The Consequences of Limiting the Tax Deductibility of R&D

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Abstract

We study the tax payment and innovation consequences of limiting the tax deductibility of research and development ("R&D") expenditures. Beginning in 2022, U.S. companies are required to capitalize and amortize R&D rather than immediately deduct these expenditures. We utilize variation in U.S. firms' fiscal year ends to test the effects of the R&D tax change in a difference-in-differences framework. We first document that affected U.S. firms' cash effective tax rates increase by 11.9 percentage points (62%), on average. We then test and find decreases in R&D investment among domestic-only, research-intensive, and constrained firms. In aggregate, these estimates translate to a reduction in R&D of $12.2 billion in the first year among the most research-intensive firms. Further, we observe decreased capital expenditures and share repurchases among affected companies, suggesting that firms also reduced other types of investment and shareholder payout to meet the increased cash tax liability. The paper provides policy-relevant evidence about the significant real effects of limiting innovation tax incentives.

Keywords: R&D, Tax Incentives

JEL Codes: H25, M41, M48

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1 Introduction

This paper provides initial evidence on the consequences of limiting the tax deductibility of research and development (R&D) expenditures on investments in innovation. Innovation is a key determinant of long-term economic growth (e.g., Solow 1957; Romer 1990), and therefore most countries provide tax incentives to stimulate innovative activities (e.g., EY 2023). For decades, the U.S. tax code permitted companies to receive immediate tax benefits for investment in innovation via the R&D tax deduction. However, in 2022, the U.S. tax law changed to require firms to capitalize and amortize R&D expenditures for tax purposes. This change substantially reduces the present value of the tax benefit. We identify hundreds of U.S. public companies affected by this change and quantify \$45 billion of impacted tax benefits among these firms in the first year alone. We find that, in response, the most research-intensive companies in our sample cut R&D investment by \$12.2 billion in 2022.

Governments provide R&D tax incentives because firms underinvest in innovation due to its risky payoff structure (Arrow 1972). The U.S. provides two main tax incentives for innovation: the R&D credit and the R&D deduction. Though prior literature focuses predominantly on the U.S. R&D credit (e.g., Berger 1993; Hall 1993; Klassen et al. 2004; Finley et al. 2015; Rao 2016), the tax benefits of the R&D deduction are much greater: using public IRS statistics, we estimate that the aggregate annual tax savings from the R&D deduction are *twice* as large as those from the R&D credit. This difference arises because the U.S. R&D credit only applies to a subset of R&D expenditures, whereas a broader range of expenses qualify for immediate deduction.[1] Given the economic benefits of the R&D deduction, U.S. companies have expressed concerns about the potential effects of the 2022 R&D tax law change on U.S. competitiveness. For example, in a November 2022 letter to the U.S. Congress, Chief Financial Officers of 178 large U.S. companies, including Ford

[1]The U.S. R&D credit can only be claimed for *qualifying incremental* expenses that exceed a firm-specific base. The credit is also only available for certain types of research. Section 2 compares the technical details of the U.S. R&D credit to the deduction.

Motor Co., Raytheon Technologies Corp, Lockheed Martin Corp, and Boeing Co., warned, "Unfortunately, the current playing field is tilted against the U.S., and every day this policy continues to be in place makes it harder for the U.S. to remain a global leader in innovation" (WSJ 2022). Indeed, at the same time this change decreased U.S. R&D tax benefits, other countries increased their innovation tax incentives (EY 2023).

Under the new R&D capitalization and amortization requirement (hereafter "R&D capitalization" or "R&D change"), instead of immediately deducting 100% of R&D costs as the tax law historically allowed, U.S. companies must now capitalize and amortize R&D investment over a period of five years.[2] In practice, this means that firms will deduct 10% of the cost in year 1, 20% in years 2 through 5, and the remaining 10% in year 6. While the total *nominal* value of deductions is the same over time, the *real* value of the tax benefits is lower due to the reduced present value. Figure 1 and Appendix A depict that, for the average firm in our sample, the present value of cumulative tax benefits received for R&D deductions over the amortization period (assuming constant R&D spending) is only *half* the value that would have otherwise been received under the previous immediate expensing regime.

This stark change in the tax deductibility of U.S. companies' R&D expenditures provides a rare opportunity to study the effect of the R&D tax deduction on innovation. Specifically, this setting provides two main benefits. First, it is plausible that firms will respond to the change given its salience and magnitude. Second, the change was relatively isolated from other tax policy changes. This was the first large change in the U.S. R&D tax deduction since its inception in 1954. Unlike the R&D tax credit, which was plagued by uncertainty (Hoopes 2018), the R&D deduction has been a stable part of the U.S. tax code.[3] Furthermore, even though the change was included in the 2017 Tax Cuts and Jobs Act (TCJA) primarily to

[2]The law also requires U.S. firms to capitalize and amortize foreign R&D investment over 15 years. This requirement applies to R&D expenses incurred in foreign operations for purposes of any income computations or reporting on a U.S. tax basis. Examples of affected calculations include computations of global intangible low-tax income (GILTI), Subpart F, and foreign tax credits (RSM 2023). The U.S. R&D change does not impact the R&D tax treatment in the foreign country.

[3]After decades of repeated lapses and temporary extensions, the U.S. R&D tax credit was finally made permanent by the Protecting Americans from Tax Hikes (PATH) Act of 2015.

raise revenue to offset the costs of other TCJA provisions, the implementation was delayed until 2022. Thus, the effective date was sufficiently later than the initial years of the TCJA, as well as the height of the COVID-19 pandemic. Given the lack of confounding earlier events *specific to this policy*, we can more confidently attribute any observed economic impact to this tax policy change.

Our primary research question is whether the R&D tax change reduces R&D investment. Economic theory predicts that increases in tax burdens decrease capital investment spending (Hall and Jorgenson 1967), with prior work adapting this theory to the R&D setting (Rao 2016). Prior research examining changes in the timing of other tax deductions (i.e., depreciation on capital investments) documents sizeable effects on corporate investment due to present value differences such as those introduced through the R&D change (e.g., Zwick and Mahon 2017; Ohrn 2019; Garrett et al. 2020; Curtis et al. 2022). In addition to economic theory and prior empirical research, anecdotal evidence suggests that businesses may indeed respond to the tax law change by cutting R&D.[4] We make two predictions. First, we predict U.S. companies' decrease R&D investment in response to the tax law change. Second, we predict that the effects of the tax law change will be greatest among constrained firms, whose ability to finance R&D investments is most impacted by the increased after-tax cost of R&D.

Despite clear theoretical predictions and prior empirical evidence on the importance of tax deductions in capital investment decisions, there are four reasons why the R&D capitalization requirement may not affect U.S. companies' R&D investment. First, substantial policy uncertainty may impede firms' responses (e.g., Guceri and Albinowski 2021; Gallemore et al. 2024). The actual implementation of the change was largely unexpected. Many in both the policy and business communities expected the capitalization requirement to be changed or repealed before it actually took effect (e.g., Bloomberg 2023; WSJ 2023b; WSJ 2023d). Even with bipartisan Congressional agreement that R&D capitalization should be reversed,

[4]As one example, Moderna Inc.'s CFO Jamey Mock cautioned, "The recent change in research and development capitalization rules will require a greater use of short-term cash and could place some pressure on the amount that innovative, research-based companies can invest over time" (WSJ 2023a).

Democrats and Republicans were unable to enact legislation prior to the effective date (e.g., WSJ 2023c; WSJ 2023d). Consequently, the change caught many firms by surprise, reducing their ability to plan for and subsequently react to the change.[5] To the extent companies expected R&D capitalization to be reversed before their taxes were due for the 2022 year, they would not have incorporated the tax law change into their R&D investment decisions. A second reason firms may not respond by cutting R&D is that they may compensate for the increased after-tax cost of R&D through other means, such as decreasing capital expenditures, taking on additional debt, or reducing payouts to shareholders. Third, some prior work finds limited effectiveness of R&D tax policies (e.g., Wilson 2009; Rao 2016), suggesting that the reduced tax benefits may not alter companies' investments. Finally, high R&D adjustment costs may delay any real spending effect beyond the period we study (e.g., Hall and Lerner 2010).

We employ a difference-in-differences research design that exploits variation in U.S. firms' fiscal year ends by comparing affected U.S. December fiscal-year-end firms (whose fiscal years ending in December 2022 were the first impacted by R&D capitalization) to U.S. firms with fiscal years ending in September, October, or November 2022 (who were not yet affected by the change). We identify 577 affected firms based on hand-collected financial statement deferred tax asset (DTA) disclosures specifically related to this tax change. In 2022, the average affected firm capitalized \$374 million of R&D, or an amount equivalent to 13.9% of total assets. To address concerns about differences between treatment and control firms, we (i) require all firms to engage in R&D activity, measured with financial statement disclosures, (ii) entropy balance treatment and control firms based on observable firm characteristics, and (iii) include firm- and event-year fixed effects that minimize the impact of other unobservable

[5]Consistent with the unexpected implementation of this change, the Bloomberg Editorial Board asserted: "If this [R&D capitalization] sounds foolish, that's because it was never intended to actually happen. Lawmakers scheduled the end of full expensing for R&D as one of many maneuvers to make budget numbers add up in outlying years... The law's designers expected policymakers to revisit the matter before any harm was done. Congress never got around to it" (Bloomberg 2023). As another example, Doyle Edwards, director of government programs for Brewer Science, admitted, "Our understanding was that Congress was going to find a way to fix it, so we really didn't plan for it" (WSJ 2023b).

differences across the two groups. Event-study plots confirm that the firms appear similar in terms of both pre-period tax payments and R&D investment.

Before testing our hypotheses, we quantify the impact of the R&D capitalization requirement on U.S. companies' tax payments. Coefficient estimates show that affected December fiscal-year-end firms report an 11.9 percentage point increase in cash effective tax rates ("ETRs"). This effect is equivalent to a 61.7% increase given the average cash ETR for treated firms of 19.3 percent. We perform three analyses to evaluate the reasonableness of this estimate. First, we compare these amounts to government estimates and firm disclosures, confirming that the estimate is in line with these other accounts (e.g., Joint Committee on Taxation 2017; Appendix B). Second, we prepare example calculations based on a representative firm in our sample (see Appendix C). These calculations illustrate how the move to R&D capitalization induces large changes in cash effective tax rates, validating the plausibility of the economic magnitudes. Finally, we use an alternative sample of December fiscal-year-end firms that engage in R&D activity but that do not specifically disclose being impacted by the law change to estimate a lower-bound. As expected, we observe a smaller, but still statistically and economically significant, average increase in cash ETRs of 6.3 percentage points (29.0% of the average cash ETR). Beyond establishing a range of magnitudes, these effects confirm that firms disclosing R&D capitalization DTAs are the most strongly impacted.

Next, we test our hypothesis regarding the impact of the R&D capitalization requirement on U.S. companies' R&D investments. We do not observe a significant decrease in R&D investment on average for affected firms relative to control firms after the tax law change. However, we observe decreased R&D investment among two important subsamples of firms that are most acutely affected by the R&D capitalization requirement: (1) domestic-only companies for which all R&D is subject to this tax law change and (2) research-intensive firms. Observing that the effects vary predictably among these subsamples is consistent with the effects being attributable to the 2022 R&D tax change and not to other policy or regulatory events. Among domestic-only firms, R&D investment decreased by 2.7% of assets ($13.2 million per firm, or $2.3 billion in aggregate for this subsample). For the most research-intensive firms whose average R&D is 33% of assets, the decline is 3.8% of assets ($58.8 million per firm). This is equivalent to 11.5% of these firms' average R&D, which is similar to estimates in Zwick and Mahon (2017) of firms' responses to bonus depreciation.[6] In aggregate for the most research-intensive firms, this represents a decrease in R&D of $12.2 billion in the first year alone. The aggregate impact across all firms in the economy is likely greater, when taking into account non-disclosing public firms affected by this policy, as well as private firms for which data are not publicly available to estimate the response.

Next, we test our second hypothesis regarding the stronger impact on financially constrained firms. Not only did constrained firms experience an increase in the after-tax cost of R&D similar to the domestic-only and research-intensive companies, but the sudden increase in cash taxes likely further hindered these firms' ability to actually fund R&D investments. We find that constrained firms decreased R&D expenditures by 2.5% to 9.2% of assets (or $2.7 to $356.8 million per firm, per year), depending on the constraint measure.

We conduct two additional analyses. While constrained firms cut R&D investment, unconstrained firms appear to largely sustain their innovation activity. This implies that unconstrained firms adjust along other margins to compensate for the increased tax payments triggered by R&D capitalization. Thus, we test the effect of the R&D change on other firm decisions and find that unconstrained firms reduce capital investment spending and share repurchases. We do not observe, however, that firms increase external borrowing, nor do they alter their dividend payout (as this is a less flexible form of shareholder payout than repurchases).

Second, we study the effect of this requirement on innovation quality. We separate firms

[6] Bonus depreciation accelerates tax deductions for specified capital expenditures. Zwick and Mahon (2017) find a 10.4% (16.9%) investment response to bonus depreciation between 2001 and 2004 (2008 and 2010).

based on several measures of innovation quality, including those engaging in "radical" versus "incremental" innovation, where radical innovation is identified as a patent application that does not cite a prior patent (Goldman et al. 2024). We fail to find a difference in the R&D investment effects across these subsamples, and with four other firm-level measures of patenting activity or innovative efficiency (Hirshleifer et al. 2013). While these tests provide an initial analysis of changes in R&D investment, we caveat that the firm-level measures used in the literature do not permit an analysis of within-firm changes made across a portfolio of projects (such as cutting incremental R&D projects). Consequently, it is difficult to evaluate the extent to which the foregone investments would have been value-increasing for firm stakeholders or society.

This paper contributes to the literature on the role of tax policy in innovation. Prior work on R&D tax incentives focuses on the R&D tax credit (Hall 2022) and largely ignores the R&D tax deduction. Glaeser and Lang (2023) conclude "how tax incentives affect innovation, and in particular the degree to which they affect real innovation production over shorter horizons, are open empirical questions" (pg. 60). We contribute to this literature by studying the tax deductibility of R&D and how restrictions on deductibility impact firms' investment responses in the short-term. In so doing, we shed light on a common, yet understudied, policy for incentivizing R&D and address the calls in Jacob (2022) and Lester and Olbert (2024) for research on the effect of tax base elements on investment behavior.

In addition, this paper provides timely, policy-relevant evidence of the impact of the R&D capitalization requirement on U.S. firms. This issue is of great concern to policy-makers, the media, and affected U.S. firms. R&D capitalization was included in the TCJA as an accounting maneuver to reduce the legislation's estimated cost. There is bipartisan agreement that the capitalization requirement should be repealed, and in January 2024, the U.S. House of Representatives passed legislation (the Tax Relief for American Families and Workers Act of 2024 (H.R. 7024)) that would reinstate immediate expensing for domestic

R&D expenditures through 2025 and provide retroactive relief (RSM 2024). Although the legislation was sent to the U.S. Senate in February, there has been no legislative action to advance the bill, and it is unclear when or if a vote will occur. Even if the current bill does become law, R&D capitalization had consequences for U.S. firms starting in 2022 that can not be fully unwound (WSJ 2024). We document the real economic costs of such legislative accounting maneuvers and of lawmakers' inability to take timely actions with respect to this policy.

2 Hypotheses

Theory shows that changes in taxation impact investment through changes in the after-tax user cost of capital (Hall and Jorgenson 1967; Rao 2016). Specifically, Hall and Jorgenson (1967) model two specific channels by which tax changes increase capital investment: (i) increased deductibility of investment and (ii) reduced tax rates on income earned from such investment. Rao (2016) extends this model to the R&D tax credit setting, confirming that these two channels also apply to innovation-related investment.

In line with this theory, governments provide two types of innovation tax incentives: *output*-based tax incentives (e.g., lower tax rates that apply to profits generated by innovation, such as patent box tax regimes) and *input*-based tax incentives (e.g., deductions and tax credits for R&D expenditures). Without such tax incentives, companies may otherwise underinvest in innovation because it is a risky type of investment with highly uncertain payoffs (Arrow 1972). Research on output-based R&D incentives generally finds that lower tax rates are associated with increased innovation (e.g., Akcigit et al. 2022; Atanassov and Liu 2020).

