Nothing is Certain Except Death and Taxes: The Lack of Policy Uncertainty from Expiring "Temporary" Taxes

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Abstract

Do people expect extensions of statutorily temporary taxes? To answer this question, I look at the U.S. research and development tax credit, which was statutorily temporary but was extended 10 times from 1996 to 2015. Using event studies and abnormal stock market returns, I find that, on average, market participants expected these extensions. I then use a text analysis of 8,000,000 news items and also find that nonmarket participants expected these extensions. My results suggest that at least some temporary tax policies do not contribute to policy uncertainty and, therefore, that their extensions are not fiscal shocks.

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1 Introduction

Uncertainty over future policy can cause large economic effects. As such, researchers have taken interest in measuring and quantifying the effects of policy uncertainty. Perhaps the best-known metric of U.S. policy uncertainty is the economic policy uncertainty index of Baker, Bloom, and Davis [2015, 2016]. This index uses: (1) a newspaper-based search for mentions of uncertainty, (2) disagreement about the future macroeconomy from professional forecasters, and (3) the number of provisions of the federal tax code set to expire to quantify policy uncertainty. More uncertainty mentions, more forecaster disagreement, and more expiring tax provisions all imply higher policy uncertainty.

However, expiring fiscal policies may not be the source of much, or any, policy uncertainty. That is because governments often design fiscal policies as statutorily temporary instead of statutorily permanent, perhaps to make the policies more appealing to voters or to increase the chance of forming a winning political coalition. But when these temporary policies expire governments often extend them. The state of Pennsylvania implemented an "emergency" corporate income tax in 1935 that was supposed to last only two years —but Pennsylvania extended this emergency tax at ***every single Pennsylvania legislative session*** until this tax was finally made statutorily permanent in 1957 —twenty plus years after it was first passed as a two year tax.[1] U.S. President George W. Bush's 2001 tax cuts were set to expire after 10 years so that they could pass with a simple majority, instead of a super majority, of Senate votes.[2] Yet when the time came for the tax cuts to expire, U.S. President Barack Obama extended the cuts through the end of 2012 and then, in 2013, made most of them permanent.[3] Outside of the U.S., in February 2022, the U.K. enacted a "temporary" expansion of its tax credit for activities in relation to theatrical productions (a "theatre tax credit"), which was supposed to only apply to productions through March 2023.[4] In

[1] Committee on Continuation of the Tax Study [1944], McKenna [1960], Commonwealth of Pennsylvania Department of Revenue [2007].

[2] U.S. Public Law 107-16.

[3] U.S. Public Laws 111-312. and 112-240.

[4] U.K. Public General Acts 2022, Chapter 3, Part 1, Creative Reliefs, Section 17, "Temporary increase in

July 2023, however—just after the policy's expiration—the U.K. extended this temporary expansion through March 2025.[5]

While governments often extend statutorily temporary taxes, a necessary condition for determining their economic significance, and whether the temporary taxes are a source of policy uncertainty, is assessing whether people *expect* the extensions. Expectations matter. Absent other constraints, statutorily temporary taxes that everyone expects will be extended have economic effects equivalent to permanent taxes and do not contribute to policy uncertainty. Furthermore, if people expect these extensions, then these extensions are not fiscal shocks. Conversely, statutorily temporary taxes that people do not expect will be extended have the economic effects of temporary taxes that add to policy uncertainty. And these extensions, which would be unexpected, are fiscal shocks.

This paper looks at whether all expiring temporary taxes should be counted towards measured policy uncertainty by looking at the U.S. research and development (R&D) tax credit from 1996 to 2015. In 1996, the R&D tax credit was statutorily temporary but was routinely extended 10 times until 2015, when it was made statutorily permanent.[6]

I use two nearly independent, yet complementary, approaches to measure people's expectations of extensions of this credit. First, I measure market-based expectations of the tax extensions using event studies and cumulative abnormal returns (CARs) for firms that received the credit. I measure CARs both when these 10 extensions were introduced into committee and when they were signed into law by the U.S. president, as these are major legislative days that could generate CARs.

The key assumption linking CARs to expectations of these tax policy extensions is that the market's expectation about whether these extensions would become law is reflected in the stock prices of firms that benefited from these extensions. If the market anticipated these extensions to become law, then there should be no CARs for the firms that benefited from

the theatre tax credit."

