Tax Incentives for Research & Development: Policy Design and Evidence

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1. INTRODUCTION

In 2024, U.S. businesses spent $824 billion on Research and Development. This represents 16 percent of all U.S. private fixed investment, and 76 percent of total U.S. R&D spending. Roughly one-third of this investment was either basic or applied research ("R") directed towards the production of new knowledge, and the remainder was experimental development ("D") that applies existing knowledge to novel commercial problems.[1]

Although these private R&D investments are substantial, economic theory and evidence suggests that they remain far below the socially optimal level (Bloom et al 2013; Lucking et al 2022). This is because the knowledge produced by R&D investment resembles a public good. Individual firms may seek to protect their knowledge by keeping it secret or relying on intellectual property rights, but these mechanisms typically have limited usefulness – most innovations are quickly copied, and new knowledge is often applied to problems that an R&D performing firm did not anticipate. The resulting knowledge "spillovers" create a gap between the private and public benefits of R&D investment, and this gap implies that private incentives to invest are too low.

Several types of government policy can address private under-investment in R&D. One approach is to select projects and fund them directly, either through government agencies or grants to labs and universities. A second more market-oriented approach is to grant intellectual property rights, market exclusivity, or other types of guaranteed demand that increase the

[1] Aggregate spending is from Bureau of Economic Analysis (FRED). Including software development costs in R&D roughly doubles total spending to around 30 percent of all private fixed investment. The breakdown between "R" and "D" is from the NSF Science and Engineering Statistics for 2022.

private benefits of R&D investment. This approach allows for decentralized project selection by firms and individuals, who may have better information about the costs and benefits associated with a particular line of research, but also creates market power that can undermine the knowledge spillovers that justify any sort of policy intervention. A third approach that can preserve the benefits of decentralized decision-making, without introducing market power that might undermine knowledge spillovers, is to reduce the costs of private R&D through subsidies like tax incentives.

This chapter reviews the economic theory and evidence on the effectiveness of R&D tax incentives. Although we draw upon evidence from around the world, we place particular emphasis on U.S. firms and policies. Section 2 provides an overview of how tax credits work in theory and discusses some salient accounting issues. Section 3 reviews the empirical evidence on effectiveness of R&D tax credits. Section 4 describes the structure of the U.S. R&D tax credit, and its evolution from 1981 through the most recent changes in the Tax Cuts and Jobs Act of 2017. Section 5 concludes by discussing how the R&D credit interacts with other features of the corporate income tax system, and offers some informed speculation about ways to simplify the current scheme.

This chapter is not meant to be a comprehensive review. We focus on the federal tax credit and say little about the numerous state-level R&D tax incentives that have been adopted. We also limit our attention to tax policies that target expenditures rather than research outputs, such as the "IP Boxes" that have been proposed or adopted in several jurisdictions (Gaessler, Hall and Harhoff 2019). We will also refrain from discussing the closely related issue of "tax competition" between jurisdictions hoping to attract business activity to their region through more generous tax treatment of R&D (e.g., Wilson 2009). Likewise, we avoid the topic of "place based" initiatives that aim to stimulate local economic activity and that may have tax and R&D related components.

2. Tax Credits in Theory

The standard economic model linking tax policy to investment decisions was developed Robert Hall and Dale Jorgenson (1967). The basic idea behind their model is to convert the cost of any capital expenditure from an up-front payment, such as the cash paid to purchase a new building, into a rental or "user" cost. In the simplest case, this user cost is just the real interest rate – which a firm could have earned by investing its cash in a risk-free asset – plus the rate of depreciation on the underlying asset.

When applying the Hall and Jorgenson model to R&D investments, the relevant asset is the intangible stock of knowledge that a firm relies upon to produce its products and services. This knowledge capital differs from tangible assets, such as machines and equipment, in several important ways. First, investment in R&D is generally riskier than investment in tangible assets, because there is no guarantee that a particular investment will lead to improved products or services. Second, it is difficult to pledge a firm's knowledge as collateral, which can make it harder to find bank financing for R&D than for tangible assets. And third, when R&D investments do succeed, the underlying stock of knowledge does not wear out in the manner of tangible capital. Instead, the knowledge stock depreciates as other firms catch up to an innovator and the insights generated by its past R&D become commercially obsolete.[2]

With these caveats in mind, the Hall and Jorgenson model provides a useful framework (and relatively simple formula) for studying how taxes and tax-credits affect the cost of investment. The formula is

$$\text{User Cost} = \underbrace{(r+\delta)}_{\substack{\text{Pre-tax} \\ \text{User Cost}}} * \underbrace{\frac{[1-u*t*\{1+A\}-C]}{1-t}}_{\text{B-ind}ex}.$$

The first part of this formula, $(r+\delta)$, is the pre-tax user cost, which equals the real interest rate plus the depreciation rate, as described above. The second part of the formula is the tax-cost of R&D, or the "B" (for break-even) index. The B-index is equal to the after-tax cost of $1 of

[2] Hall (2007) summarizes several difficulties with estimation of this depreciation rate, and notes that in practice, many authors assume a figure of 15 percent.

