms and funded by industry and other non-federal entities. It is based on annual surveys of R&D in industry and covers the wages, salaries, and fringe benefits of research personnel, as well as the cost of materials and supplies, overhead expenses, and depreciation related to research activities; expenditures on plant and equipment used in research are excluded, however.[20] By contrast, QRE is the sum of spending on research eligible for the credit reported by firms claiming the credit on their tax returns and covers only wages and salaries, materials and supplies, leased computer time, and 65% or 75% of contract research funded by these firms. Thus, it is no surprise that QRE is significantly less than industry R&D spending.

What can be said about the overall impact of the credit on domestic R&D? The figures in **Table 3** suggest that the credit exerted a modest stimulus on domestic

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[19] U.S. Congress, Joint Committee on Taxation, *Description of Revenue Provisions Contained in the President's Fiscal Year 2004 Budget Proposal*, joint committee print, JCS-7-03, 108th Cong., 1st sess. (Washington, March 2003), p. 250.

[20] National Science Foundation, Division of Science Resource Statistics, *The Methodology Underlying the Measurement of R&D Expenditures: 2000 (data update)* (Arlington, VA: Dec. 10, 2001), p. 2.

business R&D investment from 1996 to 2000. More specifically, assuming the price elasticity of R&D spending is between -0.5 and -1.0 and the average effective rate of the credit is .033, it is possible that the credit boosted business R&D investment between 1.65% and 3.3% over that period.

Table 3. U.S. Industrial R&D Spending, Federal R&D Spending, and the Research Tax Credit
($ billions)

	1996	1997	1998	1999	2000	2001
Industry R&D Spending[a]	121.0	133.6	145.0	160.3	180.4	181.6
Qualified Research Spending[b]	38.3	85.3	95.9	102.7	109.9	99.8
Federal R&D Spending[c]	67.6	69.8	72.1	75.3	72.9	79.9
Current-Year Research Tax Credit[d]	2.2	4.5	5.3	5.3	7.2	6.5

Source: National Science Foundation, Division of Science Resources Statistics, *U.S. Industrial R&D Expenditures and R&D-to-Sales Ratio Reach Historical Highs in 2000*; National Science Foundation, Division of Science Resources Statistics, *Survey of Federal Funds for Research and Development: Fiscal Years 2000, 2001, and 2002*; Internal Revenue Service, Statistics of Income Division, e-mail data transmissions.

a. Total spending on domestic industrial R&D by companies and other non-federal entities, including non-profit organizations and state and local governments.
b. Spending on research that qualifies for the research tax credit as reported by business taxpayers claiming the credit on their federal income tax returns.
c. Federal obligations for defense and non-defense R&D by fiscal year.
d. Total value of claims for the regular, incremental and basic research tax credits included on federal income tax returns. Because of limitations on the use of the general business credit, of which the research credit is a component, the total amount of the research credit allowed in a particular year is likely to differ from the amount claimed.

Policy Issues Raised by the Current Research Tax Credit

Although there appears to be a broad consensus among economists and policymakers that tax incentives are a desirable way to boost business R&D investment, the current research tax credit has drawn plenty of criticism. A major concern is that the credit is less effective than it could or should be because of its present design. Critics argue that the credit will produce its intended benefits only if certain perceived flaws in its design are remedied. They cite five such flaws in particular: (1) a lack of permanence, (2) weak and arbitrary incentive effects, (3) non-refundable status, (4) an inadequate and unsettled definition of qualified research, and (5) its tendency to target R&D that generates significant private returns but relatively meager social returns.

Lack of Permanence

The current R&E tax credit is due to expire on December 31, 2005. It has never been a permanent fixture of the IRC, despite repeated attempts in Congress to extend it permanently in the past decade.[21] In fact, the credit has been extended 11 times, most recently by the Working Families Tax Relief Act of 2004 (P.L. 108-311).