[5] U.K. Public General Acts 2023, Chapter 30, Part 1, Other Reliefs Relating to Businesses, Section 14, "Extension of the temporary increase in theatre tax credit etc."

[6] These routine extensions are also called "tax extenders."

these extensions, as the passage of the bill was already integrated into firms' stock prices before these extensions became law. Alternatively, if the market did not anticipate these extensions to become law, then there should be positive CARs, as the extended credit would have been an unexpected book asset for these firms.

On average, I find no statistically significant CARs on these major legislative days for firms that benefited from extensions of the R&D tax credit. The point estimates suggest that, on average, the market assessed at least a 95% chance of these extensions. The confidence intervals on most of these specifications can reject an 80-90% chance. These results suggest that, on average, the market expected these extensions to become law.

For my second approach, I measure nonmarket expectations of tax extensions using a text analysis of 8,000,000 news items from the Thomson Reuters News Archive (TRNA). Text analysis complements the event studies nicely because it has the benefits of: (1) capturing expectations of extensions over the entire time leading up to the major legislative days, not just in the brief period around these legislative days as in the event studies, (2) inferring the expectations of nonmarket participants, as opposed to just the expectations of market participants in the event studies, and (3) using different data and methods and, therefore, allowing me to infer people's expectations using a nearly independent approach from the event studies. From the news items that discussed extensions of the R&D tax credit, I find that at least 90% express sentiment that the credit would be extended. The combined results from the event studies and text analysis indicate that people largely expected extensions of the R&D credit.

To my knowledge, this paper is the first to test whether people expect extensions of statutorily temporary taxes. This paper contributes to at least three literatures.

The first literature is on measuring economic uncertainty [Jurado, Ludvigson, and Ng, 2015, Baker, Bloom, and Davis, 2015, 2016, Husted, Rogers, and Sun, 2016, 2020]. In particular, the monthly U.S. economic policy uncertainty index of Baker, Bloom, and Davis [2015, 2016] uses the value of expiring taxes as an input [Economic Policy Uncertainty, 2019].

My results suggest that, at a minimum, the policy uncertainty assigned to certain expiring taxes should be consistent with people assigning a high likelihood of a tax extension.

The second literature examines the effects of uncertainty, or lack of uncertainty, on economic activity. This literature is large and looks at a wide range of both sources of uncertainty and types of economic activity.[7] Because I find that people assign a high likelihood for extensions of certain expiring taxes, my results support assigning, at most, a low amount of uncertainty to whether certain statutorily temporary taxes will be renewed. For these policies and in the absence of some other friction, the implications of this finding are that, on average, (1) the economic effects of these policies are similar to the counterfactual scenario where the policies were statutorily permanent, and (2) firms forecasting their expected modal future tax liabilities under these statutorily temporary taxes should use the rate that would be in effect under an extension.[8]

The third literature is on estimating the effects of innovation-enhancing policies, of which the R&D tax credit is one tool to enhance innovation [Arrow, 1962, Bloom, Griffith, and Van Reenen, 2002, Guellec and van Pottelsberghe, 2003, Wilson, 2009, Chang, 2018, Guceri and Liu, 2019, Chen, Liu, Suárez Serrato, and Xu, 2021]. The assumption that the statutorily temporary nature of the R&D tax credit did not alter its economic effects is used by several studies on the effects of R&D tax credits on R&D expenditures, as in Bloom, Griffith, and Van Reenen [2002], Wilson [2009], Chang [2018], and so my results support the use of this assumption by these studies.

Outside of the aforementioned academic literatures, generally predicting the effects of

[7]For example, see Garfinkel and Glazer [1994] on the effect of electoral uncertainty on the timing of wage contracts; Bloom, Bond, and Van Reenen [2007] on the relationship between uncertainty, investment, and demand shocks; Gulen and Ion [2016] on how economic activity correlates with the Baker, Bloom, and Davis [2015, 2016] economic policy uncertainty index; Kaufman [2011]'s case study on the effects of uncertainty from the US estate and gift tax; Pierce and Schott [2016] for the effects of a reduction in trade uncertainty by granting China permanent favored tariff status; Hines Jr. and Keen [2021] on the effects of tax uncertainty conditional on potential policy changes being revenue neutral; and Julio and Yook [2012], Canes-Wrone and de Leon [2014], Jens [2017] on the effects of electoral uncertainty on economic activity. For reviews see Bloom [2014], Cascaldi-Garcia et al. [2023].