R&D, divided by one minus the corporate tax rate. It has four components: the tax rate t, the depreciation schedule u, tax allowances A, and tax credits C.

To understand how taxes affect the R&D user-cost, it helps to begin by considering a scenario where R&D investments are expensed immediately (u=1) and there are no tax credits or allowances (A=0 and C=0). In that case, the B-index equals one, so the tax rate has no impact on the user cost. Intuitively, increasing the tax rate in this scenario makes an R&D investment less costly today (by increasing the value of the deduction from the current tax bill) and reduces the value of future earnings by the same amount. When investments are amortized instead of expensed, so u<1, the R&D user cost increases because some of the benefits of the deduction are deferred. For tax accounting purposes, most countries set u=1 and allow all R&D expenditures to be expensed, although (as described below) the U.S. changed this policy starting in 2018 as part of the TCJA.[3]

Tax credits and allowances both reduce the tax-cost of R&D, though in different ways. Tax credits reduce the user cost by allowing firms to deduct a portion of their R&D investment called the credit rate, C, from their tax bill. Because the credit rate is subtracted directly from taxes owed, its impact on the B-index does not depend upon the tax rate. However, many countries do not allow firms to "double dip" by claiming a credit on the portion of R&D that is deducted from their current tax bill.[4] Allowances (also known as "super-deductions") increase the pre-tax cost of investment by a percentage, A, called the allowance rate. The impact of allowances on the B-index will depend on the tax rate, because they work by shrinking pre-tax profits (i.e., the tax base) instead of directly reducing tax liability.

[3] For financial accounting purposes, U.S. Generally Accepted Accounting Principles (GAAP) calls for immediate expensing all R&D expenditures except for the purchase of long-lived assets, such as equipment, that may have alternative uses (ASC-730-10-25). This rule has specific provisions for other types of intangibles such as software and artistic works. Under International Financial Reporting Standards (IFRS), research is expensed while development expenditures may be capitalized starting from the point where technical feasibility is established.

[4] This is equivalent to multiply the credit rate by $1 - t$, so that in a setting where R&D is fully expensed (u=1), the B-index simplifies to $(1 - C)/(1 - t)$.

Before considering the empirical evidence on R&D tax credits, it is worth noting a few practical considerations that are not captured by the Hall and Jorgenson framework. First, their model focuses on a single firm that is always profitable. In actuality, some firms lose money, and tax credits generally have no impact on firms with no tax liability. Policy could address this in a few ways. The most common is to allow firms to allocate a share of operating losses into future years (a "carryforward") or prior years (a "carryback") so that they pay tax on average profits over a multi-year period. In some cases, credits and allowances may also be refundable, which means that they can be converted to cash or deducted from other types of tax liability (e.g. payroll or Medicare tax) that do not depend on profitability.

Second, although the major benefit of the Hall-Jorgenson formula is its "universal" applicability, there are reasons why some firms may benefit more than others from tax policies directed at R&D. While there are many potential sources of heterogeneity, the most frequently discussed is scale. The distribution of R&D expenditures is heavily skewed towards large firms, and tabulations from the IRS Statistics of Income indicate that corporations with gross receipts exceeding $250 million claim more than 85% of federal research credits. Given the amount of money involved, these firms may be more likely to overcome the fixed cost of establishing sophisticated tax-planning capabilities that help them take advantage of tax credits. Large firms may also be more likely to achieve steady profitability. At the same time, smaller firms may find it harder to access external finance – particularly for investments in intangible assets – making R&D credits relatively more valuable to these firms as a means of relaxing capital constraints.

3. Evaluating R&D Tax Credits

While economists have expended considerable effort to assess the impacts of R&D tax credits, there are several persistent challenges that any evaluation must still confront. Foremost is the basic question of what to measure. Ideally, we would like to measure the size of the gap between private and social returns to the marginal investment. While there is considerable evidence that R&D generates substantial knowledge spillovers, it is quite difficult to measure their value. So instead, most studies measure either the "user cost elasticity" (i.e., the percentage change in R&D investment for each percentage change in the tax credit) or the "additionality ratio" (i.e., the dollars of additional R&D investment caused by the credit, divided by the amount of forgone tax revenue).