Our study focuses on *input*-based incentives for innovation. Broadly speaking, input-based incentives for innovation fall into two categories. The first, R&D tax credits, have been extensively examined in prior work. For example, the U.S. R&D tax credit is available for qualifying R&D spending in excess of a base amount, where the base amount is intended to approximate what the firm would spend on R&D in the absence of the credit.[7] Prior literature generally finds that the R&D tax credit is associated with greater R&D investment (e.g., Berger 1993; Hall 1993; Bloom et al. 2002; Klassen et al. 2004; Gupta et al. 2011; Finley et al. 2015). However, additional studies show that R&D tax credits largely affect R&D location decisions (Wilson 2009) and the type of R&D investments (Rao 2016), rather than motivating incremental R&D spending. Furthermore, the credit's complexity creates uncertainty over the expected value of the tax benefit (Towery 2017), reducing firms' willingness to claim the credit and, consequently, invest in additional R&D (Cowx 2024).

The second type of input-based innovation tax incentive is the tax deduction for R&D expenditures. This deduction permits firms to deduct many expenses that may not otherwise qualify for the R&D tax credit. For example, in the U.S., firms can deduct all experimental or laboratory costs related to the development or improvement of a product or process (I.R.C. 174; Deloitte 2023).[8] We estimate that, under the previous policy in place prior to 2022, the U.S. tax deduction for R&D confers approximately *twice* the tax benefits as the U.S. R&D tax credit.[9] Most other countries also permit immediate R&D expensing, with some jurisdictions even providing "super-deductions" equal to more than 100% of the R&D cost

[7]Qualifying R&D for purposes of the U.S. R&D tax credit consists of activities that pass a four-part test as defined by I.R.C. Sec. 41(d). This test requires R&D projects (1) to eliminate uncertainty (as defined by I.R.C. Sec. 174), (2) to discover previously unknown technological information, (3) for a new or improved business component, and (4) through a process of experimentation (such as a process through which hypotheses are formulated, tested, and subsequently refined).

[8]Unlike the R&D tax credit, firms must only meet part one of the four-part test (i.e., the elimination of uncertainty requirement) for expenses to qualify for the R&D tax deduction. Examples of qualifying expenditures include researchers' wages and benefits, contract research expenditures, wages of researchers' direct supervisors, costs of supplies, overhead expenses, depreciation on equipment, costs related to a pilot model, and software development expenses (RSM 2023).

[9]In 2020, prior to the tax law change, the total amount of R&D deducted on corporate tax returns was more than $268 billion. At a 21% statutory rate, this is equivalent to tax savings of $56 billion. By comparison, the total amount of R&D tax credit for 2020 was $25.6 billion. These amounts are based on the IRS Statistics of Income estimate of Schedule M-3, Part III, line 35 column (d) of research and development costs deducted per the tax return for Form 1120 filers, as well as estimates from Form 3800, Part III, line 1c for the credit for increasing research activities (Internal Revenue Service 2023). Prior to the 2022 tax change, U.S. taxpayers did have the option to elect to capitalize and amortize R&D expenses rather than immediately deduct the costs in the year incurred. We are unaware of public data to evaluate how prevalent this election was among corporate taxpayers, but practitioner guidance implies that it was rare (Weinberg and Eller 2022).

(EY 2023).

The ability to immediately deduct R&D expenditures decreases the after-tax present value cost of R&D investments and should encourage investment in innovation, consistent with the theoretical predictions. These benefits are analogous to the tax benefits provided by bonus depreciation, which allows firms to immediately deduct a significant portion (e.g., 30% to 100%) of the cost of certain tangible assets. Prior research on bonus depreciation shows that immediate expensing of capital equipment increases firms' investment spending. For example, Zwick and Mahon (2017) document a 10.4% (16.9%) investment response to the U.S. bonus depreciation available between 2001 and 2004 (2008 and 2010).

The recent U.S. tax change that we study substantially reduces the present value of R&D tax benefits. Appendix A provides an illustrative example to quantify this decrease. Assuming R&D spending of $410 million in year 1, which is the average amount for firms in our sample, and applying the U.S. corporate tax rate of 21%, the tax benefit from fully deducting these expenses as permitted prior to the tax law change would be $86.1 million ($410 million × 21%). In contrast, after the tax law change, only 10% of the R&D expenditures, or $41.0 million, can be deducted in the first year, with the remaining amount spread across the following five years. This change means that the tax benefit is only $8.61 million in the year of the R&D spending ($41.0 million × 21%). Figure 1(a) depicts the differences in the current period present value of R&D tax benefits for years 1 through 6.

While the difference in the annual present value is greatest in the first year, differences continue even in year 6, which is the point at which the nominal annual tax deductions under the old and new rules equalize, assuming constant R&D spending. Appendix A shows that, when incurring $410 million of R&D costs each year for six years, firms receive total tax benefits of $516.6 million under the prior immediate expensing rules ($410 million x 21% x 6 years). In contrast, under the new rules, the present value of the tax benefit is approximately *half* of this amount at only $262.6 million. Figure 1(b) depicts this cumulative present value difference in tax benefits.

Motivated by economic theory and prior empirical work, we state our first hypothesis in the alternative as follows:

H1: R&D investment declines in response to the U.S. requirement to capitalize and amortize R&D.

While this change applies to all U.S. firms investing in R&D, the large increases in cash tax payments should particularly impact financially constrained firms. Brown et al. (2009) provide evidence that internal cash flows and external equity are important sources of R&D financing. Prior work shows that the effect of tax changes on investment vary based on constraints (e.g., Zwick and Mahon 2017). Further consistent with this evidence, Atanassov and Liu (2020) find the positive effect of corporate tax rate cuts on innovation is stronger for financially constrained firms. We state our second hypothesis in the alternative as follows:

H2: R&D investment declines more for financially constrained firms in response to the U.S. requirement to capitalize and amortize R&D.

While theory and prior work provide clear support for these predictions, it is unclear *ex ante* that we will observe a decline in R&D investment after this tax change. First, in this setting, there is substantial policy uncertainty that could dampen firms' responses (Gallemore et al. 2024; Guceri and Albinowski 2021). Many companies expected Congress to change the tax law to preserve the immediate deductibility of R&D expenditures and thus did not plan for this change. Furthermore, as of July 2024, companies are continuing to actively lobby in support of legislation to retroactively restore the immediate deduction.[10]

While we expect policy uncertainty to be the most substantial source of tension for our hypotheses, there are three other reasons why firms may not respond to this change by cutting R&D. First, innovation is a key driver of future firm performance, and firms could

[10]In H.R. 7024, the Tax Relief for American Families and Workers Act of 2024, Title II, Section 201 entitled "Deduction for Domestic Research and Experimental Expenditures" includes the reinstatement of the R&D deduction. Specifically, Section 201(e)(1) provides for retroactive treatment by stating that "the amendments made by this section shall apply to amounts paid or incurred in taxable years beginning after December 31, 2021."

take other steps to compensate for the increased tax cost of R&D activity, such as raising outside capital, decreasing other expenditures, or decreasing payments to shareholders. Therefore, the increased tax cost of R&D may not lead firms to decrease their real R&D investments. Second, there is some mixed evidence as to whether R&D tax benefits actually induce incremental R&D spending (e.g., Wilson 2009). Thus, to the extent the R&D deduction subsidized innovative activity that would have occurred regardless of its tax treatment, we will not observe a decrease in R&D activity as a result of the requirement to capitalize and amortize R&D expenditures. Third, even if U.S. firms reduce their R&D investments, adjustment costs may result in delayed effects beyond the one-year window that we study.

3 Research Design and Data

3.1 Quantification of Tax Impact

We first quantify the extent to which the R&D change affects U.S. companies' tax liabilities, measured with effective tax rates. Our identification strategy exploits variation in the timing of the effective date of the R&D capitalization requirement by comparing affected U.S. December year-end firms to not-yet-affected U.S. firms with fiscal years ending in September, October, or November, following prior work (Gipper 2021). Specifically, U.S. December year-end firms were required to capitalize and amortize R&D for their 2022 fiscal year, but U.S. firms with fiscal years ending in September, October, or November 2022 were not yet required to capitalize and amortize R&D for their 2022 fiscal year. We estimate the following specification:

$$ETR_{it} = \beta_0 + \beta_1 \, Dec\ FYE\ Firm_i \times Post_t + ETR\ Controls_{it-1} + Fixed\ Effects + \epsilon_{it} \quad (1)$$

where ETR is the cash ETR (cash taxes paid divided by pre-tax income) or current ETR (current tax expense divided by pre-tax income). Both measures require positive pre-tax income. We trim observations with extreme ETR values that are less than zero or greater than one. The resultant measures, *Cash ETR* and *Current ETR*, are increasing in cash taxes paid and current tax expense, respectively.[11] Other variables are defined below and in Appendix D; event years are depicted in Appendix E. We include firm fixed effects to address cross-sectional variation in effective tax rates not otherwise captured by the control variables. We also include event-year fixed effects to capture the effects of macroeconomic events occurring during the sample period. All continuous variables are winsorized at the 1st and 99th percentiles. Standard errors are clustered at the firm level.

Dec FYE Firm is an indicator variable set equal to one if the firm has a December fiscal year end and is "affected" by the R&D capitalization requirement. We identify affected U.S. firms based on financial statement disclosures; specifically, we search firms' Forms 10-K for R&D keywords, and then research assistants review each disclosure to determine if the firm was, in fact, impacted by this tax law change. We retain only those firms that specifically disclose a deferred tax asset related to R&D capitalization.[12] Collectively, these requirements mean that our estimates likely under-state the aggregate economy-wide impact of the change because we employ relatively strict requirements to construct the sample of "treatment" firms.

Post is an indicator variable set equal to one for fiscal years ending in 2022. The firm and event-year fixed effects subsume the main effects of *Dec FYE Firm* and *Post*, respectively. The variable of interest is the interaction term *Dec FYE Firm* $\times$ *Post*. A positive and

[11]Because the R&D tax law change is not a permanent book/tax difference with respect to the total nominal deductions claimed, we expect less of an effect on the GAAP ETR and thus do not use this alternative measure. Appendix C provides an example of how this change affects a representative sample firm's Cash ETR, GAAP ETR, and the amount of R&D credit claimed.

[12]The keywords include capitalized development costs; capitalization of research and development, capitalized research and development, capitalized R&D, R&D capitalization, Section 174, and Sec. 174. Among the small number of firms with R&D-related deferred tax assets in the pre-period that were previously electing to capitalize and amortize R&D, we retain only those firms that report an *increase* in the deferred tax asset from 2021 to 2022. For these firms, we compute the DTA relating to the R&D capitalization change as the change in R&D DTA from 2021 to 2022.

significant β_1 coefficient indicates that affected U.S. firms paid higher cash taxes or incurred increased current tax expense in fiscal year 2022, relative to U.S. firms not yet subject to the R&D capitalization requirement (i.e., firms with fiscal years ending in September, October, or November).

ETR Controls is a vector of control variables shown to be associated with tax avoidance in prior literature (e.g., Hoopes et al. 2012; Dyreng et al. 2017), including firm size (*Log(Assets)*), firm age (*Log(Age)*), leverage (*Leverage*), loss firm status (*Loss Firm*), performance (*ROA*), sales growth (*Sales Growth*), market-to-book ratio (*MTB*), cash holdings (*Cash*), R&D (*R&D Investment*), capital expenditures (*Capex*), property, plant, and equipment (*PPE*), domestic-only operations (*Domestic*), foreign income percentage (*Foreign Income %*), and the presence of net operating loss carryovers (*NOL Indicator*). We measure all control variables in year t-1 to ensure that they are not impacted by the R&D change (Whited et al. 2022).

Controlling for observable characteristics and including firm fixed effects helps address endogeneity concerns related to differences in treatment and control firms. We further ensure treatment and control samples are comparable across observable dimensions by employing entropy balancing, where treatment and control observations are balanced across all control variables using the first two moments of the distribution (Hainmueller 2012; Hainmueller and Xu 2013).

3.2 R&D Investment Hypotheses

To test our first hypothesis that R&D investment declines in response to the U.S. R&D capitalization requirement, we estimate the following model:

$$R\&D\ Investment_{it} = \beta_0 + \beta_1\ Dec\ FYE\ Firm_i \times Post_t + Controls_{it-1} + Fixed\ Effects + \epsilon_{it} \tag{2}$$

where *R&D Investment* is the ratio of research and development expenditures as reported in a firm's financial statements to beginning-of-year total assets. We scale R&D by assets to account for cross-sectional differences in R&D spending due to firm size (e.g., Brown et al. 2009; Ljungqvist et al. 2017; Williams and Williams 2021). *Controls* is a vector of control variables intended to capture cross-sectional variation in firm characteristics associated with R&D investment decisions. Following prior literature (e.g., Ljungqvist et al. 2017; Li et al. 2021), we include *Log(Assets), Log(Age), Leverage, Loss Firm, ROA, Sales Growth, MTB, Cash, Capex, PPE, Domestic, Foreign Income %,* and *NOL Indicator*. The other variables are as defined previously, and we retain firm and event-year fixed effects. A negative and significant β_1 coefficient supports our hypothesis that U.S. R&D investment declines due to the R&D tax change.

To test our second hypothesis related to the heterogeneous effects of the R&D capitalization requirement due to financial constraints, we augment Eq. 2 as follows:

$$\begin{aligned} R\&D\ Investment_{it} = \beta_0\ &+ \beta_1\ Dec\ FYE\ Firm_i \times Post_t \\ &+ \beta_2\ Dec\ FYE\ Firm_i \times Post_t \times High\ Constraints_i \\ &+ \beta_3\ High\ Constraints_i \times Post_t + Controls_{it-1} + Fixed\ Effects + \epsilon_{it} \end{aligned} \quad (3)$$

where *High Constraints* is an indicator variable equal to one for constrained firms, and zero otherwise. Due to the documented limitations of financial constraints proxies (see, for example, Farre-Mensa and Ljungqvist 2016), we use several measures of constraints, including the Hadlock and Pierce (2010) size-age index, the Kaplan and Zingales (1997) KZ index, and the Altman (1968) Z Score. For each index, we construct an indicator variable (*High HP Index, High KZ Index,* and *High Z Score*, respectively) equal to one if the firm is in the top tercile of the financial constraint index in event year t-1, and zero otherwise.[13]

[13] When forming terciles to construct indicator variables, we use all available firm-year observations in Compustat with necessary data.

We also measure financial constraints using two firm-level characteristics: the indicator variables *Small* and *Young* are equal to one if the firm is in the bottom tercile of *Assets* or *Age* in event year t-1, and zero otherwise. Finally, *Negative OCF* is an indicator variable equal to one if the firm has negative cash flow from operations in event year t-1, and zero otherwise. This measure identifies those firms most impacted by an unexpected increase in cash tax obligations. A negative and significant β_2 coefficient implies a larger decrease in R&D investment for constrained treatment firms than for unconstrained treatment firms, relative to their respective control groups.

3.3 Data

Table 1 reports our sample selection procedure. We begin with all U.S. incorporated firms in Compustat North America with fiscal years ending January 1, 2019 through December 31, 2022. Starting the sample in 2019 ensures that the sample is not affected by the immediate impacts of the TCJA. We exclude observations with missing industry codes, observations in the financial and utilities industries (two-digit GICS of 40 or 55), and observations with missing data necessary to construct control variables. As our research question focuses on the effect of a U.S. tax policy change, we exclude firms with non-U.S. headquarters. We also exclude firms with fiscal years ending in January through August in line with our identification strategy. We require non-zero, non-missing R&D expense to calculate the dependent variable in Eq. 2 and 3, and as described above, we retain only those December year-end firms that disclose the impact of the R&D capitalization requirement. Finally, we require that each firm have requisite data for our tests in the year prior to the tax law change and the year of the tax law change (event years t-1 and $t = 0$, where the latter is the first year that the U.S. R&D capitalization requirement is effective for December year-end firms). This sample selection procedure results in 2,465 observations (672 firms) for the event window [-3,0].