This lack of permanence is a matter of concern to critics because it is thought to diminish the credit's incentive effect. Many R&D projects have planning horizons extending beyond a year or two. Some analysts have pointed out that if business managers cannot count on receiving the credit throughout the life of a R&D project, then it is unlikely they will factor it into their decisions on the size of annual R&D budgets. In the view of these analysts, instead of boosting R&D investment, a temporary incremental R&D tax credit may have the unintended effect of restraining it somewhat by compounding the considerable uncertainty that typically surrounds the projected after-tax returns on planned R&D investments. This added uncertainty may deter managers from undertaking R&D projects they would pursue if the credit were permanent.

It should be noted, however, that not all firms investing in R&D may be affected equally by an impermanent research credit. In general, those with longer R&D planning horizons and relatively high fixed R&D investment costs can be expected to be more sensitive to uncertainty in the duration of the credit than those with shorter horizons and more flexible investment costs. For example, some analysts believe that pharmaceutical firms may be affected more by a temporary research tax credit than software firms, simply because pharmaceutical R&D projects tend to have much longer planning horizons and require much greater initial investment in plant and equipment and staff training than software R&D projects.

Weak and Disparate Incentive Effect

Another problem with the credit, in the view of many of its critics, lies in its incentive effect. They maintain that the effect varies among firms conducting qualified research in ways that have no basis in economic theory and appear to run counter to the purpose of the credit. In addition, according to the same critics, the effect seems too weak to produce socially optimal levels of business R&D investment. They trace the roots of this dual problem to the design of the current regular credit.

Uneven Incentive Effect. The regular credit's incentive effect appears to vary widely among firms investing in qualified research, including those that increase their qualified research expenditures over an extended period. Evidence for such variation comes from a 1996 CRS report by economist William Cox that analyzed the results of an estimation of which firms with sizable research budgets in 1994 could have claimed the regular R&E tax credit that year.

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[21] The R&E tax credit has been in effect for each year between July 1, 1981, and the present except for period from July 1, 1995, to June 30, 1996, when it expired. Since July 1, 1996, the credit has not been renewed to include this period.

The starting point for the analysis was a sample of 900 publicly traded U.S.-based firms with the largest R&D budgets retrieved from a database maintained by Compustat, Inc. On the reasonable assumption that the QREs for these firms in 1994 were equal to 70% of their reported R&D spending, Cox estimated that 62.5% of the firms could be considered established firms for the sake of claiming the credit because they had both business revenue and QREs in three of the years from 1984 to 1988; the remainder were considered start-up firms. What is more, he found that 78% of the 900 firms in the sample (44.4% of the established firms plus 33.5% of the start-up firms) could have claimed the R&E tax credit in 1994, while 22% could have claimed no credit (18% of established firms plus 4% of start-up firms).[22] A total of 34% of all firms (32.3% of established firms plus 1.7% of start-up firms) were estimated to have QREs greater than their base amounts but less than twice these amounts; as a result, they could have claimed credits with a marginal effective rate of 13%. And 43.8% of all firms had QREs greater than double their base amounts, enabling them to claim credits with a marginal effective rate of 6.5%.[23] These rates measure the reduction in the after-tax cost of qualified research because of the credit. In addition, Cox found that some of the most research-intensive firms were able to claim either no credit or credits with a marginal effective rate that was half of the rate of the estimated credits claimed by firms with much lower research intensities.

The results showed that the credit was most beneficial to firms whose research intensities had grown since their base periods and least beneficial to whose research intensities had changed little or not at all or had shrunk since their base periods. Firms whose research intensities had diminished found themselves in that position for two reasons: (1) their R&D spending was lower in 1994 relative to their base period; or (2) their sales revenue had grown faster than their R&D expenditures over the same time span.