The user cost elasticity captures firms' sensitivity to the tax cost of R&D. The additionality ratio, which is sometimes referred to as the "bang for the buck" measure, captures the cost of each dollar of incremental R&D. The two measures are clearly linked – firms must be sensitive to the tax cost of R&D for a dollar of subsidy to generate at least a dollar of private investment.[5] But it is important to note that an R&D credit may be economically efficient even if the additionality ratio falls below one. In particular, a government might subsidize R&D that generates substantial spillovers even if the cost of the subsidy is greater than the cost of the research.[6] The welfare comparison should also account for the feasibility of directly funding the type of projects that private firms pursue, and the relative costs of using direct subsidies (i.e., grants or procurement) as compared to a tax credit.

Studies that seek to measure the effectiveness of R&D tax credits typically estimate a regression model where the outcome is R&D expenditure – by either a firm, an industry or a country – in a given year. As explanatory variables, the model usually includes the user cost of R&D along with a set of other controls. Variation in the user cost typically comes from policy changes, which have been plentiful in the US and elsewhere (e.g., Hall et al 2000).

Early studies using macro-economic or industry-level data (Bailey and Lawrence 1992; Swenson 1992; McCutchen 1993) typically used simple measures of credit availability or generosity. This approach benefits from simplicity, but at a substantial cost in precision, given that the credit can affect even firms in the same industry quite differently. Firm-level studies have become more common with the increased availability of administrative data. Firm-level data allow more

[5] It can be shown that, for a volume-based credit, the additionality ratio is strictly less than (the absolute value of) the user cost elasticity.
[6] For example, if the cost of an investment is $10, the private benefits are $4 and the social benefits are $20 then the government should be willing to offer a $6 tax credit to induce $4 of private investment.

precise measurement of both qualified expenditure and the tax-cost of R&D, but raise a new problem: the credit rate on the marginal dollar of R&D investment is often a function of the firm's R&D expenditure. This introduces a statistical challenge that economists call "simultaneity" or reverse-causality.

For example, suppose that the tax credit is 20 percent on the first $100 in R&D expenditure and zero for all expenditures above $100. This policy should lead firms that planned to spend less than $100 on R&D before the credit to invest a bit more, and should have no impact on firms that initially planned to spend more than $100. However, a simple regression of R&D expenditure on the firm-specific marginal credit rate (i.e., 20 percent below $100, and zero above) will find a negative correlation between those two variables – suggesting that the policy discourages investment – because the credit is *designed* to phase out at higher levels of R&D. Researchers have developed several strategies to circumvent this problem. One method is to construct "synthetic tax rate" instrumental variables that capture variation in the credit rate produced by policy changes, but do not incorporate variation associated with firms' contemporaneous investment decisions. Another approach is to leverage changes in policy that lead to differential treatment for similar firms, such as an enhanced credit rate for firms that fall just below a size threshold.

Table 1 summarizes a number of recent studies that measure the impact of R&D tax credit policies using firm level data and modern econometric tools for solving the simultaneity problem. The first two rows in the table cite a pair of literature reviews that each take a somewhat broader perspective than our selection of papers. Both literature reviews conclude that the user-cost elasticity is roughly one (so a 10 percent change in the tax credit rate leads to 10 percent increase in R&D expenditure) and that the additionality ratio is also close to one (so tax expenditures are roughly equal to the amount of induced R&D). The bottom part of the table focuses on a set of firm-level studies.

All of the individual studies that we reviewed conclude that tax credits do stimulate R&D investment. There is considerable variation, however, in the size of the relationship, which may reflect differences in both measurement strategy and policy design. For example, the third column shows that some studies use accounting data from Compustat, while others rely on data from national R&D surveys or tax authorities. In our modest sample of papers, the estimated impact of the tax credit appears to be larger for studies that use administrative tax data, perhaps because these papers have less measurement error on both R&D expenditure (e.g. because qualifying expenditures differ from R&D as reported in financial statements) and the user cost of R&D, which is difficult measure without tax data. Studies of the U.S. credit also find larger effects, although those papers all use data that is now over thirty years old.