[8]Closely related papers look at what tax rate firms or households use for decision-making [Ito, 2014, Graham, Hanlon, Shevlin, and Shroff, 2017].

fiscal stimuli before they are implemented is also of paramount importance to several U.S. policymaking agencies including: the Board of Governors of the Federal Reserve System, the Congressional Budget Office, the Council of Economic Advisers, and the Government Accountability Office–and also attracts attention outside of the U.S. For example, at the 2016 meeting of G-20 countries, a central theme was improving certainty over future taxes in order to support growth [Gurría, 2016], which led to follow-up work on the topic by the International Monetary Fund (IMF), the Organisation for Economic Co-operation and Development (OECD), and the European Commission [Zangari, Caiumi, and Hemmelgarn, 2017, IMF and OECD, 2019]. My results suggest that fears over the negative real economic effects of tax policy uncertainty, at least when it comes to certain tax extensions like the R&D tax credit, may be overstated.[9]

2 Market Expectations of Tax Extensions

2.1 Policy Background

Since its inception in 1980, effective in 1981, the U.S. R&D tax credit has been a credit for qualified research expenditures (QREs) over a base amount and, until 2015, was a statutorily temporary part of the tax code (see Figure 1). From its inception up until the effective date of Public Law (PL) 101-239 in 1990, the base amount was a firm-level moving-average of QREs, which effectively meant the credit gave a very low or even *negative* marginal credit rate prior to 1990 [Hall, 1993, Chang, 2018].[10] Throughout its history, the credit has been extended and modified and was allowed to lapse without a retroactive renewal once, applicable to QREs paid or incurred after June 30, 1995 and before July 1, 1996.

[9] Before the U.S. R&D tax credit was made statutorily permanent, policy briefs by Guenther [2015] and Rao [2015] discussed the economic effects of uncertainty over whether the R&D tax credit would be extended. However, Guenther [2015] and Rao [2015] conducted no analysis of expectations of whether the R&D credit would be extended.

[10] The moving-average base amount meant that R&D in a given year contributed to increases in the base amount for future years, so the credit the firm could claim in future years would be lessened by the R&D done in the current year. The base amount was intended to represent the counterfactual amount of research the firm would do in the absence of the credit so that the credit would only apply to additional research caused by the credit.

In my analysis of market returns, I focus on extensions of the R&D tax credit after 1996 for three reasons: (1) the effective credit was very small for its introduction and subsequent extensions through 1990 and, therefore, would not be the cause of meaningful increases in stock prices, (2) as the R&D tax credit was allowed to lapse without retroactive renewal once, the willingness for Congress to let the R&D tax credit lapse without retroactive renewal could have been taken as an indicator that there was increased uncertainty of whether the R&D tax credit would be renewed after 1996, so renewals after this lapse could have been more likely to generate CARs, and (3) perhaps most importantly, the extensions to the credit before 1996 were accompanied by significant changes to the structure of the credit, especially from PL 99-514 and PL 101-239. Therefore, any changes in market returns pre-1996 could have been due to unexpected changes in the structure of the credit, not necessarily due to uncertainty over the credit's extension. See Appendix A for details and additional background on the credit.

2.2 Data and Method for Event Studies and Computing Cumulative Abnormal Returns

For each extension of the R&D tax credit from 1996 to 2015, I use three main data sources to perform my event studies:

1. Compustat-Center for Research in Security Prices (CRSP) merged database for firm financials and daily stock prices for days that markets were open (trading days). [Center for Research in Security Prices, 2016][11]

2. Legislative histories and public records of vote histories (roll call votes) from the United States Congress [2015], which track each bill's progression toward enactment. From

[11] Trading days exclude weekends, U.S. federal holidays, and other extraordinary days when markets were closed. I downloaded Compustat-CRSP on August 4, 2016, so most firms have data through the end of 2015. As different data versions can lead to different estimates, even when using the same time period [Faust, Rogers, and Wright, 2003, Croushore and Stark, 2003, Koenig, Dolmas, and Piger, 2003, Chang and Li, 2018], I fix the version of data.

these data, I take the event dates as the 10 dates when extensions were introduced into committee (introduction dates) and the 10 dates that extensions were subsequently signed into law by the U.S. president (passage dates), for a total of 20 events, shown in Figure 1. I choose the introduction and passage dates as my event dates because they are the first and last major observable legislative actions on a bill.