Critics of the current research credit maintain that such a pattern of R&D subsidization is unfair and arbitrary, has no justification in economic theory, and undercuts the central purpose of the credit, which is to encourage firms to spend more on R&D than they otherwise would in an effort to bolster their international competitiveness. Cox noted that the widely varying marginal effective rates of the research credit realized by R&D-performing firms "imply that society places a higher value on adding R&D at certain firms than at others and on adding R&D of certain types than others, when little or no basis for such different valuations exists."[24]

Two primary causes of the credit's disparate incentive effects are the 50% rule and the rule requiring established firms to use a fixed base period of 1984 to 1988 in computing their fixed-base percentages. This period bears no relationship to current

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[22] CRS Report 96-505, *Research and Experimentation Tax Credits: Who Got How Much? Evaluating Possible Changes*, by William A. Cox, pp. 5-10. (The report is out of print. Copies may be obtained from Gary Guenther (202) 707-7742 upon request.) (Hereafter cited as Cox, *Research and Experimentation Tax Credits*.)

[23] Their effective credit rate was lower because each firm was subject to the 50-percent rule, which reduced the marginal effective rate of the credit on R&D spending above the base amount by 50%.

[24] Cox, *Research and Experimentation Tax Credits*, p. 10.

economic or competitive conditions in a number of industries. As a result, many of the firms that have existed since the early 1980s and invested heavily in R&D relative to revenue back then now face a vastly altered set of incentives to invest in R&D; in some cases, the new set of incentives has resulted in much lower research intensities. Firms in this position could not expect to claim the R&E tax credit, even though they still spend substantial sums on R&D.[25]

Weak Incentive Effect. In claiming that the credit's incentive effect is too weak, critics have in mind both the credit rate necessary to raise business R&D investment to socially optimal levels and the difference between the regular credit's statutory rate and its average marginal effective rate. Both aspects of this policy issue are discussed here.

Some critics maintain that the typical marginal effective rate of the credit is too low to boost business R&D investment to levels commensurate with its potential spillover benefits. Another CRS report by Cox on the R&E tax credit examined this issue in depth.[26] In his view, tax incentives can rectify the private sector's predisposition to invest too little in the creation of new technical knowledge and know-how. For this to happen, the incentives must be designed so that they apply only to R&D investments in excess of what firms would undertake in the absence of a subsidy, and they must be large enough to "raise private after-tax returns on R&D investments to the level that would result from applying the same rate of taxation to the social rate of return from R&D."[27] As Cox correctly noted, various researchers have concluded that the median private rate of return on R&D investment is roughly 50% of the median social rate of return.[28] Thus, assuming that the average social pre-tax rate of return is double the average private pre-tax rate of return, the optimal R&D tax subsidy would seek to double the private after-tax rate of return to R&D investment. For example, at a corporate tax rate of 35%, after-tax returns would equal 65% of pre-tax returns for firms organized as corporations. In this case, the optimal R&D tax subsidy would double the private after-tax returns to R&D investment by elevating them to 130% of pre-tax returns [2 x (1 - 0.35)], in effect subsidizing private pre-tax returns by 30%.[29]

Cox's analysis seems to imply that the optimal average effective rate for a R&D tax subsidy or a combination of such subsidies (e.g., a research tax credit combined with expensing of research expenditures) is around 30%. But this implication comes with a caveat: namely, the gap between private and social returns varies

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[25] Two examples are aerospace and semiconductor chip manufacturers. See McGee Grisby and John Westmoreland, "The Research Tax Credit: A Temporary and Incremental Dinosaur," *Tax Notes*, vol. 93, no. 12, Dec. 17, 2001, p. 1633.

[26] See CRS Report 95-871, *Tax Preferences for Research and Experimentation: Are Changes Needed?*, by William A. Cox. (This report is out of print. Copies may be obtained from Gary Guenther at (202) 707-7742 upon request.) (Hereafter cited as Cox, *Tax Preferences for Research and Experimentation*.)

[27] Ibid., p. 8.

[28] See, for example, Edwin Mansfield, *The Positive Sum Strategy*, pp. 309-311.