3.4 Descriptive Statistics

Table 2 reports descriptive statistics for the variables used in our main analyses. Average R&D as a percent of assets (*R&D Investment*) is 15.0%. This value is higher than that reported in other R&D studies such as Ljungqvist et al. (2017) (5.3%) and Williams and Williams (2021) (2.7%), primarily because those studies include firms with zero values of R&D, whereas we require positive R&D for the empirical tests. For the 577 December year-end treatment firms, the average increase in the deferred tax asset related to the R&D tax change (Δ*R&D DTA*) is \$78.5 million, which is equal to 2.9% of total assets (Δ*R&D DTA / Assets*). In total, this represents \$45 billion dollars of deferred tax benefits; Figure 2 provides the amounts by industry.[14] We also estimate the gross pre-tax amount of R&D expenditures impacted by this change by dividing Δ*R&D DTA* by the U.S. statutory tax rate of 21%; average *Capitalized R&D* is \$374 million, or 13.9% of total assets (*Capitalized R&D/Assets*). *Capitalized R&D* exhibits substantial skewness, as the standard deviation of *Capitalized R&D* is \$1.3 billion. Average values of *Cash ETR* and *Current ETR* are 21.6% and 21.7%, respectively.

Table 3 reports descriptive statistics after partitioning the firm-year sample on the treatment indicator (*Dec FYE Firm*). Tests of differences in means indicate that affected December year-end firms and non-December year-end firms differ along several observable dimensions. After entropy balancing, the differences across treatment and control observations for all control variables are not statistically different from zero (untabulated).

[14]The \$45 billion amount is similar to the Joint Committee on Taxation ("JCT") estimates. The JCT projected this change would raise \$24.2 (\$32.9) billion for the fiscal year ending September 30, 2022 (2023) (Joint Committee on Taxation 2017), where the former (latter) amount reflects an estimate for nine months (a full year) during which the policy was effective.

4 Results

4.1 Effective Tax Rates

Table 4 reports results from estimating Eq. 1 to quantify the impact of R&D capitalization on tax burdens of affected U.S. firms. The dependent variables in Columns (1) and (2) are *Cash ETR* and *Current ETR*, respectively. Across both columns, the coefficient on *Dec FYE Firm* × *Post* is positive and significant. The coefficients translate to increased effective tax rates of 11.9 and 9.9 percentage points, respectively, for December fiscal year-end firms as compared to control firms. Relative to the sample means for affected December fiscal year-end firms (as reported at the bottom of the table), these magnitudes represent a sizeable 61.7% increase in *Cash ETR* (0.119 / 0.193) and 50.5% increase in *Current ETR* (0.099 / 0.196).

We take four steps to further assess these large estimated effects. First, we confirm that the effects are not driven by observable pre-period differences in the treatment and control firms. Figures 3(a) and 3(b) present the event study plots for *Cash ETR* and *Current ETR*, respectively, that correspond to Table 4. In both panels, the effects are plotted relative to base year t-1. The figures confirm that treatment and control firms exhibit similar pre-event trends in the outcomes of interest. The figures also depict the statistically significant increase in ETRs for treated firms in 2022 (t=0).

Second, we review firm disclosures to further place the magnitudes in context. Consistent with the effects in Table 4, the examples in Appendix B show large increases in deferred tax assets specifically related to this tax law change. These examples validate that our estimated effects are in line with the underlying impact.[15] Third, we prepare example ETR calculations based on the average firm in our sample. Appendix C shows that this tax law change reduces the average firm's cash ETR by approximately 13 percentage points, which is in line with

[15] Appendix B shows DTAs for capitalized R&D reported by Microsoft Corporation ($7.0 billion) and Chipotle Mexican Grille ($17.4 million); these companies reported increases in their cash ETRs following the tax law change of 6.8 and 25.5 percentage points, respectively, reflecting the large impact across firms.

our estimates.

Fourth, in untabulated analysis, we examine the effect of the tax law change on an alternative sample of U.S. December year-end firms. Specifically, we relax the requirement that treatment firms report specific financial statement disclosures (deferred tax assets) related to this R&D tax change. Instead, we compare December fiscal year-end firms that report R&D financial statement expense but do *not* make an R&D tax capitalization disclosure to our control firms. Our expectation is that we should find a positive, but muted, effect among this sample of non-disclosing December fiscal year end firms, relative to control firms. As expected, we find smaller – but still statistically and economically significant – coefficients indicating increased cash and current ETRs of 6.3 and 6.1 percentage points (29.0% and 29.5% increases), respectively. These results establish a lower bound effect and also confirm that firms with specific deferred tax asset disclosures are the most strongly affected.

4.2 R&D Investment (H1)

Table 5 reports results from testing our hypothesis about the effect of the R&D capitalization requirement on R&D investment. In Column (1), we observe a negative but statistically insignificant coefficient on the interaction of *Dec FYE Firm* $\times$ *Post* (coefficient = -0.005; p-value = 0.134). This result does not provide evidence consistent with a decline in R&D investment among affected U.S. firms, on average. Figure 4(a) presents the corresponding event study plot and confirms parallel pre-period trends in R&D expenditures among treatment and control firms.

While we do not observe an on-average decline in R&D, we do observe decreased R&D investment among two subsamples that should be most impacted by this change: firms operating entirely in the U.S. ("domestic-only" companies for which all R&D expenditures are subject to the tax change) and firms that are more R&D-intensive (given that the tax effect is directly tied to the scale of a firm's R&D activity). We first re-estimate Eq. 2 after including a triple interaction with the indicator *Domestic*, which is an indicator equal to one for firms that report zero pre-tax foreign income and zero foreign tax expense in event year t-1, and zero otherwise. While these firms are relatively smaller, we start with this subsample because all of their R&D investment is affected by this change.[16] The main effect of *Domestic* is subsumed by the firm fixed effects. The coefficient on *Dec FYE Firm* $\times$ *Post* represents the difference-in-differences (DiD) estimate for the benchmark group (i.e., the change in R&D spending for multinational treatment firms, relative to multinational control firms). The sum of the coefficients on *Dec FYE Firm* $\times$ *Post* and the triple interaction term (reported at the bottom of each panel) represents the DiD estimate for the domestic-only firms, and the coefficient on the triple interaction reflects the difference in these two DiD estimates.

We observe a negative and significant coefficient on the triple interaction term (*Dec FYE Firm* $\times$ *Post* $\times$ *Domestic*), providing evidence of a greater decrease in R&D investment among affected domestic-only firms than affected multinational firms, relative to their respective control groups. The sum of the coefficients on *Dec FYE Firm* $\times$ *Post* $\times$ *Domestic* and *Dec FYE Firm* $\times$ *Post* indicates a decrease in R&D of approximately 2.7% of assets for affected domestic-only firms, relative to domestic-only control firms. This represents a decline of 10.6%, relative to the average *R&D Investment* in this subsample of 25.5%. Based on these firms' average assets of $488 million (untabulated), we estimate a decrease in U.S. R&D investment of $13.2 million per firm in the first year. There are 176 affected domestic-only firms in our sample, which results in an estimated aggregate decline in R&D investment among our sample of domestic-only firms of $2.3 billion.

Second, we investigate whether the effect differs based on the research intensity of the

[16] Multinational companies may conduct R&D activities outside of the U.S., and the tax treatment of R&D in the country where the R&D takes place is unaffected by the U.S. tax law change. Though the U.S. tax law includes a provision requiring a fifteen-year amortization period for foreign R&D investments, this provision is only applicable in calculations that involve foreign income for U.S. tax purposes (for example, the GILTI tax rules) and can have an unfavorable or favorable impact. See WSJ (2023a) for an example of a favorable impact.

firm. We re-estimate Eq. 2 after including a triple interaction with the indicator *High R&D Firm*, which is equal to one for firms with *R&D Investment* in the top tercile in event year *t*-1, and zero otherwise. We observe a negative and significant coefficient of -0.038 on the triple interaction term (*Dec FYE Firm* × *Post* × *High R&D Firm*), indicating the R&D capitalization requirement resulted in a greater decrease in R&D investment among affected research-intensive firms as compared to low R&D affected firms, relative to their respective control groups. In terms of economic magnitude, the sum of the coefficients on *Dec FYE Firm* × *Post* × *High R&D Firm* and *Dec FYE Firm* × *Post* translates to a decrease in R&D investment of 3.8% of assets for affected research-intensive firms, relative to research-intensive control firms. This represents an 11.5% decline relative to these firms' average *R&D Investment* (0.331). Based on these firms' average assets of $1,547.2 million (untabulated), we estimate a sizeable decrease in U.S. R&D investment of $58.8 million per firm in the first year. There are 208 affected R&D intensive firms in our sample, which results in an estimated aggregate decline in R&D investment among our sample firms of $12.2 billion.

Figures 4(b) and 4(c) present the event study plots for domestic-only and research-intensive firms, respectively, confirming the absence of differential pre-period trends in R&D investment. Both graphs also illustrate a decline in R&D among these two subsamples, although we note that the standard error of the estimate in Figure 4(c) is large. Observing that the results vary predictably across these subsamples further points to the R&D tax change as the driving force behind the effects. We are unaware of other policy or regulatory events that would induce similar heterogeneity in the response.

4.3 R&D Investment among Financially Constrained Firms (H2)

Table 6 reports the results of testing whether the effect of the tax change on R&D investment is greater among constrained firms (H2). Each column presents results using one of the six measures of constraints defined in Section 3.2. We find strong evidence in support of H2.

In four of the six specifications, we observe negative and significant coefficients on the triple interaction term *Dec FYE Firm* × *Post* × *High Constraints*. This indicates that the R&D capitalization requirement has a stronger impact on constrained firms than on unconstrained firms, relative to their respective control groups.

Further, the sum of the coefficients on *Dec FYE Firm* × *Post* and *Dec FYE Firm* × *Post* × *High Constraints* is negative and statistically significant when measuring constraints using *High HP Index, High Z Score, Small, Young*, and *Negative OCF*. These coefficients suggest declines in R&D ranging from 2.5% to 9.2% of assets for constrained U.S. December year-end firms relative to their respective constrained control firms.[17] These coefficients translate to a decline of 10.1% (35.4%) for *Small* (*High Z Score*) firms relative to their mean *R&D Investment* of 0.247 (0.260). Based on the average total assets within each subsample of constrained firms, these effects translate to per firm magnitudes ranging from $2.7 million among the *Small* subsample to $356.8 million among the larger firms in the *Z Score* sample.

5 Additional Analyses

5.1 Effects on Payout and Capital Investment

While Table 6 shows a decline in R&D investment among constrained affected December year-end firms, unconstrained firms appear to sustain their R&D spending despite the increased tax payments triggered by the R&D capitalization requirement. In this section, we study whether these unconstrained firms adjust along other margins in response to the sud-

[17]One concern is that the constraint measures used in our tests of H2 capture firms in tax loss positions that are relatively insensitive to the R&D policy change. While we control for tax losses in Eq. 3, we also re-estimate our tests of H2 using several subsamples of firms that we estimate have positive federal taxable income (untabulated). We identify these firms in the following three ways (each measured in event year t-1): (1) firms with positive pre-R&D pre-tax income, (2) firms with positive cash taxes paid, and (3) firms with positive current federal tax expense. We continue to find reduced R&D among constrained firms in these tests.

den increase in their U.S. tax liability. Specifically, we estimate the following specification:

$$Outcome_{it} = \beta_0 + \beta_1\, Dec\ FYE\ Firm_i \times Post_t + Outcome\ Controls_{it-1} + Fixed\ Effects + \epsilon_{it} \quad (4)$$

Where *Outcome* is *Repurchases* or *Capital Investment*, and *Outcome Controls* represents a vector of control variables, described below and in Appendix D. Eq. 4 includes firm and event-year fixed effects, and standard errors are clustered by firm.

We first examine whether affected firms reduce share repurchases in response to the R&D capitalization requirement. We select *Repurchases* because they are a more flexible shareholder payout vehicle than dividends, and prior work shows that firms alter repurchases after prior tax changes (e.g., Blouin and Krull 2009). Following Nessa (2017), we measure *Repurchases* based on a firm's purchases of common and preferred stock, less any annual decrease in redemption value of preferred stock, scaled by beginning of year assets. Control variables include *Domestic ROA, Foreign ROA, Log(Assets), Sales Growth, MTB, Capex, Log(Age), Retained Earnings, Cash, Domestic ROA Volatility, Foreign ROA Volatility,* and *Returns.*

Table 7, Panel A reports the results, with effects for the full sample with requisite data in Column (1). Columns (2) through (7) present results for subsamples of *unconstrained* firms for which we do not observe an on-average decline in R&D (i.e., financially unconstrained firms, larger firms, older firms, and firms with positive prior year cash flows). Because the control variables in these specifications are distinct from the controls used in the R&D tests, and because the samples are smaller due to requisite data restrictions, we entropy balance within each sample to ensure covariate balance across the treatment and control firms. Event study plots in Figure 5 confirm parallel trends that correspond to Column (1).

The coefficient of -0.014 in Column (1) implies a reduction in share repurchases of 1.4% of assets, on average, by affected December fiscal-year end firms as compared to control firms. Based on average *Repurchases* for December fiscal year end firms (0.034), this translates to a

41.2% reduction in repurchases. We further observe this decrease among the unconstrained subsamples in Columns (2) through (7), with effect sizes ranging from -1.1 to -1.4% of assets.[18]

Panel B reports the results for testing *Capital Investment*. We select this measure to evaluate whether firms offset the increased tax cost of R&D investment by cutting other forms of investment. The dependent variable *Capital Investment* is equal to capital expenditures divided by beginning of year property, plant, and equipment. Control variables follow those in prior work (e.g., Lester 2019) and include *Log(Assets), ROA, MTB, Leverage,* and *Cash Flow*. In Column (1) of Panel B, the statistically significant coefficient of -0.074 indicates a decrease in capital expenditures of 7.4% of prior year property, plant, and equipment. This represents a decline equal to 25.0% of the mean *Capex Investment* of affected December fiscal year end firms (0.296). We observe similar effects ranging from -0.055 to -0.101 in Columns (2) through (7), confirming decreased capital expenditures among the subsamples of unconstrained firms.

In additional untabulated tests, we also examine whether firms decrease dividends or increase borrowing in response to the R&D capitalization requirement. In both the full sample and in subsamples of unconstrained firms, we fail to find evidence of such effects. One possible explanation, albeit *ex post*, for why we do not observe increased borrowing is that it introduces additional costs that the firm can otherwise avoid by adjusting along the other margins. Observing no change in dividend payout re-affirms that dividends are a less flexible form of payout, and that firms are less likely to cut dividends given the information content of such a decision.

[18] Untabulated tests fail to find evidence of a change in the extensive margin (i.e., the likelihood of repurchasing shares). Thus, the evidence is consistent with firms, on the margin, not changing *whether* they repurchase shares but rather changing the *amount* of repurchases. One concern is that these effects may be driven by the 1% excise tax on repurchases passed in the Inflation Reduction Act of 2022. However, this tax applies to repurchases made after December 31, 2022, which is after our sample period ends. Thus, the 1% excise tax cannot explain the observed decline in repurchases.

5.2 Innovation Quality

Given the evidence of declines in R&D among certain cross-sections of firms, we next study the effect of the R&D change on innovation quality. We estimate the following model:

$$\begin{aligned} R\&D\ Investment_{it} = \beta_0\ &+ \beta_1\ Dec\ FYE\ Firm_i \times Post_t \\ &+ \beta_2\ Dec\ FYE\ Firm_i \times Post_t \times Quality_i \\ &+ \beta_3\ Quality_i \times Post_t + Controls_{it-1} + Fixed\ Effects + \epsilon_{it} \end{aligned} \tag{5}$$

where *Quality* represents one of four firm-level measures of innovation quality: *Radical, Log(1+P Count), Innovative Efficiency,* and *High IE*, described below. We measure innovation quality in event year t-1.

First, we identify firms that engage in radical research relative to firms that engage in more incremental innovation. Radical innovation activities, which are measured based on patent applications on which the applicant does not cite another patent (Goldman et al. 2024), are unique and novel, whereas incremental innovation activities build on existing innovations. Radical innovations should have higher expected payoffs than incremental innovations, and thus radical innovators should be more likely to sustain their R&D investment in response to the increased after-tax cost of R&D resulting from the R&D capitalization requirement. Alternatively, because radical innovation may be more costly, these firms may myopically cut their R&D investment when faced with a sudden cash tax increase. We construct an indicator variable *Radical* that is equal to one if the firm applied for a radical patent in calendar year 2018, and zero otherwise. We measure radical patents using backward citations on patent applications filed in calendar-year 2018 (which is the last full year of backward citation data available in the WRDS U.S. Patents database).