3. Legislative text from the U.S. Government Publishing Office [2015].[12]

I first restrict the sample from Compustat-CRSP to ordinary shares (share codes 10 and 11) and firm-fiscal years with positive book equity, market equity, and gross receipts.[13] I drop the electric, gas, and sanitary services industry (SIC 49); financial firms (SIC 60, 61, 62, 67); the public administration industry (SIC 91 to 97); and firms that are missing both the firm's stock ticker symbol (tic) and the firm's Global Company Key (gvkey, a unique identifier for each company). Finally, I require that firms be in the sample 270 trading days before through 20 trading days after the event.[14] I then use these data to calculate the amount of R&D credit that each firm in each fiscal year received.

My event studies measure the correlation between observed returns and the "abnormal" returns that should have been caused by unanticipated R&D tax credit extensions to infer whether the market expected extensions of the credit. The rationale behind this investigation is that tax credits are book assets. If an extension of the credit were unanticipated by the market, then the extension would give credit-receiving firms an unanticipated book asset that would also increase their stock prices. Conversely, if an extension of the credit were anticipated by the market, then the value of this extension would be priced into these firms' stock and the extension would not increase their stock prices.

[12] For additional details on the R&D tax credit, see Guenther [2015].

[13] The definitions for book equity and market equity follow Fama and French [1993]. Book equity is the book value of stockholders' equity (seq) plus balance sheet deferred taxes and investment credits (txditc) minus the book value of preferred stock (pstk). When the book value of preferred stock is missing, I instead use redemption (pstkrv) or, when redemption is also missing, liquidation (pstkl). I set further missing values of these variables to zero. Market equity is price (prc) times shares outstanding (shrout).

[14] This sample restriction is necessary to calculate the value of the retroactive component of tax credit extensions.

Formally, let $ln(\bullet)$ be the natural log operator, i denote a R&D credit-receiving firm, w be an event-window size, e denote an event (bill introduction and passage dates), and t be a trading day with $t = 0$ as the event date for event e. My event studies relate the observed changes in a firm's market equity *(ME)* to hypothetical changes in market equity caused by an unanticipated extension, which is a function of the firm's market equity, book equity (BE), and the total discounted book value of the credit extension Σ:

$$ln(ME_{i,e,t=w}) - ln(ME_{i,e,t=-w}) = \alpha_{w,e} +$$
$$\beta_{w,e} * [ln(ME_{i,e,t=-20}/BE_{i,e,t=-20} * \Sigma_{i,e} + ME_{i,e,t=-20}) - ln(ME_{i,e,t=-20})] + \varepsilon_{i,w,e} \quad (1)$$

I estimate equation (1) with ordinary least squares and White [1980] standard errors.[15] The dependent variable is the R&D credit-receiving firm i's cumulative return, measured as the natural log difference in market equity for event e over the event window $t = [-w, w]$.

Part of the right hand side of equation (1) has a key component $\Sigma_{i,e}$, which is the total discounted book value of the credit extension. The discounted book value Σ can also be thought of as a firm's "exposure" to an extension; high-R&D intensity firms have a larger book asset to potentially gain from extensions of preferential tax treatment for R&D.

Most extensions affect more than one of a firm's fiscal years (see Figure 1). For these multi-fiscal year extensions, to compute a firm's total discounted book value of a credit extension, I sum the full book value of the extension for the fiscal year that overlaps with the event and the full book value for any prior fiscal years. I use the full book value for the current and prior fiscal years because an extension for these fiscal years represents an immediate book asset for the firm. Therefore, the book value of the extension for these fiscal years is the face value of the credit. For future fiscal years, which are presumably worth less to the firm and to the market than the immediate book asset generated for the current and

[15] Specifically, HC3 from MacKinnon and White [1985].

prior fiscal years, I discount the book value of the extension using geometric discounting by 15% per fiscal year. I prorate partial fiscal years as necessary.