[29] Cox, *Tax Preferences for Research and Experimentation*, pp. 7-8.

considerably among R&D projects and may shift over time. One implication of this variability and instability is that a R&D tax subsidy rate of 30% would provide excessive subsidies for projects with below-average spillover benefits and insufficient subsidies for projects with above-average spillover benefits. Policymakers should be aware that "this imprecision is unavoidable, and its consequences are hard to assess."[30]

How do existing tax subsidies for R&D investment compare with Cox's estimate of the optimal R&D tax subsidy rate? Cox provided an answer. To assess the incentive effect of these subsidies, he estimated the pre-tax and after-tax rates of return under then-current tax law for a variety of hypothetical R&D projects. The projects differed according to the proportion of R&D expenditures for depreciable assets like structures and equipment, the proportion of R&D expenditures eligible for both expensing under IRC section 174 and the R&E tax credit, and the economic lives of the intangible assets arising from the investments. Cox was seeking to compare the combined effect of expensing and the credit on after-tax returns to investment in capital-intensive, intermediate, and labor-intensive R&D projects yielding intangible assets with economic lives of three, five, 10, and 20 years.[31]

Expensing has the effect of equalizing the pre-tax and after-tax rates of return on an investment, as it imposes an effective marginal tax rate of zero on the income earned by affected assets.[32] In other words, if the full cost of an asset is expensed, its after-tax returns are equal to 100% of pre-tax returns. But only part of the full cost of an R&D investment qualifies for expensing, as it does not apply to tangible depreciable assets like structures and equipment. As a result, the effect of expensing on a R&D investment's after-tax rate of return depends on both the proportion of the total cost accounted for by structures and equipment and the effective tax rate on income from those assets.

At the same time, the R&E tax credit, which magnifies the tax benefits of expensing, raises after-tax returns only on qualified research expenditures above a base amount for those firms able to claim it; the credit has no effect on the returns to other research expenditures. So its effect on after-tax returns to R&D investment depends on both the share of a project's cost accounted for by structures, equipment, and overhead items and the effective tax rate on income from those depreciable assets.

After allowing for these limitations on the incentive effects of expensing and the research tax credit, Cox estimated that in the presence of these tax incentives, median

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[30] Ibid., p. 9.

[31] In the case of capital-intensive projects, 50% of outlays go to structures and equipment, 35% qualify for expensing and the credit, and 15% qualify for expensing alone. In the case of intermediate projects, 30% of outlays go to structures and equipment, 50% qualify for expensing and the credit, and 20% qualify for expending alone. And in the case of labor-intensive projects, 15% of outlays go to structures and equipment, 65% qualify for expensing and the credit, and 20% qualify for expensing only.

[32] See Jane G. Gravelle, "Effects of the 1981 Depreciation Revisions on the Taxation of Income from Business Capital," *National Tax Journal*, vol. 35, no. 1, Mar. 1982, pp. 2-3.

after-tax rates of return ranged from 101.0% of pre-tax returns for a capital-intensive project yielding intangible assets with an economic life of 20 years to 124.7% for a labor-intensive project yielding intangible assets with an economic life of three years.[33] These results led him to conclude that existing R&D tax subsidies did not increase private after-tax returns to R&D investments to the "levels warranted by the spillover benefits that are thought to be typical" for these investments.[34]

By contrast, critics tend to view the credit's incentive effect from the perspective of the difference between its average effective rate and its statutory rate of 20%. This difference stems from three of the rules governing the use of the credit discussed earlier. One of the rules is the basis adjustment, which requires that any credit claimed be subtracted from the deduction for research expenditures under IRC section 174. The adjustment has the effect of taxing the credit at a firm's marginal income tax rate. At the maximum corporate and individual tax rates of 35%, the basis adjustment lowers the marginal effective rate of the credit from 20% to 13%. A second rule is the so-called 50% rule, which requires that a firm's base amount for the credit be equal to 50% or more of its current-year qualified research expenses. The firms affected by this rule are established firms whose ratios of current-year qualified research spending to gross income are more than double their fixed-base percentages or whose current-year ratios are more than double the 16% cap on the fixed-base percentage, and start-up firms whose current-year ratios exceed 6% or are more than double their ratios during the transitional period. For these firms, the rule further reduces the marginal effective rate of the credit to 6.5%. Yet another rule affecting this rate is the exclusion of outlays for R&D-related equipment, structures, and overhead from expenses eligible for the credit, even though these outlays are a component of the total cost of most R&D projects. The effect of the rule on the marginal effective rate of the credit depends on the proportion of the cost of an R&D investment that is ineligible for the credit: as this share rises, the credit's marginal effective rate decreases. For example, if expenditures for physical capital and overhead constitute half of the cost of an R&D investment, then the marginal effective rate of the credit for the entire investment is half of what it would be if the entire cost were eligible for the credit.