We also use three additional measures of innovation quality. *Log(1+P Count)* is the number of patent applications measured either in event year t-1 or over the entire pre-event window. *Innovative Efficiency* is computed as the number of patent grants in event year t-1 scaled by R&D capital following Hirshleifer et al. (2013). For this purpose, R&D capital is computed as the five-year cumulative R&D spend (measured two years before the patent grants), assuming an annual depreciation rate of 20%. Finally, *High IE* is an indicator variable equal to one for firms in the top sample tercile of *Innovative Efficiency* in event year t-1, and zero otherwise. Higher values of the measures indicate higher innovation quality. A negative (positive) coefficient on the three-way interaction term indicates firms with higher innovation quality decrease R&D more (less) than other affected firms, relative to control firms.

Table 8 presents the results of this analysis. Across all columns, the coefficient on the triple interaction term *Dec FYE Firm* $\times$ *Post* $\times$ *Quality* is insignificant. Thus, we fail to find evidence that the tax law change has differential effects for highly innovative (or high R&D efficiency) firms relative to other firms. However, we acknowledge that, while we use firm-level measures following prior work, these measures do not capture whether firms make adjustments *within* their R&D project portfolio, for example by continuing radical innovations and cutting incremental projects.

5.3 Anticipatory Effects

The delay between enactment and implementation of the R&D capitalization requirement creates the potential for anticipatory effects among firms in our sample. Specifically, firms have an incentive to shift R&D expenditures into the fiscal year before the requirement becomes effective to maximize the present value of the tax benefits from the R&D expenditures. Such anticipatory effects should be limited among our December fiscal year end treatment firms because, as of December 2021, many expected Congress to repeal the law during calendar year 2022. However, our control firms with fiscal years ending in 2022 may have responded to the looming requirement to capitalize and amortize R&D for their

2023 fiscal year by accelerating R&D expenditures into their 2022 fiscal year to ensure full deductibility. If control firms accelerated their R&D spending into fiscal year 2022, the documented difference-in-differences effects of R&D declines among treated firms may instead reflect *increases* in R&D among control firms. While anticipatory effects are interesting and important to understand, observing such effects would change the inferences that we draw from our empirical analyses (i.e., control firms shifting the timing of R&D deductions in anticipation of the tax law versus treatment firms decreasing their R&D investment in response to the tax law).

We assess this potential concern by comparing our control firms (i.e., firms with fiscal years ending in September, October, and November) to firms with fiscal years ending in June, July, and August. Like our control firms, firms with fiscal year-ends in June, July, and August will be impacted by the change in their 2023 fiscal years. Thus, like the September, October, and November fiscal-year-end control firms, they potentially have the ability to accelerate R&D expenditures into fiscal year 2022. However, given widespread beliefs that the R&D capitalization requirement would be repealed during calendar year 2022, we expect any such shifting will be more prevalent among firms with later fiscal year ends (i.e., September, October, and November year ends) as it became clearer to managers that the law would not be repealed as the end of calendar year 2022 approached. Thus, comparing these two groups helps to identity any potential anticipatory effect among our control firms. If our control firms accelerated R&D expenditures into fiscal year 2022, we expect to observe increased (decreased) R&D expenditures for September, October, and November fiscal year end firms in fiscal year 2022 (2023) relative to June, July, and August fiscal year end firms.

Figure 6 presents the results of this analysis. We find statistically similar trends in R&D among our control firms and firms with fiscal years ending in June, July, and August, mitigating the concern that intertemporal R&D shifting by control firms drives our main difference-in-differences results. Furthermore, in untabulated analyses, we re-estimate the event study with subsamples of constrained firms, and we again continue to find similar trends in R&D spending among these two groups of firms. Overall, this analysis does not support anticipatory effects among our control firms.

6 Conclusion

We study the impact of changing the tax treatment of R&D on U.S. public firms. Using a within-U.S. difference-in-differences research design, we find the U.S. R&D capitalization requirement substantially increased the tax burdens of affected U.S. firms, with current and cash ETRs increasing by 9.9 and 11.9 percentage points percentage points, respectively. This translates to a 50.5% to 61.7% change in effective tax rates in 2022.

In our primary tests, we find that R&D investment declined for domestic-only U.S. companies and for the most research-intensive U.S. firms. For these companies, we observe decreases of around 11% of average R&D investment. In aggregate, we estimate a decrease in R&D investment of $12.2 billion among the research-intensive firms in our sample. In addition, we find decreases in R&D investments for constrained affected firms. While these subsamples of firms reduce their R&D to compensate for the increased tax burdens, we observe that unconstrained firms reduce other types of investment and cut share repurchases.

This paper provides timely, policy-relevant evidence regarding the impact of the R&D capitalization and amortization requirement on U.S. firms. While prior research on R&D tax incentives focuses largely on the R&D tax credit, we provide empirical evidence of economically significant real effects of the change from R&D immediate expensing to R&D capitalization in the policy's first year. Removing the R&D deduction is incongruent with other U.S. efforts to ensure the U.S. remains a leader in innovation and to promote U.S. competitiveness. Our paper informs the broader discussions about the effects of U.S. innovation tax policies and the effects of the TCJA.

References

Akcigit, U., Grigsby, J., Nicholas, T., and Stantcheva, S. (2022). Taxation and Innovation in the Twentieth Century. *The Quarterly Journal of Economics*, 137(1):329–385.

Altman, E. I. (1968). Financial Ratios, Discriminant Analysis and the Prediction of Corporate Bankruptcy. *The Journal of Finance*, 23(4):589–609.

Arrow, K. (1972). Economic welfare and the allocation of resources for invention. In *The Rate and Direction of Inventive Activity: Economic and Social Factors*, pages 219–236. Macmillan Education, U.K.

Atanassov, J. and Liu, X. (2020). Can Corporate Income Tax Cuts Stimulate Innovation? *Journal of Financial and Quantitative Analysis*, 55(5):1415–1465.

Berger, P. G. (1993). Explicit and Implicit Tax Effects of the R&D Tax Credit. *Journal of Accounting Research*, 31(2):131–171.

Bloom, N., Griffith, R., and Van Reenen, J. (2002). Do R&D tax credits work? Evidence from a panel of countries 1979–1997. *Journal of Public Economics*, 85(1):1–31.

Bloomberg (2023). America's Broken Tax System Is Punishing R&D. Available at: https://www.bloomberg.com/opinion/articles/2023-04-27/america-s-tax-system-is-punishing-r-d (last accessed October 31, 2023).

Blouin, J. and Krull, L. (2009). Bringing It Home: A Study of the Incentives Surrounding the Repatriation of Foreign Earnings Under the American Jobs Creation Act of 2004. *Journal of Accounting Research*, 47(4):1027–1059.

Brown, J. R., Fazzari, S. M., and Petersen, B. C. (2009). Financing Innovation and Growth: Cash Flow, External Equity, and the 1990s R&D Boom. *The Journal of Finance*, 64(1):151–185.

Cowx, M. (2024). Investment and Tax Incentive Enforcement: Evidence from the R&D Tax Credit. Working paper.

Curtis, M., Garrett, D., Ohrn, E., Roberts, K., and Serrato, J. C. S. (2022). Capital Investment and Labor Demand. Working paper.

Deloitte (2023). No Relief in Sight from Section 174. So Now What? *Wall Street Journal*, CFO Section. Available at: https://deloitte.wsj.com/cfo/no-relief-in-sight-from-section-174-so-now-what-01675453273 (last accessed October 23, 2023).

Dyreng, S. D., Hanlon, M., Maydew, E. L., and Thornock, J. R. (2017). Changes in corporate effective tax rates over the past 25 years. *Journal of Financial Economics*, 124(3):441–463.

EY (2023). Worldwide R&D Incentives Reference Guide. Available at: https://www.ey.com/en gl/tax-guides/worldwide-r-and-d-incentives-reference-guide (last accessed October 30, 2023).

Farre-Mensa, J. and Ljungqvist, A. (2016). Do Measures of Financial Constraints Measure Financial Constraints? *The Review of Financial Studies*, 29(2):271–308.

Finley, A. R., Lusch, S. J., and Cook, K. A. (2015). The Effectiveness of the R&D Tax Credit: Evidence from the Alternative Simplified Credit. *Journal of the American Taxation Association*, 37(1):157–181.

Gallemore, J., Hollander, S., Jacob, M., and Zheng, X. (2024). Tax Policy Expectations and Investment. Working paper.

Garrett, D. G., Ohrn, E., and Suárez Serrato, J. C. (2020). Tax Policy and Local Labor Market Behavior. *American Economic Review: Insights*, 2(1):83–100.

Gipper, B. (2021). The economic effects of expanded compensation disclosures. *Journal of Accounting and Economics*, 71(1):101338.

Glaeser, S. and Lang, M. H. (2023). A Review of the Accounting Literature on Innovation. Working paper.

Goldman, N., Lampenius, N., Radhakrishnan, S., Stenzel, A., and de Almeida, J. E. F. (2024). IRS scrutiny and corporate innovation. *Contemporary Accounting Research*, 41(1):391–423.

Guceri, I. and Albinowski, M. (2021). Investment responses to tax policy under uncertainty. *Journal of Financial Economics*, 141(3):1147–1170.

Gupta, S., Hwang, Y., and Schmidt, A. P. (2011). Structural change in the research and experimentation tax credit: success or failure? *National Tax Journal*, 64(2.1):285–322.

Hadlock, C. J. and Pierce, J. R. (2010). New Evidence on Measuring Financial Constraints: Moving Beyond the KZ Index. *The Review of Financial Studies*, 23(5):1909–1940.

Hainmueller, J. (2012). Entropy Balancing for Causal Effects: A Multivariate Reweighting Method to Produce Balanced Samples in Observational Studies. *Political Analysis*, 20(1):25–46.

Hainmueller, J. and Xu, Y. (2013). Ebalance: A Stata Package for Entropy Balancing. *Journal of Statistical Software*, 54(7):1–18.

Hall, B. H. (1993). R&D Tax Policy during the 1980s: Success or Failure? *Tax Policy and the Economy*, 7:1–35.

Hall, B. H. (2022). Tax Policy for Innovation. In *Innovation and Public Policy*, pages 151–188. University of Chicago Press.

Hall, B. H. and Lerner, J. (2010). Chapter 14 - The Financing of R&D and Innovation. In Hall, B. H. and Rosenberg, N., editors, *Handbook of The Economics of Innovation, Vol. 1*, volume 1 of *Handbook of the Economics of Innovation*, pages 609–639. North-Holland. ISSN: 2210-8807.

Hall, R. E. and Jorgenson, D. W. (1967). Tax Policy and Investment Behavior. *The American Economic Review*, 57(3).

Hirshleifer, D., Hsu, P.-H., and Li, D. (2013). Innovative efficiency and stock returns. *Journal of Financial Economics*, 107(3):632–654.

Hoopes, J. (2018). The Effect of Temporary Tax Laws on Understanding and Predicting Corporate Earnings. Working paper.

Hoopes, J. L., Mescall, D., and Pittman, J. A. (2012). Do IRS Audits Deter Corporate Tax Avoidance? *The Accounting Review*, 87(5):1603–1639.

Internal Revenue Service (2023). SOI Tax Stats - Corporation Income Tax Returns Line Item Estimates (Publication 5108). Available at: https://www.irs.gov/statistics/soi-tax-stats-corporation-income-tax-returns-line-item-estimates-publication-5108 (last accessed November 3, 2023).

Jacob, M. (2022). Real Effects of Corporate Taxation: A Review. *European Accounting Review*, 31(1):269–296.

Joint Committee on Taxation (2017). Distributional Effects of the Conference Agreement for H.R. 1, The "Tax Cuts and Jobs Act" JCX-68-17.

Kaplan, S. and Zingales, L. (1997). Do Investment-Cash Flow Sensitivities Provide Useful Measures of Financing Constraints? *The Quarterly Journal of Economics*, 112(1):169–215.

Klassen, K. J., Pittman, J. A., Reed, M. P., and Fortin, S. (2004). A Cross-national Comparison of R&D Expenditure Decisions: Tax Incentives and Financial Constraints. *Contemporary Accounting Research*, 21(3):639–680.

Lester, R. (2019). Made in the U.S.A.? A Study of Firm Responses to Domestic Production Incentives. *Journal of Accounting Research*, 57(4):1059–1114.

Lester, R. and Olbert, M. (2024). Firms' Real and Reporting Responses to Taxation: A Review. Working paper.

Li, Q., Ma, M. S., and Shevlin, T. (2021). The effect of tax avoidance crackdown on corporate innovation. *Journal of Accounting and Economics*, 71(2):101382.

Ljungqvist, A., Zhang, L., and Zuo, L. (2017). Sharing Risk with the Government: How Taxes Affect Corporate Risk Taking. *Journal of Accounting Research*, 55(3):669–707.

Nessa, M. L. (2017). Repatriation Tax Costs and U.S. Multinational Companies' Shareholder Payouts. *The Accounting Review*, 92(4):217–241.

Ohrn, E. (2019). The effect of tax incentives on U.S. manufacturing: Evidence from state accelerated depreciation policies. *Journal of Public Economics*, 180:104084.

Rao, N. (2016). Do tax credits stimulate R&D spending? The effect of the R&D tax credit in its first decade. *Journal of Public Economics*, 140:1–12.

Romer, P. M. (1990). Endogenous Technological Change. *Journal of Political Economy*, 98(5):S71–S102.

RSM (2023). FAQ: Capitalization and amortization of R&D costs under new section 174 rules. Available at: https://rsmus.com/insights/services/business-tax/faq-capitalization-and-amortization-of-r-d-costs-under-new-section-174-rules.html (last accessed October 31, 2023).

RSM (2024). Tax framework agreement sets direction for potential business and individual tax relief. Available at: https://rsmus.com/insights/tax-alerts/2024/tax-framework-agreement-sets-direction-potential-business-individual-tax-relief.html (last accessed January 29, 2024).

Solow, R. M. (1957). Technical Change and the Aggregate Production Function. *The Review of Economics and Statistics*, 39(3):312–320.

Towery, E. M. (2017). Unintended Consequences of Linking Tax Return Disclosures to Financial Reporting for Income Taxes: Evidence from Schedule UTP. *The Accounting Review*, 92(5):201–226.

Weinberg, S. and Eller, S. (2022). Starting in 2022 R&D Expenses Must Be Amortized Over 5 Years. Available at: https://www.pkfod.com/insights/starting-in-2022-rd-expenses-must-be-amortized-over-5-years/ (last accessed January 31, 2024).

Whited, R. L., Swanquist, Q. T., Shipman, J. E., and Moon, Jr., J. R. (2022). Out of Control: The (Over) Use of Controls in Accounting Research. *The Accounting Review*, 97(3):395–413.

Williams, B. and Williams, B. M. (2021). Real Effects of Financial Reporting on Innovation: Evidence from Tax Law and Accounting Standards. *The Accounting Review*, 96(6):397–425.

Wilson, D. J. (2009). Beggar Thy Neighbor? The In-State, Out-of-State, and Aggregate Effects of R&D Tax Credits. *The Review of Economics and Statistics*, 91(2):431–436.

WSJ (2022). U.S. CFOs Ask Congress to Repeal Change to R&D Tax Rules. *Wall Street Journal*. Available at: https://www.wsj.com/articles/u-s-cfos-ask-congress-to-repeal-change-to-r-d-tax-rules-11667845533 (last accessed November 1, 2023).

WSJ (2023a). Big Companies Seeing Tax Benefits From Law Change Some of Them Fought. *Wall Street Journal*. Available at: https://www.wsj.com/articles/big-companies-seeing-tax-benefits-from-law-change-some-of-them-fought-d836535d (last accesssed November 3, 2023).

WSJ (2023b). Small Businesses Face Big Tax Bills From Research-Deduction Change. *Wall Street Journal*. Available at: https://www.wsj.com/articles/small-businesses-face-big-tax-bills-from-research-deduction-change-a189b113 (last accessed October 23, 2023).