As a simple example to illustrate the computation of $\Sigma_{i,e}$, consider the fifth extension in Figure 1, which was introduced on September 19, 2006 and passed on December 20, 2006. This extension retroactively extended the credit for 2006 and further extended the credit for 2007. Suppose a firm's fiscal year aligns with the calendar year and that the firm earned \$100 from the credit in 2006 and \$200 in 2007. To compute $\Sigma_{i,e}$ for this firm at this extension, I take the full book value of the credit the firm earned in 2006, \$100, plus 85% of the value of the credit the firm earned in 2007, \$170, for a total of \$270.

Overall the right hand side variable, which includes $\Sigma_{i,e}$ as one component, is how much an unanticipated extension of the credit should have increased the market equity of the firm assuming that the marked assessed the book value of the credit at the firm's market-to-book ratio 20 trading days before the event (equivalently, that the market assessed the marginal value of a credit to the net present value of the firm as an average book asset 20 trading days before the event). Using a market-to-book ratio sufficiently before the event avoids confounding the event's effect on this ratio. Under these assumptions, the average expected increase in market equity for an unanticipated extension is about 80 basis points (see Figure 2).

The coefficient β measures what proportion of cumulative returns are cumulative "abnormal" returns (CARs), in that I can attribute the returns to tax credit extensions as opposed to normal market variation. Because the dependent variable and the regressor for β are on the same scale, $1 - \beta$ also represents the market-assessed probability of an extension. An estimate of $\beta = 1$ implies that, on average across firms, the market was completely surprised by an extension. $\beta = 0$ would indicate that normal market variation explains, on average, all of the cumulative returns and suggests that the market fully anticipated the credit extension.

Equation (1) expresses the relationship between market equity and book equity in natural logged levels. It can also be written using growth rates

$$ln(ME_{i,e,t=w}/ME_{i,e,t=-w}) = \alpha_{w,e}+$$
$$\beta_{w,e} * ln[(\Sigma_{i,e} + BE_{i,e,t=-20})/BE_{i,e,t=-20}] + \varepsilon_{i,w,e} \tag{2}$$

where the natural logged growth rate of a firm's market equity (dependent variable) is related to the expected natural logged growth rate in a firm's book equity due to the firm's discounted book equity benefit from the credit Σ (independent variable). Because both the left and right hand sides are in growth rates and, on average, unanticipated growth in a firm's book equity will grow a firm's market equity by the firm's market-to-book ratio, so long as the market views Σ as an average and unanticipated book asset, $\beta = 1$.

One way to think about the coefficient β from equation (2) is the following: suppose that a firm received an unexpected windfall (cash) from a tax credit extension that was worth 2% of the firm's book equity. How would that unexpected 2% growth in book equity translate to growth in market equity? It would depend on how the market views the cash relative to other assets the firm holds. Assuming the asset is valued as an average asset for the firm by the market, then market equity should also grow by 2%, so $\beta = 1$.

2.3 Did the Market Expect Tax Credit Extensions?

Figure 3 displays estimates of $\beta_{w,e}$ and 95% confidence intervals from equation (1) across all bill introduction dates. For each date, the figure plots estimates over three event windows of $w = 1,\ 3$ and 5 trading days. The averages of $\beta_{w,e}$ by event window size are in the bottom row. Black estimates indicate $\beta_{w,e}$ is not statistically greater than zero; therefore, black estimates indicate that I cannot reject the null hypothesis that market variation explains all of the cumulative return and, as such, that the market fully anticipated the extension. Light gray indicates $\beta_{w,e}$ is greater than zero, so there exist some CARs and the market assigned a nonzero probability of an extension.

Figure 3 shows little to no evidence of CARs. The point estimates of $\beta_{w,e}$ all hover around zero, none of the estimates are statistically greater than zero, and the variation of the point estimates for each event across event window sizes is minimal. Furthermore, the 95% confidence intervals for the averages of $\beta_{w,e}$, displayed in the last row, show that the estimates are unable to reject the hypothesis that the market, on average, completely anticipated these extensions.

Figure 4 displays the analogous chart for bill passage dates. The estimates from passage dates tend to be nosier than those from the introduction dates. The second extension, passed on October 21, 1998, appears to have generated some CARs. The point estimates for this extension suggest that the market assigned about a 70% chance for this bill to become law, so there was some degree of uncertainty over its enactment. That said, on average, there remains little evidence of CARs on bill passage dates, as shown in the last row of the figure, suggesting that on average the market anticipated extensions. Taking the point estimates for the averages at face value, the average market-assessed probability of an extension was greater than 95%.