Would increasing the credit's average effective rate lead to a significant improvement in its incentive effect? Again, Cox's 1995 report points to an answer. Fundamentally, there are two ways to increase the credit's marginal effective rate. One is to retain its current statutory rate but to modify one or more of the three rules causing the credit's marginal effective rate to fall short of its statutory rate. The second approach is to retain these rules but to increase the credit's statutory rate.

Cox assessed the impact of both approaches on after-tax rates of return for the same set of hypothetical R&D investments discussed above. In the case of labor-intensive R&D projects, he estimated that under existing R&D tax preferences, median after-tax returns were 124.7% of pre-tax returns for projects yielding intangible assets with an economic life of three years and 115.5% for projects yielding intangible assets with an economic life of 20 years. If the basis adjustment

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[33] Cox, *Tax Preferences for Research and Experimentation*, p. 15.

[34] Ibid., p. 17.

for the R&E tax credit were eliminated, median after-tax returns increased to 146.0% of pre-tax returns for assets with a three-year economic life and 130.1% for assets with a 20-year economic life.[35] A similar gain in the credit's incentive effect also resulted from increasing the statutory rate of the credit to 25% but retaining existing rules such as the basis adjustment: median after-tax returns for assets with a three-year economic life were an estimated 133.9% of pre-tax returns and 121.9% for assets with a 20-year economic life.[36] But increasing the rate to 25% and removing the basis adjustment led to the biggest boost in after-tax returns relative to pre-tax returns: 165.8% for assets with a three-year economic life and 143.4% for assets with a 20-year economic life.

If it is true that the optimal R&D tax subsidy produces after-tax returns equal to 130% of pre-tax returns, then Cox's analysis suggests that leaving the credit's statutory rate at the current level of 20% but removing or relaxing the rules governing the credit's use may be the best available option for enhancing the credit's incentive effect.

Non-Refundable Status

The R&E tax credit is non-refundable, which means that only firms with positive federal income tax liabilities may benefit from it in the same year in which it is claimed. In addition, the credit is part of the general business credit (GBC) and therefore subject to its limitations. For firms investing in qualified research, a key limitation is that the GBC cannot exceed a taxpayer's net income tax liability, less the greater of its tentative minimum tax under the alternative minimum tax or 25% of its regular income tax liability above $25,000. Unused GBC's may be carried forward 20 years or carried back one year. While having tax credits to apply against future tax liabilities is desirable in some ways, there is no certainty the credits will be used before they expire.

Critics of the current credit say that the credit's non-refundable status is an important policy issue because of its implications for the viability of small research-intensive firms. In recent decades, a number of successful technological innovations have originated with small start-up firms. Many such firms spend substantial sums on R&D even though they lose money in their first few years of existence. In the view of critics, the credit's non-refundability decreases their chances for survival because it effectively removes the credit as a possible source of needed funding for R&D projects. Of course some small start-up firms do end up growing into large, innovative, and profitable enterprises, but only if they can raise enough capital to survive during the crucial early years. If the credit were made wholly or partially refundable, any firm investing in qualified research would have more funds to invest in R&D, regardless of tax status.[37]

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[35] Ibid., p. 27.

[36] Ibid., p. 27.

[37] For further discussion of the possible benefits to small firms of making the credit wholly or partially refundable, see Scott J. Wallsten, "Rethinking the Small Business Innovation (continued...)