Table 1 also indicates that studies focused on smaller firms (e.g. Agrawal et al 2020; Dechezlepretre et al 2023) tend to find larger user cost elasticities. Many authors have suggested that smaller firms are more responsive to the credit because their financing options are more constrained than those for larger firms. Appelt et al (2025) use firm level data from a large number of OECD countries and focus explicitly on the differential responsiveness of small and large firms. The smallest size group in their study is almost three times more responsive than the large firms that account for the bulk of expenditures.[7] This fact has significant implications for the additionality ratio, because most tax expenditures are focused on the least responsive firms. Appelt et al suggest that the overall elasticity of R&D expenditure to the tax price is around -0.6, which is substantially less than what many firm-level studies suggest. They also provide evidence that the larger response among smaller firms is related to financing constraints. In general, these results (and the broader literature) suggest that policies targeting small firms (e.g. through ceilings, preferential rates, payroll withholding tax credits or refundability) may increase the effectiveness of a R&D tax policy.

[7] They also show that "uptake" of R&D tax incentives tends to increase with R&D expenditures and the scale of the benefit, as one would expect.

Table 1: Firm-level Estimates of R&D Tax Credit Effects

	Country	Data Source	Sample	User Cost Elasticity	Incrementality Ratio
Surveys					
Hall and Van Reenen (2000)				~1.0	~1.0
Parsons and Philips (2016)				~1.0	0.98 to 1.3
Papers					
Hall (1993)	USA	Compu-stat	~1,000 Mfg Firms 1980-1991	1.0 to 1.5	2.0
Hines (1993)	USA	Compu-stat	116 US Mulitnationals 1984-1989	1.2 to 1.6	1.3 to 2.0
Rao (2016)	USA	Tax	IRS Statistics of Income 1981 to 1991	2.0	1.8
Appelt et al (2025)	OECD	R&D Surveys	14 countries 2000 to 2021	Small = 1.4 Medium = 1.2 Large = 0.5	0.66
Guceri & Liu (2019)	UK	Tax	~3,000 small firms[1] 2002 to 2011;	1.6	Small = 1.5 Large = 1.0
Dechezlepetre et al (2023)	UK	Tax	5,700 small firms[4]	4.1	2.3
Lokshin & Mohnen (2012)	Netherlands	Survey	~150 firms 1996 to 2004	0.6 to 0.8	Small = 3.2 Large = 0.8
Mulkay & Mairesse (2013)	France	Survey	2,782 firms 1996 to 2007	0.4	0.7
Agrawal et al (2020)	Canada	Tax	7,239 small firms[2] 2000 to 2007	0.7 to 4.6	n/a
Kasahara et al (2014)	Japan	Survey	3,400 Mfg firms[3] 2000 to 2003	0.9[5]	n/a

[1]UK defines SMEs less than and Sales below 40 million Euros; [2]Very small firms with average revenue of $1.2M; [3]Manufacturing sector firms with more than 50 employees and at least 30M Yen in Assets; [4] This is the same SME definition and data set as Guceri and Liu, but a different research design. [5]This estimate is a semi-elasticity

The studies in Table 1 all focus on R&D expenditure. This approach has several shortcomings that have been highlighted elsewhere in the empirical literature. One obvious issue is that expenditure differs from output. For example, Goolsbee (1998) suggests that if the supply of scientists and engineers is relatively inelastic, then the effects of increasing government support for R&D may be to increase wages rather than output. On other hand, studies that use patents as a proxy for innovation output generally find that patenting increases with R&D, and that the implied R&D cost per patent are in line with the broad range of estimates in the literature.

Another problem with the emphasis on expenditure is that it does not account for differences in the composition of R&D spending. In general, firms spend considerably more on development than on basic and applied research, presumably because the latter types of projects are riskier and require more time to complete. For the same reasons, we might think basic and applied research is the area where tax subsidies should be targeted. Rao (2016) provides some evidence that U.S. firms do target R&D investments that qualify for tax credits, as opposed to other types of spending that may qualify as R&D under financial accounting rules. But there is relatively little evidence to suggest whether qualified expenditures actually produce more spillovers than other types of R&D.

Finally, there is a concern that increases in R&D expenditure could reflect "relabeling" of unrelated spending for tax benefits. Chen et al (AER 2021) study this issue in the context of a relatively large Chinese R&D tax subsidy. They show that firms near notches in the tax credit rate do relabel other types of expenditure as R&D.[8] Overall, they estimate that around one quarter of reported R&D is relabeled. However, they also find that the policy produces improvements in firm productivity and would be welfare improving under reasonable assumptions about the magnitude of spillover benefits. We view these estimates as a likely upper bound on the prevalence of relabeling in settings where tax incentives are weaker and auditing institutions more robust.

4. Evolution and Design of the U.S. R&D Tax Credit

The U.S. Research and Experimentation Credit was introduced in 1981 as part of the Economic Recovery Tax Act (ERTA). At the time, sluggish economic growth, stalling productivity, and mounting concerns over foreign competition helped generate bipartisan support for legislation to promote business investment.