A natural prior would be that people were surprised at least by the first extension, and perhaps were somewhat (though less) surprised for a few extensions thereafter. But that over time, after observing multiple extensions to the same policy, people updated their expectations and were more likely to expect extensions. In this case, I would find decreasing CARs for extensions after the first (Bayesian updating). That said, my results do not appear to support this prior. The first extension has a tightly estimated CAR around zero for both introduction and passage dates, and CARs do not decrease for the later extensions relative to the earlier ones.

3 Discussion of Possible Explanations for Insignificant CARs Other than Anticipation

Any well-specified statistical test must have appropriate size and adequate power. I discuss size and power in the following subsections.

3.1 Are My CAR Tests Appropriately Sized? Placebo Tests Say "Yes."

One hypothesis for the absence of statistically significant CARs is that the test I am using for statistical significance is inappropriately sized. Therefore, I verify my test size using placebo tests.

To run placebo tests, I select 10 random placebo event dates from January 1, 1993 to December 31, 2015 and re-estimate equation (1). I require placebo dates to be at least 40 trading days away from an actual event to avoid confounding the effect of an actual event with a placebo event. For these placebo events, I construct hypothetical extensions where the R&D tax credit is extended for the current and next calendar year under the policy rules that existed at the time. This timing and length of a hypothetical extension match the median and modal timing and length of actual extensions. For these placebo events, any statistically significant CARs would just be noise.

The placebo estimates from this procedure are largely insignificant and are also still centered around zero (not shown for brevity), which suggests that my tests for the actual events are appropriately sized.

3.2 Are My CAR Tests Powerful Enough? High-R&D Firms Also Do Not Have CARs.

A second hypothesis for why I find no effect of R&D tax credit extensions on CARs is that the tests I am using could be underpowered. While, on average, an unanticipated extension of the credit should have increased the market equity of a credit-receiving firm by 80 basis points (Figure 2), perhaps market participants may be inattentive (rationally or not) and may only respond to the R&D credit when the credit is a sufficiently large benefit to a particular firm.

To investigate this potential test power issue, I estimate CARs for the subset of firms that benefited the most from R&D tax credit extensions and, therefore, should also exhibit the largest CARs from unanticipated extensions. To look for CARs of high-R&D credit firms, I estimate equation (1) using firms in the top decile of claimed R&D tax credit to book assets for the fiscal year that overlaps with a bill's passage date. Compared with the group of all R&D credit-claiming firms, for this subgroup an unanticipated R&D tax credit extension should cause, on average, about 10 times as much increase in market equity (8 p.p., Figure 5).[16]

Figure 6 shows the results for average β, omitting the individual events for brevity. As expected, because the sample is smaller the estimates are more noisy than those of the full sample. That said, for this set of high-R&D intensity firms, on average, I still find no statistically significant CARs. The estimates of average β continue to hover around zero; the point estimates indicate the market assessed at least a 95% chance of an extension. While the confidence intervals are a bit wider than the full sample, for most specifications they can still reject a 90% chance. The exception is for the 5 trading day event window specification around bill passage dates. In this case, it can still reject a 75% chance.

3.3 Am I Using the Correct Event Dates? Committee Hearings as Event Dates Also Show No CARs.

Yet another potential explanation for why I find, on average, no statistically significant CARs is that I am using the wrong event dates. Bill introduction and passage dates represent the first and last major legislative actions on a bill. Therefore, these dates are reasonable times when market expectations of new legislation could update, which would cause CARs.

Alternatively, market expectations for new legislation may update on other days leading up to these major legislative action dates. A reasonable alternative time to look for updates of expectations is on congressional hearing dates. While congressional committees use hearings to gather information, elected officials also use hearings to signal support for or against

[16] This subgroup calculation uses the same assumptions as the calculation for the full sample.

certain policies, which may cause markets to update expectations. However, on average, I also find no statistically significant CARs on relevant committee hearing dates.

Unlike bill introduction and passage dates, which are clearly tied to a single bill, hearings are often held for general information gathering and not necessarily for a particular bill. Some bills have specific hearings associated with them, but others do not. Therefore, I identify hearings that discuss extensions of the R&D tax credit using a two-stage approach.