Unsettled and Inadequate Definition of Qualified Research

Yet another policy issue raised by the current R&E tax credit is lingering uncertainty among firms conducting R&D over how the IRS will implement final regulations it issued in December 2003 on the definition of qualified research and significant gaps in those regulations. Critics point out that this uncertainty undermines the efficacy of the credit and inflates the cost of administering it. Persistent questions about what research does and does not qualify for the credit may deter some firms from claiming it and may encourage others to re-classify certain activities to make them eligible for the credit. And the uncertainty sets the stage for costly, time-consuming legal disputes between business taxpayers and the IRS over whether claims for the credit are valid.

From 1981 through 1985, research that qualified for expensing under IRC section 174 also qualified for the credit, with three exceptions: the credit did not apply to research conducted outside the United States, research in the social sciences or humanities, or research funded by another entity. Responding to numerous complaints that this definition was being interpreted too broadly by business taxpayers, Congress tightened the definition in the Tax Reform Act of 1986 by adding two tests.[38] Under the act, qualified research still had to satisfy the criteria for qualified research under section 174. But in addition, the research had to serve the purpose of discovering information that is technological in nature and useful in the development of a new or improved product, process, or some other kind of intellectual property with commercial applications. What is more, "substantially all" of the research had to be part of a process of experimentation aimed at developing a new or improved function, performance, or quality for a product or process. The act also directed the Treasury Department to issue regulations clarifying the new tests.

Nearly 12 years passed before the IRS issued proposed regulations on the definition of qualified research in December 1998. A key issue addressed by the proposal was what it meant to discover information "which is technological in nature." Most of the comments on the proposed regulations received from tax practitioners and business taxpayers were highly critical of a number of the positions taken by the IRS. In response, the agency released a revised final set of regulations in December 2000 (T.D. 8930). But about a month later, the Treasury Department issued a notice (Notice 2001-19) suspending those regulations, requesting further comment "on all aspects" of them, promising a careful review of all questions and concerns raised about the suspended regulations, and pledging to issue any changes to the final regulations in proposed form for additional comment.[39] In December 2001, the IRS fulfilled the pledge by releasing a another set of proposed regulations (REG-112991-01) addressing some of the chief concerns expressed about the

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[37] (...continued)
Research Program," in *Investing in Innovation*, Lewis M. Branscomb and James H. Keller, eds. (Cambridge, MA: MIT Press, 1998), pp. 212-214.

[38] See P.L. 99-514, Section 231.

[39] Sheryl Stratton, "Treasury Puts Brakes on Research Credit Regs; Practitioners Applaud," *Tax Notes*, vol. 90, no. 6, Feb. 5, 2001, pp. 713-715.

withdrawn regulations. Tax practitioners generally responded favorably to the proposal.[40]

On December 30, 2003, the IRS published final regulations (T.D. 9104) in the *Federal Register* clarifying the definition of qualified research.[41] The regulations made some important changes to previous guidance, although they also made it clear that the IRS shall not challenge positions taken by taxpayers that were consistent with the final regulations issued in previous years.

Under T.D. 9104, information is considered technological in nature if the process of experimentation used to discover the information draws on the principles of physical or biological sciences, engineering, or computer science. In addition, the regulations specified that it is no longer necessary for taxpayers to demonstrate that the information "exceeds, expands, or refines the common knowledge of skilled professionals in the particular field of science or engineering in which the taxpayer is performing the research" in order for the information to be considered technological in nature.

The regulations also clarified the meaning of a process of experimentation. Basically, the process must embrace three elements. The first is uncertainty about the outcome. The second is the identification of a variety of alternative approaches to eliminating this uncertainty. And the third element is the use of certain methods for evaluating these alternatives (e.g., modeling, simulation, and a systematic trial-and- error investigation).

One lingering source of uncertainty in the definition of qualified research not addressed in the regulations was the eligibility for the credit of expenditures to develop internal-use software. In proposed regulations issued in 2001, the IRS stated that costs incurred to develop such software were eligible for the credit only if the software was intended to be unique or novel and to differ in a "significant and inventive" way from previous software. The meaning of "significant and inventive" has been a source of controversy between IRS examiners and taxpayers. The final regulations offer no guidance on this question.