The ERTA subsidized corporate research by lowering effective tax rates on intangible capital through two channels. First, Section 174 of the Internal Revenue Code (IRC) allowed firms to deduct Qualifying Research Expenditures (QREs) directly from their taxable income.[9] Second, IRC Section 41 provided a Research and Experimentation tax credit, which directly reduced tax

[8] Agrawal et al (2019) use a similar approach fail to reject the null hypothesis of no relabeling.
[9] This corresponds to setting u=1 in the User Cost formula described in Section 2.

liabilities on a dollar-for-dollar basis.[10] The net subsidy from the two provisions was reduced by recapture rules that prevent "double-dipping" (i.e., deducting the full pre-tax cost of R&D while also receiving a tax credit). [11] Henceforth, we refer to the combined effect of Section 174 deductions and the Section 41 tax credit as the "U.S. R&D Tax Credit."

The remainder of section examines three key design features of the U.S. R&D Tax Credit: the types of expenditures that qualify; the base to which the credit applies; and special provisions that extend the credit to smaller firms. Over the credit's 45-year history, these features have undergone significant revisions, each impacting the subsidies available to firms.

To screen private research spending for the types of activities most likely to generate knowledge spillovers, the federal government uses a four-part test. The 1986 extension of the research credit refined this scope to include only those activities fundamentally linked to innovation and technical progress, excluding routine activities like quality control or other post-production functions. R&D investments must satisfy the following criteria to be QREs and eligible for federal subsidies:

1. **Permitted purpose**: The activity must aim to create a new or improved business component, such as a product, process, technique, formula, or invention, resulting in enhanced performance, function, reliability, or quality.
2. **Technological nature:** The research process must fundamentally rely on principles of the physical or biological sciences, engineering, or computer science.
3. **Elimination of uncertainty:** The organization must have faced technological uncertainty at the outset when designing or developing the business component.

[10] Firms that are not profitable can carry forward any net operating losses resulting from Section 174 deductions indefinitely to offset up to 80% of taxable income in a future year while Section 41 tax credits can be carried back one year or forward up to 20 years. Section 41 credits began as a temporary provision and were not made permanent until 2015.
[11] This reduction to prevent double-dipping is sometimes called “basis adjustment”, though firms also had the option of reducing the R&D credit by the corporate tax rate. From 1989 to 2017, firms had to reduce their deduction by first half, then the full R&D credit amount.

4. **Process of experimentation**: The activity must involve a process of experimentation, featuring systematic trial and error, testing various alternatives, and exploring different options or hypotheses to achieve the desired result.

Under these criteria, eligible spending spans both "R" and "D" activities as defined, for example, by the Frascati Manual (OECD 2015). Thus, development activity that applies existing knowledge to create or significantly improve products, processes, or software, are as eligible for the subsidy as basic research activities focused on investigating and discovering new knowledge. However, if "D" activities offer more limited knowledge spillovers compared to more fundamental "R" work, this equivalence may not align with the basic economic principle of subsidizing activities in proportion to their positive externalities.[12] On the other hand, research conducted after a product or process is commercially available does not qualify for the subsidy, nor do expenditures on routine testing, product adaptation, quality control, maintenance or product aesthetics. QREs also exclude any research activities conducted outside of the U.S. and its territories.[13]

The U.S. R&D tax credit does not apply to eligible investments. Instead, it operates as an incremental credit, subsidizing only QREs above a firm-specific base. Specifically, the Section 41 credit formula is equal to the product of the credit rate and the *difference* between a firm's total QREs and its base. The idea behind this approach is to enhance the cost-effectiveness of research incentives by subsidizing only marginal R&D spending (i.e., beyond what a firm would have spent in the absence of a credit). In principle, targeting marginal investment can produce

[12] Mezzanotti and Simcoe (2025) also provide evidence that firms' Research expenditures are more sensitive to changes in the cost of capital than their Development expenditures, which suggests a further rational for targeting "R" with larger subsidies than "D."

[13] The definition of QREs does not necessarily align with U.S. GAAP, with the results that R&D spending as reported in financial filings may not provide an accurate gauge of a firm's QREs. Software development expenses are treated similarly to Section 174 expenditures, but do not necessarily qualify for the Section 41 credit. In particular, software developed for internal use must pass a three-part test to determine whether it is (i) innovative, (ii) not commercially available and (iii) constitutes a significant economic risk.

the same incentive effects as a volume-based credit that applies to all R&D spending, but with a lower revenue cost. In practice, defining the base rate can be challenging.