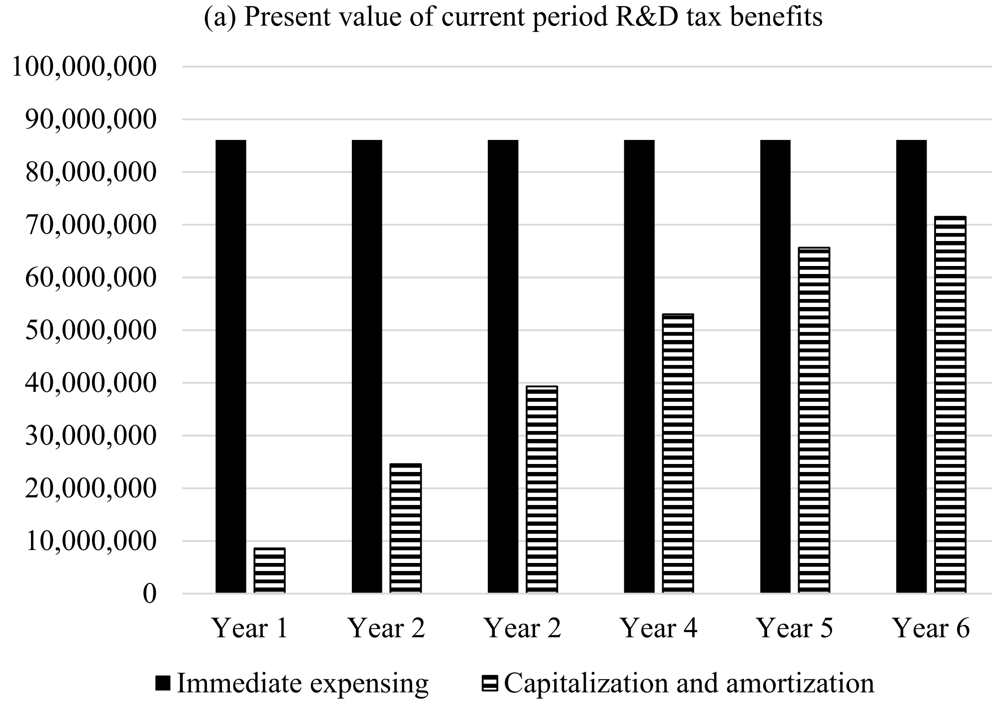
WSJ (2023c). Some Business Owners Are Facing Giant Tax Bills. Why Congress Hasn't Done Anything. *Wall Street Journal*. Available at: https://www.wsj.com/politics/why-bipartisan-support-isnt-enough-to-change-this-tax-provision-a5ef8985 (last accessed November 3, 2023).

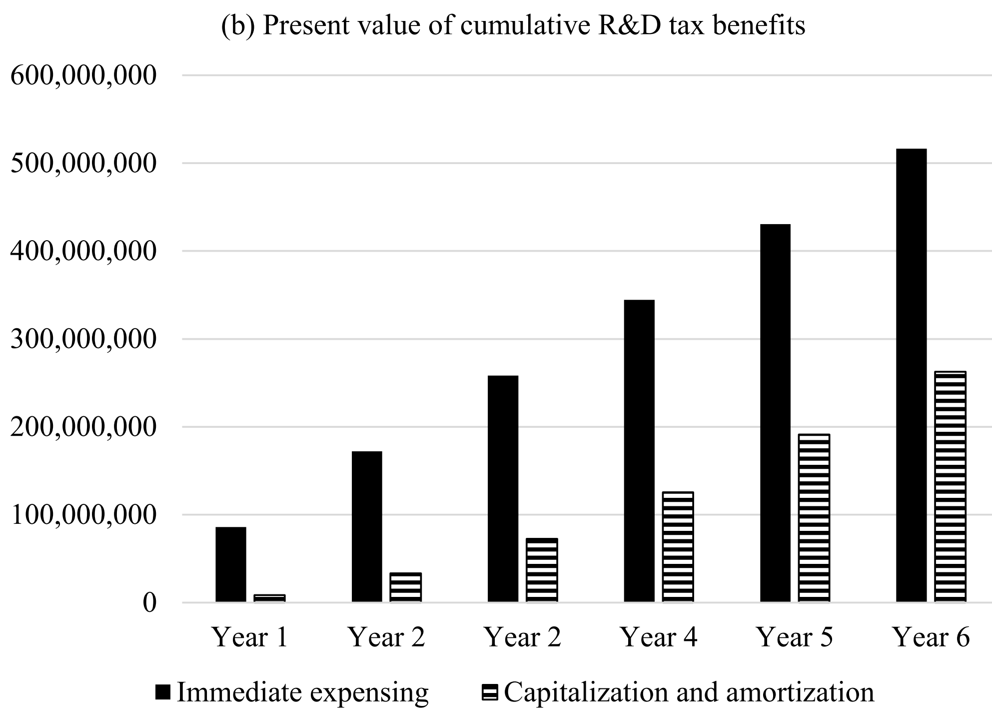
WSJ (2023d). A Tax Rule Change Is Threatening the Survival of Some Businesses. *Wall Street Journal*. Available at: https://www.wsj.com/articles/the-tax-rule-change-that-is-threatening-businesses-survival-a9236658 (last accessed October 31, 2023).

WSJ (2024). A Research Tax Deduction Change May Go Away. Some Business Pain Won't. *Wall Street Journal*. Available at: https://www.wsj.com/articles/a-research-tax-deduction-change-may-go-away-some-business-pain-wont-0f5b3adc (last accessed April 11, 2024).

Zwick, E. and Mahon, J. (2017). Tax Policy and Heterogeneous Investment Behavior. *American Economic Review*, 107(1):217–248.

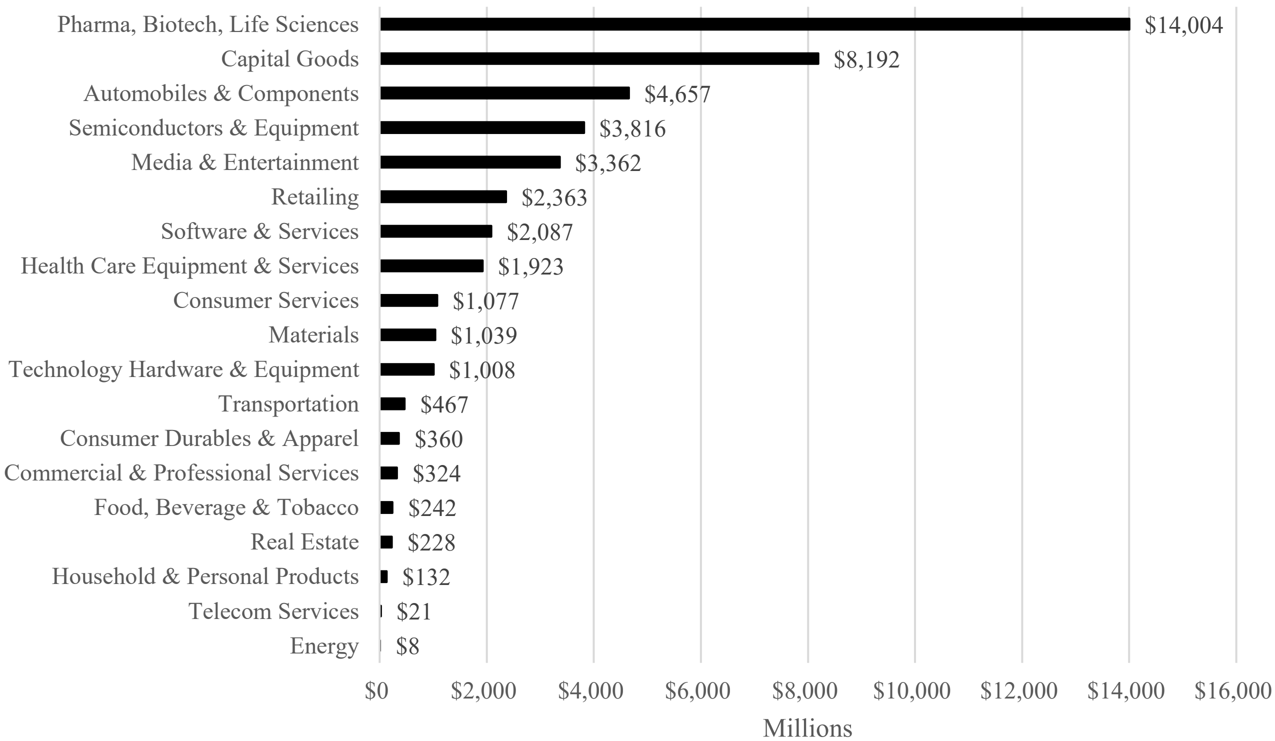
Figure 1: Present value of R&D tax benefits: capitalization vs. immediate expensing





This figure depicts the present value of current period R&D tax benefits (Panel A) and cumulative R&D tax benefits (Panel B) under the R&D capitalization and amortization requirement, relative to immediate expensing, assuming stable R&D investment. See Appendix A for additional details of the calculations.

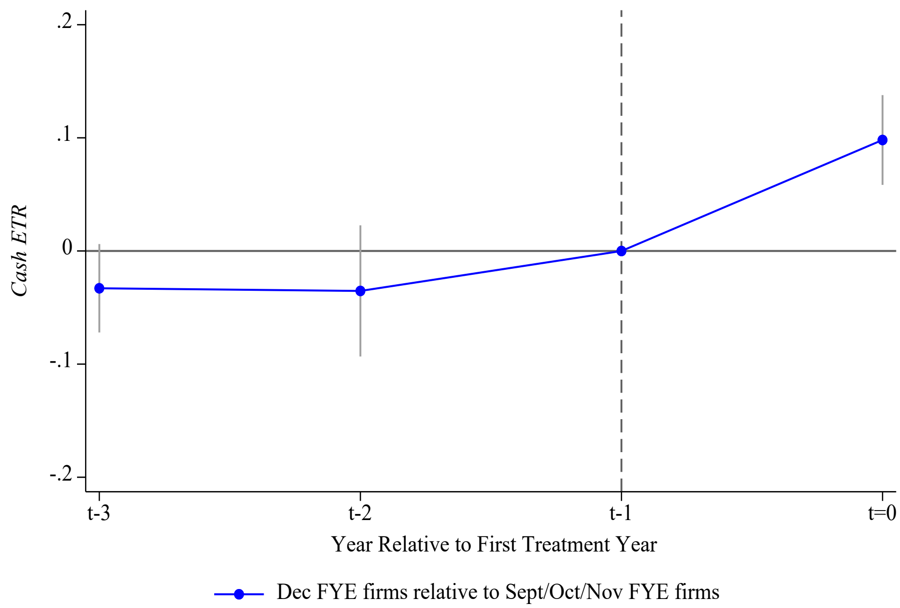
Figure 2: Aggregate Capitalized R&D Deferred Tax Assets by Industry



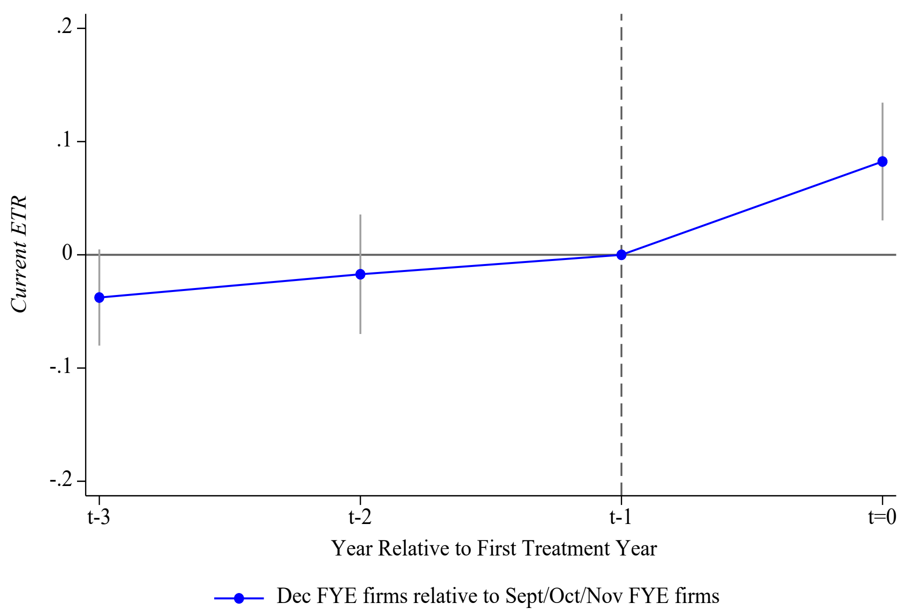
This figure depicts the aggregate capitalized R&D deferred tax assets by industry (GICS 4-digit) in millions, as calculated using hand-collected data from financial statement deferred tax asset disclosures specifically related to the R&D capitalization requirement.

Figure 3: Effective Tax Rates Parallel Trends

(a) Cash ETR analysis



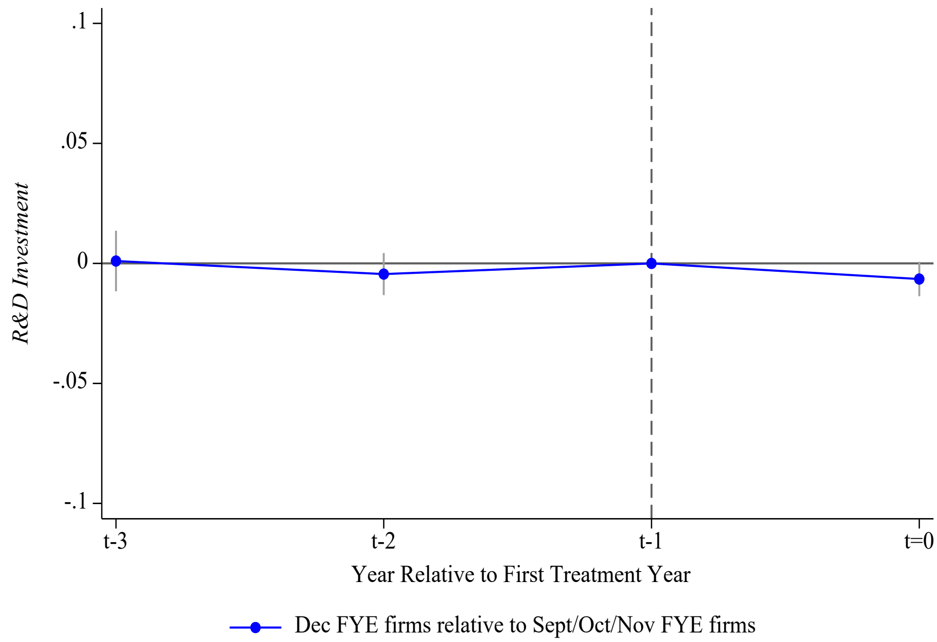
(b) Current ETR analysis



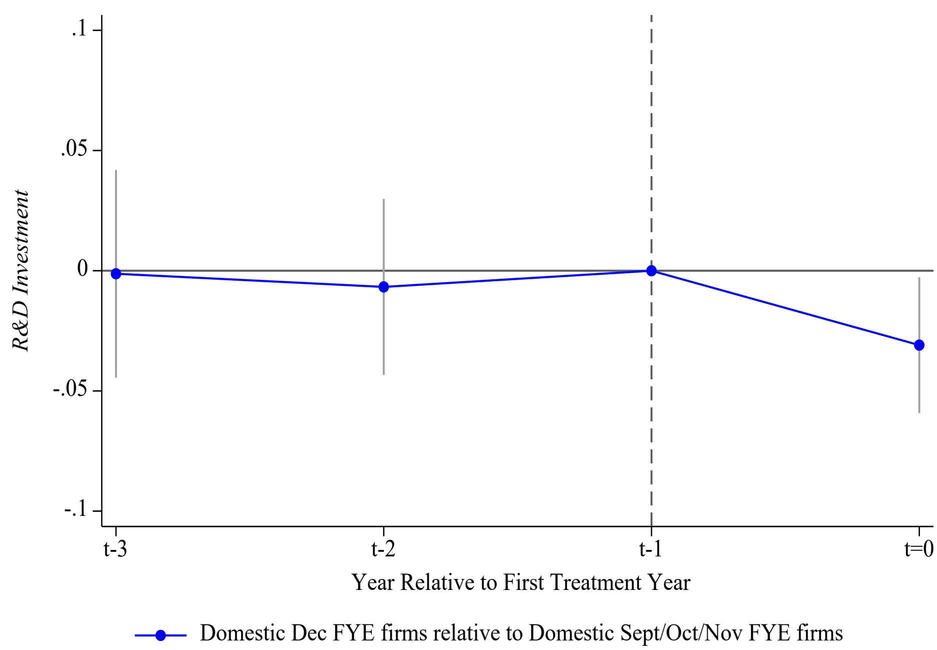
This figure depicts the difference-in-differences coefficient estimates for our effective tax rate OLS regressions in event time (see Appendix E). The dependent variables are *Cash ETR* (Panel A) and *Current ETR* (Panel B). The regression models include all controls, firm and event-time fixed effects, and entropy balancing. Standard errors are clustered at the firm level. The Y-axis represents the difference-in-differences (DiD) estimate. The X-axis represents the year relative to the treatment year, where year $t = 0$ is the first year the U.S. R&D capitalization requirement takes effect. The dots represent the point estimates of the DiD estimators in event-time. The bars represent the 95% confidence intervals.