The definition of gross receipts for an affiliated group of companies also remains uncertain. Such a definition is critical to the determination of a business taxpayer's base amount for the credit. Contradictory rulings by the IRS on this matter have caused confusion for some U.S.-based multinational corporations with majority-owned foreign subsidiaries.[42]

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[40] For more details on the latest set of proposed regulations and reactions to them in the business community, see David Lupi-Sher and Sheryl Stratton, "Practitioners Welcome New Proposed Research Credit Regulations," *Tax Notes*, Dec. 24, 2001, vol. 93, no. 13, pp. 1662-1665.

[41] Alison Bennett, "IRS Issues Final Research Credit Rules With Safe Harbor For Qualified Activities," *Daily Report for Executives*, Bureau of National Affairs, Dec. 23, 2003, p. GG-2.

[42] Annette B. Smith, "Continuing Uncertainty on Research Credit Definition of Gross (continued...)

Inefficient Targeting of R&D With Large Social Returns

Another concern about the credit relates to its efficacy in spurring increased investment in R&D projects yielding large spillover benefits, or its "bang for the buck." Some critics question whether an additional dollar of the credit leads to more investment in R&D with relatively high social returns, on average, than an additional dollar of direct government spending on basic or applied research.

For many, an advantage of the credit over direct spending is that private companies, not the federal government, choose which R&D projects end up receiving the subsidy. Firms claim the credit for projects they decide to fund, and the federal government ends up covering as much as 20% of the cost above a base amount.[43] The tax subsidy permits market forces to determine which projects are funded, and many believe that such an approach is more likely to promote valuable diversity in the search for new technical knowledge and knowhow than a direct subsidy such as federal R&D grants.

But others say that the current credit does a poor job of targeting R&D projects with large external benefits. While there are no data to verify this claim, it does have a modicum of plausibility. Business managers and owners are motivated to earn the highest possible return on investment for their firms. Consequently, in selecting R&D projects to pursue, they are likely to assign a higher priority to projects with favorable odds of generating substantial profits for their firms than to projects likely to yield greater social returns than private returns. Such a predilection is apparent in recent data on domestic industrial R&D expenditures. In 1999, according to data collected by the National Science Foundation, U.S. industry spent a total of $160.3 billion on R&D, of which 9% went to basic research, 20% to applied research, and 71% to development.[44] This distribution raises the distinct possibility that the credit, to the extent that it is claimed, mainly subsidizes R&D projects with relatively modest social returns. Some would modify the design of the credit to give firms a stronger incentive to invest in basic or applied research than development activities. Options include re-defining qualified research so that it encompasses basic and applied research only and altering the basic research credit so that it applies to basic

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[42] (...continued)
Receipts," *Tax Adviser*, vol. 35, no. 7, July 1, 2004, p. 407.

[43] Joseph E. Stiglitz, *Economics of the Public Sector* (New York: W.W. Norton, 2000), p. 348.

[44] National Science Foundation, Division of Science Resource Studies, *Research and Development in Industry: 1999*, NSF 02-312 (Arlington, VA: 2002), table A-28, p. 86. For industry, the NSF defines basic research as "original investigations for the advancement of scientific knowledge ... which do not have specific commercial objectives, although they may be in fields of present or potential interest to the reporting company;" applied research as "research projects which represent investigations directed to the discovery of new scientific knowledge and which have specific commercial objectives with respect to either products or processes;" and development as "the systematic use of the knowledge or understanding gained from research directed toward the production of useful materials, devices, systems or methods, including design and development of prototypes and processes," but excluding quality control, routine product testing, and production.

research undertaken by a business taxpayer and has a higher statutory rate than the regular R&E tax credit.

In evaluating this criticism, it is important to keep in mind that the federal government has long served as a major source of funding for basic research performed in the United States. In 1997, for example, the federal share of spending for this purpose was 52%, compared to 28% for industry. The federal role partly reflects a broad recognition among policy analysts and lawmakers that firms are likely to invest less in basic research than applied research or development because of the greater uncertainty surrounding the expected returns on investment in basic research.