Initially, the base for the U.S R&D tax credit was the greater of the firm's average nominal QREs over the prior three years or one-half of current QREs. This design renders a firm's marginal credit rate a non-monotonic function of its research spending: firms below their base receive no subsidy, those spending between 100% and 200% of their base receive the full statutory subsidy rate, and firms exceeding twice their base receive half the statutory credit rate on their marginal spending.

Although a moving average base is straightforward to calculate and may have the appeal of feeling like an intuitive measure of typical research spending, it has several drawbacks. Each dollar spent on R&D in the current year contributes to a firm's base for the next three years, raising the threshold for future tax credits, and ultimately reducing the incentive to increase R&D expenditures. The original incremental credit with a moving-average base even left some firms with negative credit rates. To address these issues, the Omnibus Budget Reconciliation Act of 1989 replaced the moving-average calculation with a base formula tied to historic research spending. Under that system, the base was determined by multiplying the firm's average gross receipts by a "fixed-base percentage," defined by its historical research intensity from 1984 to 1988.[14] This approach also has tradeoffs, as historical measures of research intensity can become less relevant for firms that undergo mergers, acquisitions, or changes in business lines.

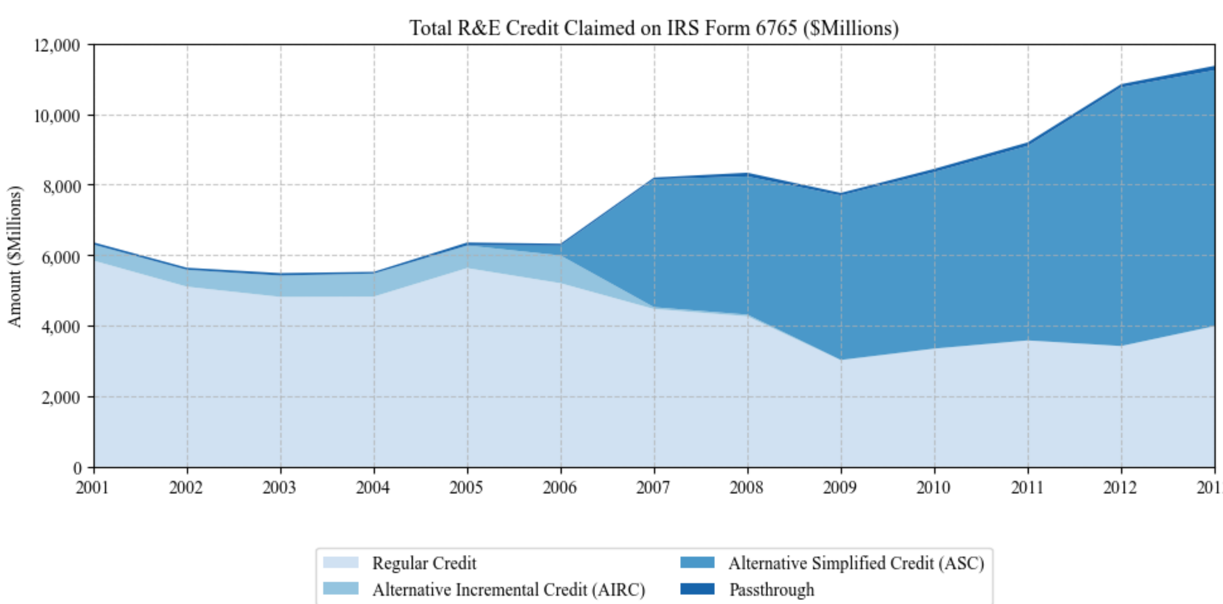
While the U.S. has stuck with an incremental design for R&D credits, other countries have opted instead for volume-based R&D subsidies. This type of credit offers a straightforward incentive structure that is easier for businesses to understand and for governments to administer. Canada, for example, offers a 15% subsidy for eligible research activities (35% on

[14] Start-ups and firms lacking gross receipts or QREs for three years of the 1984-1988 period were assigned a fixed-base percentage of 3%.

the first $3 million of research spending), while France offers a 30% credit for research spending up to €100 million. Volume-based credits can be more predictable and more valuable for companies with steady R&D spending patterns, as they avoid pitfalls associated with maintaining or exceeding a specific spending baseline. This can be particularly advantageous for startups or firms with significant R&D investments that might not increase incrementally year over year. However, substantial volume subsidies can be costly for governments, as they apply to all R&D expenses, regardless of past spending levels.