Figure 4: R&D Investment Parallel Trends

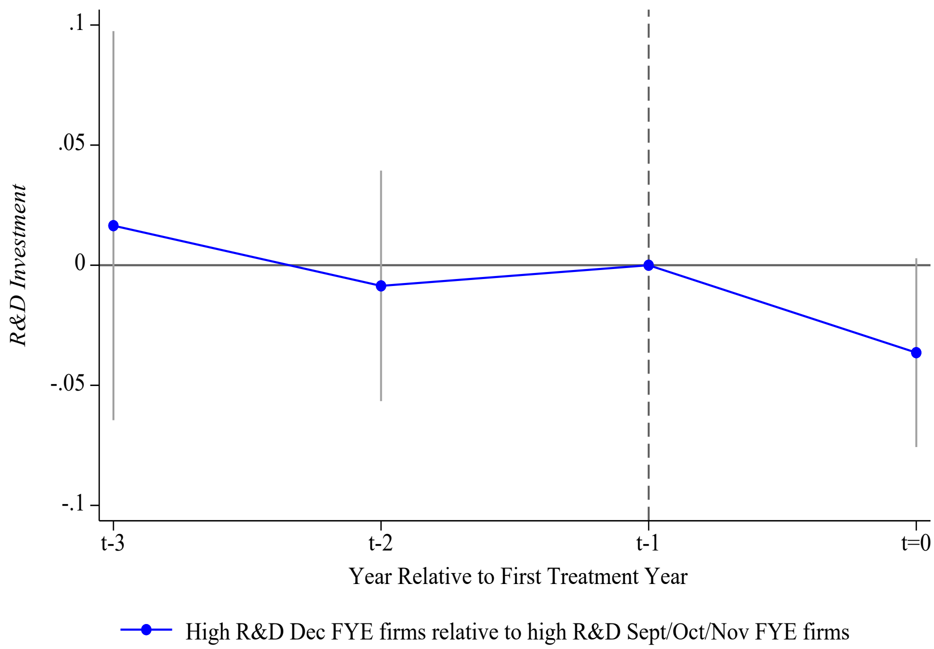
(a) Main analysis



(b) Domestic firm analysis



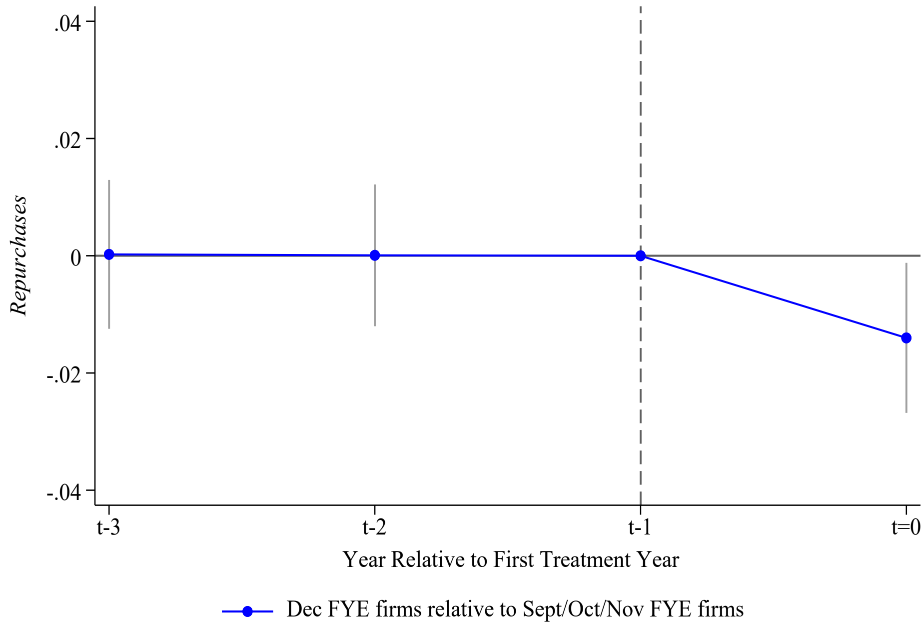
(c) High R&D intensity analysis



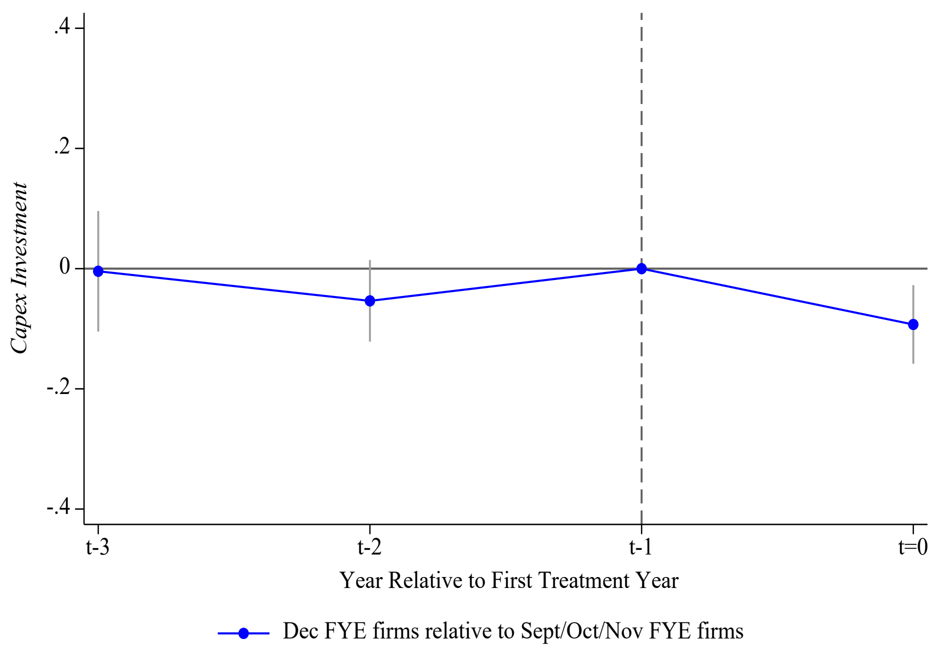
This figure depicts coefficient estimates for our R&D investment OLS regressions in event time (see Appendix E) for our test of H1 (Panel A) and cross-sectional tests of domestic-only firms (Panel B) and high-R&D intensity firms (Panel C). In all panels, the dependent variable is *R&D Investment* . The regression models include all controls, firm and event-time fixed effects, and entropy balancing. Standard errors are clustered at the firm level. In Panel A, the Y-axis represents the difference-in-differences (DiD) estimate. In Panel B (Panel C), the Y-axis represents the difference-in-differences estimate for domestic-only (high R&D) firms. The X-axis represents the year relative to the treatment year, where year $t = 0$ is the first year the U.S. R&D capitalization requirement takes effect. The dots represent the point estimates of the DiD estimators. The bars represent the 95% confidence intervals.

Figure 5: Other Outcomes

(a) Repurchases

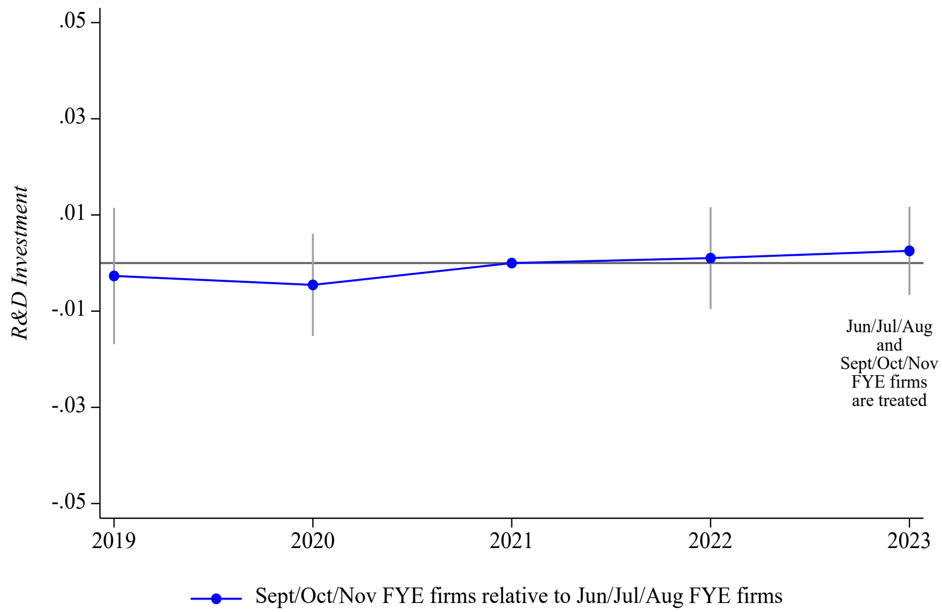


(b) Capital Expenditures



This figure depicts the difference-in-differences coefficient estimates for our other outcomes analyses in event time (see Appendix E). The dependent variables are *Repurchases* (Panel A) and *Capex Investment* (Panel B). The regression models include all controls, firm and event-time fixed effects, and entropy balancing. Standard errors are clustered at the firm level. The Y-axis represents the difference-in-differences (DiD) estimate. The X-axis represents the year relative to the treatment year, where year $t = 0$ is the first year the U.S. R&D capitalization requirement takes effect. The dots represent the point estimates of the DiD estimators in event-time. The bars represent the 95% confidence intervals.

Figure 6: Anticipatory Effects



This figure depicts coefficient estimates for our analysis of possible anticipatory effects. The sample includes firms with fiscal years ending June through November. The sample does not include our main treatment group (i.e., December fiscal year end firms). The dependent variable is *R&D Investment* . The regression model includes all controls, firm and year fixed effects, and entropy-balancing. Standard errors are clustered at the firm level. The Y-axis represents the difference-in-differences (DiD) estimate. The X-axis represents the calendar year, where calendar year 2023 is the first year the U.S. R&D capitalization requirement takes effect for firms with fiscal years ending June through November. The dots represent the point estimates of the DiD estimators. The bars represent the 95% confidence intervals.

Appendix A: Present value (PV) calculation

Pre-period: R&D immediate expensing

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
R&D expenditure	410,000,000	410,000,000	410,000,000	410,000,000	410,000,000	410,000,000
PV tax savings from year 1 expenditure	86,100,000					
PV tax savings from year 2 expenditure		86,100,000				
PV tax savings from year 3 expenditure			86,100,000			
PV tax savings from year 4 expenditure				86,100,000		
PV tax savings from year 5 expenditure					86,100,000	
PV tax savings from year 6 expenditure						86,100,000
Total PV tax savings	86,100,000	86,100,000	86,100,000	86,100,000	86,100,000	86,100,000
PV of after-tax R&D costs	323,900,000	323,900,000	323,900,000	323,900,000	323,900,000	323,900,000
Cumulative PV tax savings	**86,100,000**	**172,200,000**	**258,300,000**	**344,400,000**	**430,500,000**	**516,600,000**
Cumulative PV of after-tax R&D costs	323,900,000	647,800,000	971,700,000	1,295,600,000	1,619,500,000	1,943,400,000

Post-period: R&D capitalization and five-year amortization

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
R&D expenditure	410,000,000	410,000,000	410,000,000	410,000,000	410,000,000	410,000,000
PV tax savings from year 1 expenditure	8,610,000	15,944,444	14,763,374	13,669,791	12,657,214	5,859,821
PV tax savings from year 2 expenditure		8,610,000	15,944,444	14,763,374	13,669,791	12,657,214
PV tax savings from year 3 expenditure			8,610,000	15,944,444	14,763,374	13,669,791
PV tax savings from year 4 expenditure				8,610,000	15,944,444	14,763,374
PV tax savings from year 5 expenditure					8,610,000	15,944,444
PV tax savings from year 6 expenditure						8,610,000
Total PV tax savings	8,610,000	24,554,444	39,317,819	52,987,610	65,644,824	71,504,646
PV of after-tax R&D costs	401,390,000	385,445,556	370,682,181	357,012,390	344,355,176	338,495,354
Cumulative PV tax savings	**8,610,000**	**33,164,444**	**72,482,263**	**125,469,873**	**191,114,698**	**262,619,343**
Cumulative PV of after-tax R&D costs	401,390,000	786,835,556	1,157,517,737	1,514,530,127	1,858,885,302	2,197,380,657
Difference in year's PV tax savings	(77,490,000)	(61,545,556)	(46,782,181)	(33,112,390)	(20,455,176)	(14,595,354)
Difference in cumulative PV tax savings - stable R&D	**(77,490,000)**	**(139,035,556)**	**(185,817,737)**	**(218,930,127)**	**(239,385,302)**	**(253,980,657)**
Difference in cumulative PV tax savings - 5% R&D growth	**(77,490,000)**	**(142,910,056)**	**(196,837,739)**	**(239,792,016)**	**(272,236,793)**	**(300,443,987)**
Difference in cumulative PV tax savings - 10% R&D growth	**(77,490,000)**	**(146,784,556)**	**(208,245,192)**	**(262,182,101)**	**(308,855,487)**	**(354,336,390)**

This appendix illustrates the timing and present value of tax savings from R&D deductions under the pre-2022 immediate expensing rules and the post-2022 capitalization and amortization rules. The calculations are estimated using the sample average annual R&D spending, an 8% discount rate, and a 21% marginal tax rate. The difference in each year's present value of tax savings is reported at the bottom of the table as well as the cumulative deferred tax savings in present value dollars under various R&D growth assumptions (stable, 5% growth, and 10% growth).

Appendix B: Example Disclosures

Example 1: Microsoft Corporation (MSFT) Form 10-K for the year ended 6/30/2023

From Note 12: Income Taxes

The components of the deferred income tax assets and liabilities were as follows:

(In millions)

June 30,		**2023**		**2022**
Deferred Income Tax Assets				
Stock-based compensation expense	$	**681**	$	601
Accruals, reserves, and other expenses		**3,131**		2,874
Loss and credit carryforwards		**1,441**		1,546
Amortization [a]		**9,440**		10,183
Leasing liabilities		**5,041**		4,557
Unearned revenue		**3,296**		2,876
Book/tax basis differences in investments and debt		**373**		0
Capitalized research and development [a]		**6,958**		473
Other		**489**		461
Deferred income tax assets		**30,850**		23,571
Less valuation allowance		**(939)**		(1,012)
Deferred income tax assets, net of valuation allowance	$	**29,911**	$	22,559
Deferred Income Tax Liabilities				
Book/tax basis differences in investments and debt	$	**0**	$	(174)
Leasing assets		**(4,680)**		(4,291)
Depreciation		**(2,674)**		(1,602)
Deferred tax on foreign earnings		**(2,738)**		(3,104)
Other		**(89)**		(103)
Deferred income tax liabilities	$	**(10,181)**	$	(9,274)
Net deferred income tax assets		**19,730**	$	13,285

[a] Provisions enacted in the TCJA related to the capitalization for tax purposes of research and development expenditures became effective on July 1, 2022. These provisions require us to capitalize research and development expenditures and amortize them on our U.S. tax return over five or fifteen years, depending on where research is conducted.