Legislation in the 109th Congress to Change the Research Tax Credit

The research tax credit has enjoyed broad bipartisan support since its inception, and there is no evidence that this support has waned in the current Congress.

Four bills to extend permanently the research tax credit have been introduced in the 109th Congress: H.R. 1454, H.R. 1736, S. 14, and S. 627. Two of them have attracted substantial bipartisan backing: H.R. 1736 and S. 627.[45] Moreover, the tax reconciliation bills passed by the House (H.R. 4297) and the Senate (S. 2020) would extend the current credit by one year, through the end of 2006.[46]

In addition, H.R. 1736, H.R. 4297, S. 14, S. 627, and S. 2020 would raise the three rates for the AIRC to 3%, 4%, and 5%. The three bills would also establish a new alternative research tax credit — known as the "alternative simplified credit" — that would be equal to 12% of a firm's spending on qualified research in a tax year above 50% of its average qualified research expenditures in the three previous tax years; for firms that did not have qualified research expenditures in one or more of the preceding three tax years, the credit would be equal to 6% of qualified research expenditures in the current tax year. Finally, under S. 14, payments for contract research made to certain small firms, universities, and federal laboratories would be eligible for the credit; and S. 2020 would make payments made to private research consortia eligible for the credit.

In its budget request for FY2006, the Bush Administration proposes a permanent extension of the research tax credit.

An important consideration (some would say insuperable barrier) in deciding whether to extend or enhance the credit is the projected revenue cost of doing so. A large and growing federal budget deficit has raised concern over this cost and is

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[45] As of April 18, 2005, there were 11 co-sponsors of the bill: five Democrats and six Republicans.

[46] There are significant differences between the two bills that will need to be resolved through a conference committee before a bill can be sent to the President for his signature.

making it more difficult for Congress to pass legislation addressing perceived problems with the current credit. The Bush Administration estimates that a permanent extension of the credit would result in a revenue loss of $76.225 billion from FY2006 through FY2015. Obviously, the projected revenue loss would be greater if the design of the credit were altered to improve its incentive effect.

Table 4 summarizes the provisions of bills in the 109th Congress that would modify the credit.

Table 4. Bills in the 109th Congress to Extend or Modify the R&E Tax Credit

Bill Number	Provisions Related to the Credit
H.R. 1454	Permanently extends the regular, alternative incremental, and basic research credits.
H.R. 4297 and S. 2020	Extends the regular, alternative incremental, and basic research credits one year, through the end of 2006.
S. 14	Extends the regular, alternative incremental, and basic research credits permanently. — Raises the three rates of the alternative incremental credit to 3%, 4%, and 5%. — Creates an alternative simplified credit equal to 12% of qualified research expenses in excess of 50% of the taxpayer's average qualified research expenses in the three previous tax years, and 6% of qualified research expenses in the current tax year for taxpayers with no qualified research expenses in one or more of the three previous tax years. — Modifies the credit so that it applies to payments to research consortia, which are defined as tax-exempt organizations dedicated to the conduct of research that are not private foundations and have at least five "unrelated" paying members, not one of which accounts for more than 50% of the total research budget for the organization in a calendar year. — Makes 100% of amounts paid to eligible small firms, universities, and federal laboratories for contract research eligible for the credit.
H.R. 1736, H.R. 4297, S. 627, and S. 2020	Permanently extends the regular, alternative, and basic research credits. — Raises the rates of the alternative incremental credit to 3%, 4%, and 5%. — Creates an alternative simplified credit equal to 12% of qualified research expenses above 50% of the taxpayer's average qualified research expenses in the three previous tax years, and 6% of qualified research expenses in the current tax year for taxpayers with no qualified research expenses in one of more of the three previous tax years.
S. 2020	Makes 100% of amounts paid to private research consortia eligible for the credit.

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Source: Congressional Research Service