Today, the U.S. still uses a historic base for the regular R&D credit but offers an Alternative Simplified Credit (ASC), which reverts to a moving-average base despite its inherent disincentives. Currently, the ASC offers a 14% subsidy for QREs that exceed 50% of a firm's average QREs from the previous three tax years, or a 6% subsidy for firms without three prior years of QREs. While reverting to a moving average base simplifies credit calculations, it also means that today's research spending raises future base amounts. Figure 1 shows the rapid growth in use of the ASC between 2006 and 2013 (the most recent year of IRS data), which suggests that these dynamic disincentives remain a significant feature of the U.S. R&D tax credit.

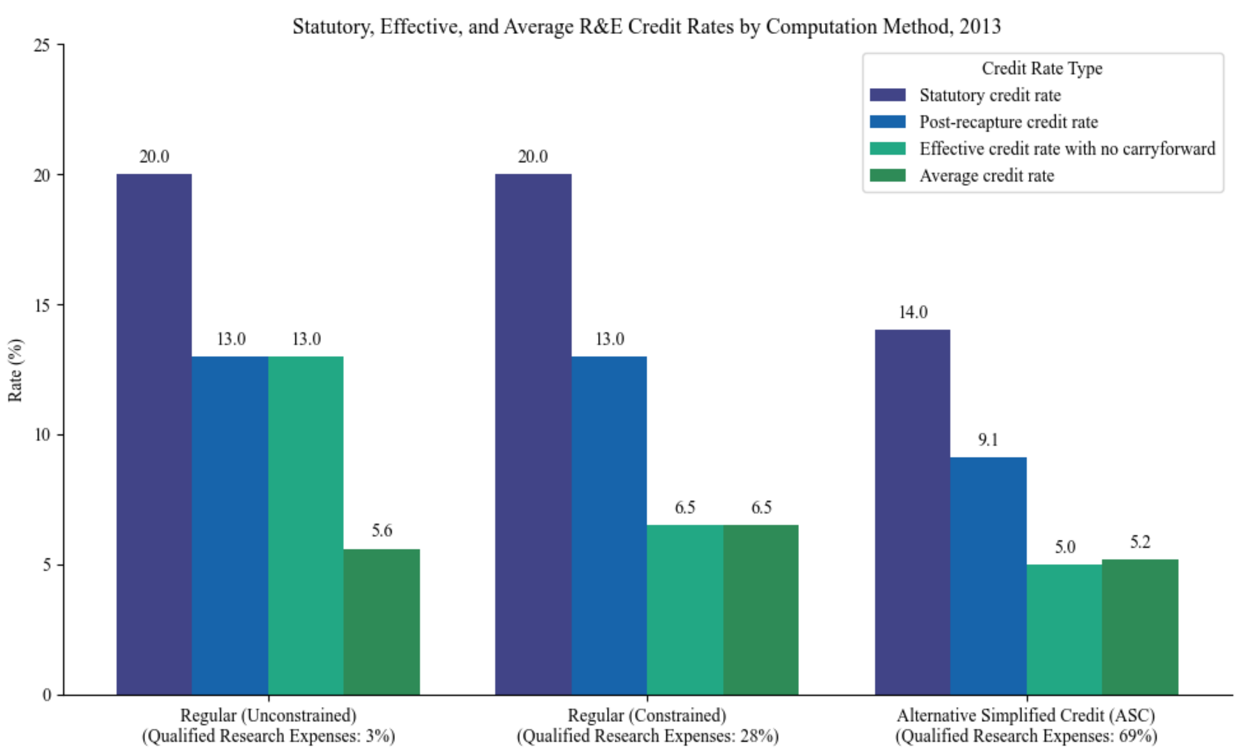
Figure 1: R&E Credit Claims by Credit Type, 2001-2013



Source: IRS SOI data; reproduction of Figure 5.5 of Hall (2022).

Figure 2 uses data from 2013 to illustrate how the credit rate interacts with the incremental base and the recapture provisions to determine an effective credit rate. The leftmost bars correspond to firms using the regular credit with a base that is greater than half of current QREs (this rule applied for just 3 percent of all QREs). For these firms, the statutory rate of 20 percent is reduced to 13 percent through recapture, given the 35%, the corporate tax rate. For “constrained” firms with current QREs more than twice as large as the regular base, the effective rate is 6.5 percent. The rightmost bars correspond to the 69 percent of all 2013 QREs claimed under the ASC. For those firms, accounting for the impact of current QREs on future bases reduced the effective credit rate from 9% to 5.0%, with similar impacts likely today. It is worth noting that, after factoring in the various provisions that restrict the use of both the regular credit and the ASC, average credit rates were similarly quite low, ranging from just 5.2% to 6.5% -- a fraction of the headline rates of 20% and 14%.