Example 2: Chipotle Mexican Grill (CMG) Form 10-K for the year ended 12/31/2022

From Note 6: Income Taxes (amounts in thousands)

The components of the deferred income tax assets and liabilities for continuing operations were as follows:

	December 31, 2022	December 31, 2021
Deferred income tax liability:		
Leasehold improvements, property and equipment, net	$ 263,444	$ 279,586
Goodwill and other assets	1,754	1,728
Prepaid assets and other	-4,685	106
Operating lease assets	901,058	851,324
Total deferred income tax liability	1,161,571	1,132,744
Deferred income tax asset:		
Gift card liability	15,893	9,699
Capitalized transaction costs	323	324
Stock-based compensation and other employee benefits	45,129	45,261
Foreign net operating loss carry-forwards	24,799	27,446
State credits	3,151	3,595
Operating lease liabilities	962,815	909,528
Allowances, reserves and other	15,688	24,179
Capitalized research costs	17,415	-
State net operating loss carry-forwards	4,832	1,568
Valuation allowance	-27,097	-30,621
Total deferred income tax asset	1,062,948	990,979
Deferred income tax liabilities	$ 98,623	$ 141,765

Appendix C: Example Effective Tax Rate Calculations

	Pre period: R&D immediate expensing	Post period: R&D capitalization and amortization			Calculation
		Stable R&D	5% R&D Growth	10% R&D Growth	
Mean values per main sample:					
Pre-tax book income	607,000,000	607,000,000	586,500,000	627,500,000	(a)
R&D expenditure year t	410,000,000	410,000,000	430,500,000	389,500,000	(b)
R&D expenditure year t-1	377,000,000	377,000,000	377,000,000	377,000,000	(c)
R&D expenditure year t-2	321,000,000	321,000,000	321,000,000	321,000,000	(d)
R&D expenditure year t-3	300,000,000	300,000,000	300,000,000	300,000,000	(e)
Statutory rate	21%	21%	21%	21%	(f)
Qualifying Research Expenditures (QREs) (assuming 50% of R&D qualifies):					
Year t	205,000,000	205,000,000	215,250,000	194,750,000	(g) = (b) × 50%
Total QREs for the prior three tax years (assuming 50% of R&D qualifies):					
Year t-1	188,500,000	188,500,000	188,500,000	188,500,000	(h) = (c) × 50%
Year t-2	160,500,000	160,500,000	160,500,000	160,500,000	(i) = (d) × 50%
Year t-3	150,000,000	150,000,000	150,000,000	150,000,000	(j) = (e) × 50%
Total	499,000,000	499,000,000	499,000,000	499,000,000	(k) = (h) + (i) + (j)
Divide total by 6	83,166,667	83,166,667	83,166,667	83,166,667	(l) = (k) ÷ 6
Excess of current year QREs over baseline	121,833,333	121,833,333	132,083,333	111,583,333	(m) = (g) - (l)
Alternative Simplified Credit rate	14%	14%	14%	14%	(n)
Section 280C adjustment:					
Reduced credit rate (14% × (1-21%))	11.1%	11.1%	11.1%	11.1%	(o) = (1 - (f)) × (n)
Reduced credit amount	13,474,767	13,474,767	14,608,417	12,341,117	(p) = (m) × (o)
Summary of current-year tax savings:					
Tax savings on R&D tax credit	13,474,767	13,474,767	14,608,417	12,341,117	(p)
Tax savings on R&D amortization		8,610,000	9,040,500	8,179,500	(q) = 50% × [(b) ÷ 5] × (f)

	(1)	(2)	(3)	(4)	
Tax savings on R&D deduction	86,100,000				(r) = (b) × (f)
Total tax savings	**99,574,767**	**22,084,767**	**23,648,917**	**20,520,617**	(s) = (p) + (q) + (r)
Total GAAP tax expense	113,995,233	113,995,233	108,556,583	119,433,883	(t) = (a) × (f) - (p)
Total cash taxes paid	113,995,233	191,485,233	189,921,083	193,049,383	(u) = (a + b) × (f) - (s)
Total deferred tax asset	0	77,490,000	81,364,500	73,615,500	(v) = (u) - (t)
Effective tax rates:					
GAAP ETR	18.8%	18.8%	18.5%	19.0%	(w) = (t) ÷ (a)
Cash ETR	18.8%	31.5%	32.4%	30.8%	(x) = (u) ÷ (a)
Percentage point change in GAAP ETR relative to pre-period		0.0%	-0.3%	0.3%	
Percentage point change in cash ETR relative to pre-period		12.8%	13.6%	12.0%	

This appendix depicts how the R&D capitalization change affects effective tax rates and deferred tax assets over time. For simplicity, the calculations use the Alternative Simplified Credit method of computing the R&D tax credit. The calculation uses the average pre-tax book income and average R&D expenditures for the firms in our main sample. Consistent with prior literature, we assume 50% of research spending qualifies for the R&D tax credit (see for example Gupta, Hwang, and Schmidt (2011) and Finley, Lusch, and Cook (2015)). Column (1) reports the calculation prior to the tax law change; the remaining columns report the calculation after the tax law change assuming stable R&D (Column 2), 5% R&D growth (Column 3), and 10% R&D growth (Column 4).

Appendix D: Variable Descriptions

Variable	Description
Treatment & Post Variables:	
Dec FYE Firm	An indicator variable set equal to one if the fiscal year end is December, and zero otherwise.
Post	An indicator variable set equal to one for fiscal years beginning on or after October 1, 2021, and zero otherwise.
Dependent Variables:	
Capex Investment	Total capital expenditures (CAPX) as a percent of beginning of year property, plant, and equipment (PPENT).
Cash ETR	Cash taxes paid (TXPD) scaled by pre-tax book income (PI). Set to missing if PI is less than zero and for ETRs less than zero and greater than one.
Current ETR	Current tax expense (TXC) scaled by pre-tax book income (PI). Set to missing if PI is less than zero and for ETRs less than zero and greater than one.
ETR	Effective tax rate measures, including *Current ETR* and *Cash ETR.*
Outcome	Other outcome measures, including *Repurchases* and *Capex Investment.*
R&D Investment	Research and development expense (XRD) scaled by beginning of year assets (AT).
Repurchases	Purchases of common and preferred stock (PRSTKC) less any annual decrease in redemption value of preferred stock (PSTKRV), scaled by beginning of year assets (AT).
Cross-Sectional Variables:	
Domestic	An indicator variable set equal to one for domestic-only corporations, and zero otherwise. We define multinational status as firms with non-zero pre-tax foreign income (PIFO) or non-zero foreign tax expense (TXFO).
High Constraints	Measures of high constraints, including *High HP Index*, *High KZ Index, High Z Score, Small, Young,* and *Negative OCF.*
High HP Index	An indicator variable set equal to one for observations in the highest tercile of the Hadlock and Pierce (2010) size-age index in event year *t-1*, and zero otherwise. We compute the size-age index as (-0.737)×*Log(Assets)* + (0.043×*Log(Assets)*^{2}) - (0.040×*Age*). For this purpose, we limit assets to a maximum of $4.5 billion and age to a maximum of 37.
High IE	An indicator variable set equal to one if *Innovative Efficiency* measured in event-year *t*-1 is in the highest sample tercile, and zero otherwise.
High KZ Index	An indicator variable set equal to one for firms with KZ Index in the top tercile in event-year *t*-1, and zero otherwise. KZ Index is computed following Kaplan and Zingales (1997) as (-1.002)×((IB+DP)/$PPENT_{t-1}$) + 0.283×((AT+MVE-CEQ-TXDB)/AT) + 3.139×(DLTT+DLC)/(DLTT + DLC + SEQ) - 39.368×((DVC + DVP)/$PPENT_{t-1}$) - 1.315×(CHE/$PPENT_{t-1}$). Where DVC or DVP are missing, total dividends (DV) is used. MVE is computed as price (PRCC_F) multiplied by shares outstanding (CSHO) at the fiscal year end.
High R&D Firm	An indicator variable set equal to one for observations with *R&D Investment* in the top tercile in event year *t-1*, and zero otherwise.

High Z Score	An indicator variable set equal to one for firms with Z Score in the top tercile in event-year *t* -1, and zero otherwise. Z Score is computed following Altman (1968) as -1×[3.3×(PI + XINT)/AT + 1.2×WCAP/AT + SALE/AT + 1.4×RE/AT + .6×(PRCC_F×CSHO) / LT].
Innovative Efficiency	Innovative efficiency per Hirshleifer et al. (2013), computed as patent grants divided by (XRD_{t-2} + 0.8×XRD_{t-3} + 0.6×XRD_{t-4} + 0.4×XRD_{t-5} + 0.2×XRD_{t-6}). For purposes of this calculation, missing values of XRD are set equal to zero.
Log(1+P Count)	Log of one plus the number of patent applications filed. Patent application data is obtained from Noah Stoffman's website.
Negative OCF	An indicator variable set equal to one for observations with negative operating cash flows (OANCF) in event year *t-1* , and zero otherwise.
Quality	One of four measures of innovation quality, including *Radical, Log(1+P Count), Innovative Efficiency,* and *High IE.*
Radical	An indicator variable set equal to one if the firm files for a radical patent, and zero otherwise. We define radical patents as patent applications on which the applicant does not cite another patent. We measure radical patents using calendar-year 2018 patent applications (the last full year of backward citations data availability in the U.S. Patents by WRDS database).
Small	An indicator variable set equal to one for observations in the lowest tercile of *Age* in event year *t-1* , and zero otherwise.
Young	An indicator variable set equal to one for observations in the lowest tercile of *Assets* in event year *t-1,* and zero otherwise.

Control Variable Vectors:

Capex Controls	A vector of control variables including *Log(Assets), ROA, MTB, Leverage,* and *Cash Flow.*
Controls	A vector of control variables including *Log(Assets), Log(Age), Leverage, Loss Firm, ROA, Sales Growth, MTB, Cash, Capex, PPE, Domestic, Foreign Income %,* and *NOL Indicator.*
ETR Controls	A vector of control variables including *Log(Assets), Log(Age), Leverage, Loss Firm, ROA, Sales Growth, MTB, Cash, R&D Investment, Capex, PPE, Domestic, Foreign Income %,* and *NOL Indicator.*
Outcome Controls	A of vector of control variables including *Payout Controls* and *Capex Controls.*
Payout Controls	A vector of control variables, including *Domestic ROA, Foreign ROA, Log(Assets), Sales Growth, MTB, Capex, Log(Age), Retained Earnings, Cash, Domestic ROA Volatility, Foreign ROA Volatility,* and *Returns.*

Other Variables:

ΔR&D DTA	Change in capitalized R&D deferred tax asset (DTA), measured in event year *t* =0, relative to event year *t* -1. We obtain R&D DTA data from financial statement disclosures via hand collection.
ΔR&D DTA / Assets	*ΔR&D DTA* scaled by beginning of year assets (AT).
Age	The number of years since the firm first appeared in Compustat with non-zero, non-missing assets.
Assets	Total assets (AT).
Capex	Total capital expenditures (CAPX) scaled by beginning of year assets (AT).

Capitalized R&D	Capitalized R&D as estimated by grossing up Δ*R&D DTA* by the federal corporate statutory tax rate of 21%.
Capitalized R&D / Assets	*Capitalized R&D* scaled by beginning of year assets (AT).
Cash	Total cash holdings (CHE) scaled by beginning of year assets (AT).
Cash Flow	Operating cash flow (OANCF) scaled by beginning of year assets (AT).
Domestic ROA	Domestic pre-tax income (PIDOM) scaled by beginning of year total assets (AT).
Domestic ROA Volatility	The standard deviation of *Domestic ROA* over the past five years, requiring at least three non-missing values of *Domestic ROA.*
Foreign Income %	Pre-tax foreign income (PIFO) scaled by total pre-tax income (PI).
Foreign ROA	Pre-tax foreign income (PIFO) scaled by beginning of year total assets (AT).
Foreign ROA Volatility	The standard deviation of *Foreign ROA* over the past five years, requiring at least three non-missing values of *Foreign ROA.*
Leverage	Total debt (DLTT + DLC) divided by total beginning of year assets (AT).
Log(Age)	Log of 1 + *Age.*
Log(Assets)	Log of 1 + *Assets.*
Loss Firm	An indicator variable set equal to one if pre-tax income is negative, and zero otherwise.
MTB	Market to book ratio, computed as price (PRCC_F) × shares outstanding (CSHO) divided by the book value of equity (CEQ). This variable is set to missing for negative values of CEQ.
NOL Indicator	An indicator variable set equal to one for positive values of tax loss carryforward (TLCF), and zero otherwise.
PPE	Total property, plant, and equipment (PPENT) scaled by beginning of year assets (AT).
Retained Earnings	Retained earnings (RE) divided by the beginning of year book value of common equity (CEQ).
Returns	Stock return compounded monthly over the prior twenty-four months.
ROA	Sum of pre-tax income (PI) divided by total assets (AT).
Sales Growth	$(SALE_t - Sale_{t-1})/SALE_{t-1}$.

Appendix E: Treatment Timeline

This appendix depicts the treatment timeline. The patterned area represents the treatment sample. The shaded area represents the post-period. As our treatment sample is limited to December year-end U.S. firms, the post-period for the treatment group includes only the period ending December 31, 2022. The post-period for the control group includes fiscal years ending September 30, 2022 through November 30, 2022.

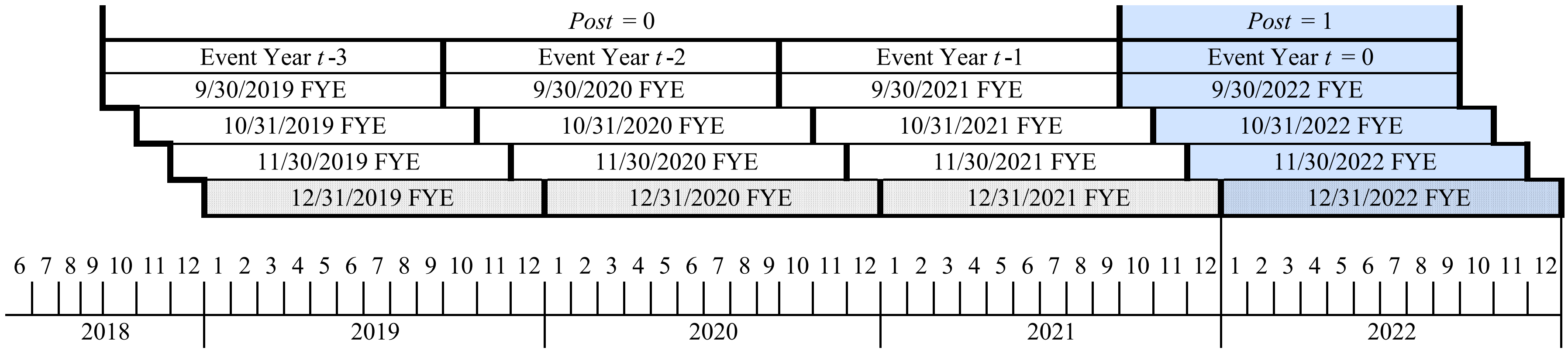


Table 1: Sample Selection

	Observations
Total observations for U.S. firms with fiscal years ending January 1, 2019 through December 31, 2022.	21,222
Less observations missing industry code	-498
Less financial and utilities industries	-4,632
Less observations with missing data to construct control variables	-5,767
Less firms with missing or non-U.S. headquarters	-226
Less observations for January through August fiscal year ends	-1,847
Less observations with zero or missing R&D expense	-3,728
Less observations for December fiscal year-end firms that do not make an R&D amortization disclosure	-1,724
Less observations for firms missing event year *t* -1 or *t* =0 data	-335
Total observations	2,465

This table reports the sample selection procedure.

Table 2: Descriptive Statistics

Variables	N	Mean	SD	p25	p50	p75
R&D Investment	2,465	0.150	0.169	0.030	0.093	0.209
ΔR&D DTA	577	78.526	274.810	3.711	13.832	37.985
ΔR&D DTA / Assets	577	0.029	0.030	0.007	0.019	0.041
Capitalized R&D	577	373.934	1,308.621	17.671	65.867	180.881
Capitalized R&D / Assets	577	0.139	0.144	0.033	0.089	0.197
Cash ETR	861	0.216	0.139	0.139	0.201	0.269
Current ETR	781	0.217	0.132	0.137	0.205	0.269
Assets	2,465	7,353.935	24,061.120	169.593	748.487	3,209.895
Log(Assets)	2,465	6.537	2.167	5.024	6.497	7.933
Age	2,465	22.800	19.108	7.250	18.000	31.000
Log(Age)	2,465	2.754	0.904	1.981	2.890	3.434
Leverage	2,465	0.265	0.255	0.061	0.213	0.390
Loss Firm	2,465	0.521	0.500	0.000	1.000	1.000
ROA	2,465	-0.170	0.479	-0.304	-0.011	0.086
Sales Growth	2,465	0.482	2.048	-0.024	0.111	0.316
MTB	2,465	6.992	9.657	2.152	3.993	7.613
Cash	2,465	0.588	0.842	0.120	0.350	0.719
Capex	2,465	0.030	0.033	0.010	0.021	0.039
PPE	2,465	0.159	0.131	0.068	0.127	0.214
Domestic	2,465	0.280	0.449	0.000	0.000	1.000
Foreign Income %	2,465	0.234	0.759	0.000	0.000	0.390
NOL Indicator	2,465	0.861	0.346	1.000	1.000	1.000
High R&D Firm	2,465	0.333	0.471	0.000	0.000	1.000
High HP Index	2,465	0.236	0.425	0.000	0.000	0.000
High KZ Index	2,234	0.185	0.389	0.000	0.000	0.000
High Z Score	2,268	0.211	0.408	0.000	0.000	0.000
Small	2,465	0.300	0.458	0.000	0.000	1.000
Young	2,465	0.229	0.420	0.000	0.000	0.000
Negative OCF	2,465	0.392	0.488	0.000	0.000	1.000

This table reports descriptive statistics for variables used in the main analyses. Appendix D provides variable definitions.