Figure 2: Statutory, Effective and Average R&E Credit Rates by Type



Source: US Department of Treasury (2016).

In 2017, the Tax Cuts and Jobs Act (TCJA) eliminated the recapture provisions. At the same time, however, TCJA reduced the value of Section 174 deductions by requiring that, starting in 2022, firms amortize QREs over five years instead of expensing them. According to estimates from the Congressional Research Service, the net impact of these two changes is a slight reduction in the overall subsidy for R&D from $0.193 to $0.18 per dollar of R&D investment.[15]

To broaden the reach of the credit, the U.S. also has introduced special research subsidies for qualified smaller business.[16] Beginning in tax year 2016, for example, qualified small businesses (with gross revenue less than $5 million) gained the option to apply the R&D tax credit against their payroll tax liabilities, effectively making the credit partly refundable. This provision enables startups and companies with minimal or no corporate income tax liability to benefit from the R&D credit. The deduction was initially capped at $250,000 in annual payroll tax liability, and that cap was increased to $250,000 in 2022 through the Inflation Reduction Act.

5. The Future of the Research Credit

With average federal research credit subsidies falling to less than half of the statutory rates, lawmakers may seek to strengthen the R&D tax credit's ability to incentivize innovation investment. Interactions between the research credit and federal tax code provisions can meaningfully curtail the financial incentives for firms. For example, General Business Credit (GBC) limitations that cap the total value of credits a firm is allowed to claim may reduce marginal research credit rates, and multinational firms face additional constraints due to foreign income taxation. Revisiting these limitations as part of the TCJA extension could better align effective credit rates with policy objectives. Additional policy reforms such as adopting a

[15]https://crsreports.congress.gov/product/pdf/IF/IF12815#:~:text=The%202017%20tax%20cut%2C%20commonly,change%20took%20effect%20in%202022.

[16] Between 1996 and 2008 firms could opt to apply for Alternative Incremental Research Credit (AIRC). Under the AIRC, firms earned credits based on their research spending relative to average gross receipts over the prior four years: a credit of 1.65% for QREs between 1% and 1.5% of gross receipts, 2.2% for QREs between 1.5% and 2%, and 2.75% for QREs exceeding 2%. The AIRC primarily benefitted firms whose research intensity had declined since the 1980s. The AIRC lasted until 2008 with subsidy rates eventually rising to 3% to 5%.

simpler volume-based credit system and increasing refundability for small firms can further improve effective credit rates and strengthen incentives for private research spending.

Originally designed to streamline and target federal business tax credits like the research credit and low-income housing credit, GBC claims are limited to 75% of a firm's tax liabilities, with excess credits available for carry-back or forward.[17] While curbing tax credit overuse is important, these limits might reduce innovation incentives, especially when profitability is low. Relaxing these restrictions, potentially by removing the R&D credit from the GBC, could sustain subsidies when firms would most benefit from reduced financing constraints.

Furthermore, international tax reforms like the OECD's global minimum tax and the U.S.-specific Base Erosion Anti-Abuse Tax (BEAT) pose challenges by potentially limiting research credits for firms facing minimum taxes. While firms facing BEAT liabilities were initially allowed fully claim any earned R&D tax credits; starting in 2026 the research credit will be disallowed in BEAT liability calculations, sharply reducing incentives for U.S.-based R&D for multinationals subject to the BEAT. The global trend towards patent boxes highlights the lure and risks of international tax competition, necessitating a careful balance between measures to counter base erosion and sustaining U.S. innovation investments. Along with returning to expensing rather than amortizing R&D expenditures, revising this BEAT interaction will be a key consideration for innovation policy in the TCJA debate.

Low effective research subsidies in the U.S., compared to more favorable international policies, may also prompt Congress to consider more fundamental reforms to innovation tax subsidies. Simplifying the credit to a lower-rate, volume-based model might improve accessibility and effectiveness, as actual credit rates often fall short of statutory ones. Expanding payroll tax deductibility for smaller firms could spark innovation among those facing higher barriers to entry and growth. Finally, maintaining IRS Statistics of Income (SOI) data to track and report

[17] To calculate the GBC limit taxpayers add their net income tax and alternative minimum tax, subtract the greater of their tentative minimum tax or 25% of their regular tax liability over $25,000. For most firms this amounts to a limit of 75% of their regular tax liability. Excess credits can be carried back one year or forward 20 years.

research credit usage is crucial for transparency and accountability, aiding researchers and policymakers in assessing the credit’s impact on economic development and innovation.

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