Table 3: Comparison of Treatment and Control Firms

	Dec FYE Firm = 0		*Dec FYE Firm* = 1		
	N	Mean	N	Mean	Diff. in Means
Log(Assets)	370	7.026	2,095	6.451	0.575***
Log(Age)	370	3.265	2,095	2.663	0.602***
Leverage	370	0.252	2,095	0.268	-0.016
Loss Firm	370	0.276	2,095	0.565	-0.289***
ROA	370	-0.029	2,095	-0.195	0.166***
Sales Growth	370	0.174	2,095	0.536	-0.362***
MTB	370	5.684	2,095	7.223	-1.539***
Cash	370	0.284	2,095	0.642	-0.358***
Capex	370	0.032	2,095	0.030	0.001
PPE	370	0.178	2,095	0.156	0.022***
Domestic	370	0.205	2,095	0.294	-0.088***
Foreign Income %	370	0.399	2,095	0.204	0.195***
NOL	370	0.776	2,095	0.876	-0.101***

This table reports descriptive statistics for the variables used in the main analyses with the sample split on the treatment indicator. All continuous variables are winsorized at the 1st and 99th percentiles. Variable descriptions are available in Appendix D. Significance levels are based on two-sided t-tests and are indicated as follows: * p<0.10, ** p<0.05, *** p<0.01.

Table 4: Impact of R&D Capitalization on Effective Tax Rates

Variables	(1) *Cash ETR*	(2) *Current ETR*
Dec FYE Firm × Post	**0.119*****	**0.099*****
	[5.554]	**[3.960]**
Log(Assets) $_{t-1}$	0.127***	0.115**
	[2.952]	[2.432]
Log(Age) $_{t-1}$	-0.298**	-0.265
	[-2.288]	[-1.256]
Leverage $_{t-1}$	-0.106	0.031
	[-1.416]	[0.258]
Loss Firm $_{t-1}$	0.004	-0.120***
	[0.096]	[-3.230]
ROA $_{t-1}$	0.269*	-0.056
	[1.835]	[-0.498]
Sales Growth $_{t-1}$	-0.067	-0.130**
	[-1.367]	[-2.414]
MTB $_{t-1}$	-0.000	0.001**
	[-0.022]	[2.073]
Cash $_{t-1}$	-0.061	-0.067
	[-0.721]	[-0.428]
R&D Investment $_{t-1}$	-0.601	-0.099
	[-1.610]	[-0.293]
Capex $_{t-1}$	0.081	0.131
	[0.258]	[0.429]
PPE $_{t-1}$	0.114	-0.007
	[0.577]	[-0.028]
Domestic $_{t-1}$	0.118	0.282
	[1.065]	[1.434]
Foreign Income % $_{t-1}$	-0.012	-0.040***
	[-1.043]	[-3.345]
NOL Indicator $_{t-1}$	-0.029	0.007
	[-0.775]	[0.217]
Constant	0.246	0.192
	[0.535]	[0.314]
Observations	861	781
R^2	0.575	0.576
Method	Entropy Balanced	Entropy Balanced
Firm FE	Y	Y
Event-Year FE	Y	Y
Clustering	Firm	Firm
Dependent variable mean values:		
Dec FYE Firms, Event Year t-1	0.193	0.196

This table presents results of testing the impact of the R&D capitalization requirement on effective tax rates. The dependent variable is *ETR* , measured by cash effective tax rates (Column 1) and current effective tax rates (Column 2). All variables are defined in Appendix D. All models are entropy-balanced on the second moment within the sub-sample of observations with available data using all control variables included in the regression model. All continuous variables are winsorized at the 1st and 99th percentiles. Fixed effects are included as indicated. Standard errors are clustered at the firm level. T-statistics are reported in brackets beneath the coefficients. Significance levels are based on two-sided t-tests and are indicated as follows: * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

Table 5: Impact of R&D Capitalization on R&D Investment (H1)

Variables	(1)	(2)	(3)
		R&D Investment	
Dec FYE Firm × Post	**-0.005**	**-0.000**	**0.000**
	[-1.501]	**[-0.056]**	**[0.069]**
Dec FYE Firm × Post × Domestic		**-0.027***	
		[-1.875]	
Domestic × Post		0.008	
		[0.625]	
Dec FYE Firm × Post × High R&D Firm			**-0.038****
			[-2.086]
High R&D Firm × Post			0.001
			[0.053]
Log(Assets) $_{t-1}$	-0.073***	-0.072***	-0.072***
	[-7.252]	[-7.251]	[-7.231]
Log(Age) $_{t-1}$	-0.033	-0.026	-0.015
	[-1.552]	[-1.218]	[-0.665]
Leverage $_{t-1}$	0.016	0.015	0.014
	[0.990]	[0.995]	[0.913]
Loss Firm $_{t-1}$	-0.004	-0.004	-0.004
	[-1.212]	[-1.164]	[-1.173]
ROA $_{t-1}$	-0.012	-0.012	-0.012
	[-1.232]	[-1.224]	[-1.192]
Sales Growth $_{t-1}$	-0.007***	-0.007***	-0.007***
	[-4.718]	[-4.868]	[-4.791]
MTB $_{t-1}$	0.000	0.001	0.000
	[1.433]	[1.491]	[1.449]
Cash $_{t-1}$	-0.024***	-0.024***	-0.024***
	[-5.194]	[-4.960]	[-5.181]
Capex $_{t-1}$	-0.200**	-0.199**	-0.193**
	[-2.475]	[-2.476]	[-2.429]
PPE $_{t-1}$	0.028	0.028	0.032
	[0.695]	[0.713]	[0.795]
Domestic $_{t-1}$	-0.008		-0.008
	[-0.807]		[-0.826]
Foreign Income % $_{t-1}$	0.000	0.000	0.000
	[0.162]	[0.201]	[0.209]
NOL Indicator $_{t-1}$	0.005	0.004	0.005
	[1.115]	[1.041]	[1.177]
Constant	0.707***	0.678***	0.646***
	[8.434]	[8.271]	[7.187]
Observations	2,465	2,465	2,465
R^2	0.929	0.929	0.930
Method	Entropy Balanced	Entropy Balanced	Entropy Balanced
Firm FE	Y	Y	Y
Event-Year FE	Y	Y	Y
Clustering	Firm	Firm	Firm

Within-group difference-in-differences estimate:			
Dec FYE Firm × Post × Domestic + Dec FYE Firm × Post		-0.027*	
Dec FYE Firm × Post × High R&D Firm + Dec FYE Firm × Post			-0.038**
Dependent variable mean values:			
Dec FYE Firms, Event Year t-1	0.162		
Dec FYE Domestic Firms, Event Year t-1		0.255	
Dec FYE High R&D Firms, Event Year t-1			0.331

This table presents results of testing whether R&D investment declines in response to the U.S. requirement to capitalize and amortize R&D (H1). Column (1) reports results of estimating Equation (1). Columns (2) and (3) report results of the cross-sectional tests on domestic-only status (*Domestic*) and past R&D intensity (*High R&D Firm*). We measure all cross-sectional variables as of event year *t-1*. In all columns, the dependent variable is *R&D Investment* (R&D expense scaled by beginning of year assets). All variables are defined in Appendix D. All models are entropy-balanced on the second moment within the sub-sample of observations with available data using all control variables included in the regression model. All continuous variables are winsorized at the 1st and 99th percentiles. Fixed effects are included as indicated. Standard errors are clustered at the firm level. T-statistics are reported in brackets beneath the coefficients. Significance levels are based on two-sided t-tests and are indicated as follows: * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

Table 6: Heterogeneity in the Impact of R&D Capitalization on R&D Investment based on Financial Constraints (H2)

	(1)	(2)	(3)	(4)	(5)	(6)
High constraints measure	*High HP Index*	*High KZ Index*	*High Z Score*	*Small*	*Young*	*Negative OCF*
Variables			*R&D Investment*			
Dec FYE Firm × Post	**0.001**	**-0.004**	**0.001**	**0.001**	**-0.004**	**0.003**
	[0.464]	**[-1.272]**	**[0.383]**	**[0.327]**	**[-1.004]**	**[1.247]**
Dec FYE Firm × Post × High Constraints	**-0.059*****	**-0.008**	**-0.093****	**-0.026****	**-0.024**	**-0.045*****
	[-2.751]	**[-0.310]**	**[-2.554]**	**[-2.077]**	**[-1.602]**	**[-2.628]**
High Constraints × Post	0.026	0.007	0.062*	0.006	0.009	0.017
	[1.377]	[0.277]	[1.750]	[0.597]	[0.737]	[1.081]
Observations	2,465	2,234	2,268	2,465	2,465	2,465
R^2	0.930	0.928	0.927	0.929	0.929	0.930
Method	Entropy Balanced	Entropy Balanced	Entropy Balanced	Entropy Balanced	Entropy Balanced	Entropy Balanced
Controls	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y
Event-Year FE	Y	Y	Y	Y	Y	Y
Clustering	Firm	Firm	Firm	Firm	Firm	Firm
Within-group difference-in-differences estimate:						
Dec FYE Firm × Post × High Constraints + Dec FYE Firm × Post	-0.058***	-0.012	-0.092**	-0.025**	-0.028*	-0.042**
Dependent variable mean values:						
Constrained Dec FYE Firms, Event Year t-1	0.275	0.149	0.260	0.247	0.231	0.253

This table presents results of testing whether R&D investment declines more for financially constrained firms in response to the U.S. requirement to capitalize and amortize R&D (H2). We measure constraints (*High Constraints*) using financial constraints indices (*High HP Index, High KZ Index,* and *High Z Score*), firm characteristics (*Small* and *Young*), and cash flow constraints (*Negative OCF*). All constraints are measured as of event year *t-1*. In all columns, the dependent variable is *R&D Investment* (R&D expense scaled by beginning of year assets). All variables are defined in Appendix D. All models are entropy-balanced on the second moment within the sub-sample of observations with available data using all control variables included in the regression model. All continuous variables are winsorized at the 1st and 99th percentiles. Fixed effects are included as indicated. Standard errors are clustered at the firm level. T-statistics are reported in brackets beneath the coefficients. Significance levels are based on two-sided t-tests and are indicated as follows: * p<0.10, ** p<0.05, *** p<0.01.

Table 7: Impact of R&D Capitalization on Share Repurchases and Capital Investment

Panel A: Repurchases

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Sample	Full sample	*High HP Index* = 0	*High KZ Index* = 0	*High Z Score* = 0	*Small* = 0	*Young* = 0	*Negative OCF* = 0
Variables				*Repurchases*			
Dec FYE Firm × Post	**-0.014****	**-0.013****	**-0.011***	**-0.011****	**-0.014*****	**-0.012****	**-0.014*****
	[-2.524]	**[-2.574]**	**[-1.922]**	**[-2.047]**	**[-2.753]**	**[-2.337]**	**[-2.708]**
Observations	1,482	1,355	1,102	1,165	1,275	1,338	1,128
R^2	0.746	0.751	0.715	0.775	0.755	0.743	0.766
Method	Entropy Balanced	Entropy Balanced	Entropy Balanced	Entropy Balanced	Entropy Balanced	Entropy Balanced	Entropy Balanced
Controls	Y	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y	Y
Event-Year FE	Y	Y	Y	Y	Y	Y	Y
Clustering	Firm	Firm	Firm	Firm	Firm	Firm	Firm
Dependent variable mean values:							
Dec FYE Firms, Event Year t-1	0.034	0.034	0.033	0.033	0.034	0.034	0.034

Panel B: Capital Expenditures

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Sample	Full sample	*High HP Index* = 0	*High KZ Index* = 0	*High Z Score* = 0	*Small* = 0	*Young* = 0	*Negative OCF* = 0
Variables				*Capex Investment*			
Dec FYE Firm × Post	**-0.074*****	**-0.061****	**-0.101*****	**-0.055****	**-0.023**	**-0.061****	**-0.056****
	[-2.721]	**[-2.474]**	**[-3.322]**	**[-2.156]**	**[-1.452]**	**[-2.169]**	**[-1.991]**
Observations	2,452	1,883	1,817	1,784	1,726	1,896	1,498
R^2	0.427	0.462	0.441	0.442	0.559	0.413	0.419
Method	Entropy Balanced	Entropy Balanced	Entropy Balanced	Entropy Balanced	Entropy Balanced	Entropy Balanced	Entropy Balanced
Controls	Y	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y	Y
Event-Year FE	Y	Y	Y	Y	Y	Y	Y
Clustering	Firm	Firm	Firm	Firm	Firm	Firm	Firm
Dependent variable mean values:							

Dec FYE Firms, Event Year t-1	0.296	0.321	0.324	0.321	0.321	0.321	0.321

This table presents results of our analyses of the effect of R&D capitalization on repurchases (Panel A) and capital expenditures (Panel B). In all panels, Column (1) reports results for the full sample with available data. Columns (2) through (7) report results for various subsamples of unconstrained firms. We measure constraints using financial constraints indices (*High HP Index, High KZ Index,* and *High Z Score*), firm characteristics (*Small* and *Young*), and cash flow constraints (*Negative OCF*). All constraints are measured as of event year *t-1*. All variables are defined in Appendix D. All models are entropy-balanced on the second moment within the sub-sample of observations with available data using all control variables included in that particular regression model. All continuous variables are winsorized at the 1st and 99th percentiles. Fixed effects are included as indicated. Standard errors are clustered at the firm level. T-statistics are reported in brackets beneath the coefficients. Significance levels are based on two-sided t-tests and are indicated as follows: * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

Table 8: Heterogeneity in the Impact of R&D Capitalization on R&D Investment based on Innovation Quality

	(1)	(2)	(3)	(4)	(5)
Quality measure	*Radical*	*Log(1+P Count $_{t-1}$)*	*Log(1+P Count $_{t-3\ to\ t-1}$)*	*Innovative Efficiency*	*High IE*
Variables			*R&D Investment*		
Dec FYE Firm × Post	-0.011*	-0.005	-0.007	-0.006*	-0.006**
	[-1.790]	[-1.011]	[-1.244]	[-1.686]	[-1.999]
Dec FYE Firm × Post × Quality	**0.011**	**-0.001**	**0.001**	**0.031**	**0.009**
	[1.519]	**[-0.367]**	**[0.455]**	**[1.388]**	**[1.329]**
Quality × Post	-0.001	0.002	0.001	0.010	-0.004
	[-0.247]	[1.491]	[0.815]	[0.773]	[-0.826]
Observations	2,191	2,465	2,465	1,025	1,025
R^2	0.929	0.929	0.929	0.955	0.954
Method	Entropy Balanced	Entropy Balanced	Entropy Balanced	Entropy Balanced	Entropy Balanced
Controls	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y
Event-Year FE	Y	Y	Y	Y	Y
Clustering	Firm	Firm	Firm	Firm	Firm
Within-group difference-in-differences estimate:					
Dec FYE Firm × Post × Quality + Dec FYE Firm × Post	0.000	-0.006	-0.006	0.025	0.003

This table presents results of testing whether the effects of R&D capitalization differ based on innovation quality, where *DEC FYE × Post* interacts with several measures of quality (*Quality*), including *Radical, Log(1+P Count), Innovative Efficiency,* and *High IE.* In all columns, the dependent variable is *R&D Investment* (R&D expense scaled by beginning of year assets). All variables are defined in Appendix D. All cross-sectional variables are measured as of event year t-1. All models are entropy-balanced on the second moment within the sub-sample of observations with available data using all control variables included in the regression model. All continuous variables are winsorized at the 1st and 99th percentiles. Fixed effects are included as indicated. Standard errors are clustered at the firm level. T-statistics are reported in brackets beneath the coefficients. Significance levels are based on two-sided t-tests and are indicated as follows: * p<0.10, ** p<0.05, *** p<0.01.