First, using the "all actions" legislative histories on www.congress.gov [United States Congress, 2015], I find hearings where a R&D tax credit extension was referred to as "hearing held." Second, I look for hearings on the topics of energy, the general economic outlook, innovation, and taxes in the following committees: the House Committees on Appropriations; Budget; Science, Space, and Technology (and its predecessors); and Ways and Means; and the Senate Committees on Appropriations; Budget; and Finance [U.S. Government Publishing Office, 2018].

In the transcripts of these hearings, I look for oral arguments both for and against R&D tax credit extensions. I identify seven hearings that contain at least three oral arguments with regards to R&D tax credit extensions.[17] Using the same approach as for bill introduction and passage dates, on average, I also do not find any statistically significant CARs on these committee hearing dates.

3.4 A Decrease in the Uncertainty of Returns?

Finally, I consider whether the extensions of the credit affected the variance of a firm's market equity rather than the firm's CAR. Perhaps extensions did resolve uncertainty, which should decrease the variance of market equity for R&D credit claiming firms, without the extensions affecting CARs.

To investigate this point, I replace the dependent variable in equation (1) with the change

[17] The seven hearings are in the House Committee on Science, Space, and Technology on March 13, 2007; the House Ways and Means Committee on June 23, 1999, September 26, 2000, June 2, 2011, April 26, 2012, and July 19, 2012; and the Senate Finance Committee on March 17, 2015.

in the standard deviation of firm-level market equity. I calculate the change in the standard deviation of market equity by comparing the 5 or 20 trading days after an event with the 5 or 20 trading days before an event, excluding the actual event date. That said, the estimated βs from these regressions, on average, do not show a decrease in the variance of market equity around bill introduction or passage dates (not shown).

4 Searching for Nonmarket Expectations About Tax Extensions in the News

My event studies infer whether market participants expected extensions of the R&D tax credit. Although I put my event study results through a gantlet of robustness checks, ultimately they are inferring expectations based on abnormal returns, or lack thereof, using a set of econometric principles on certain event dates that require certain assumptions. As such, event study results may not be entirely convincing to some readers.

To provide further evidence on whether people expected these extensions, I use text analysis of the news. While text analysis also requires data, methods, and assumptions, they are all different from the data, methods, and assumptions in the event studies. Therefore, text analysis provides an independent measurement of whether people expected these extensions that can improve the inference from the event studies [Browning and Crossley, 2009]. Text analysis has the complementary benefits of measuring the expectations of nonmarket participants over the entire time period leading up to the extensions. These benefits reduce: (1) the external validity concern of whether other people share market participants' expectations, and (2) the concern over whether expectations update on dates other than the event dates.

For text analysis, I perform a dictionary search for news items that relate to the R&D tax credit in the Thomson Reuters News Archive (TRNA, Thomson Reuters 2017), which is a database of any news item that made contact with the Thomson Reuters London servers. The TRNA covers global news from 1998 to 2017 in multiple languages and contains approximately 66,000,000 news items.[18]

Aside from its coverage and large sample size, using the TRNA for text analysis of historical records has one other very desirable characteristic compared to text analysis based on querying databases maintained by a third party, such as with Google Trends, Factiva, ProQuest, or Twitter: the TRNA is a stable database that is stored locally and is not hosted on a third-party server.[19] Therefore, the TRNA gives reproducible research results. Research that relies on a user querying databases maintained by a third party is vulnerable to the fact that the data accessible to the researcher may change. For example, the third party may change its databases and leave the researcher with a different database from which to query, the researcher's contract for querying the third party's database may change such that queries give an expanded or contracted set of results, or the researchers can get priced out of the data completely by new paywalls. These scenarios can make results based on querying external databases non-reproducible.[20]

4.1 Is the Thomson Reuters News Archive a Useful Source of News?

I start with checking whether this archive is a useful source of news by recreating the monthly U.S. news-based economic policy uncertainty index of Baker, Bloom, and Davis [2016] with the TRNA.

I first extract all English-language news items in the TRNA (approximately 42,000,000). I then select U.S.-centric news items, which I identify as either news items that Thomson Reuters signals as relevant to the U.S. or news items where "United States" or synonyms appear in the title of the news item.[21] I exclude news items that are summaries of or links

[18]See Appendix B for more details on the TRNA.

[19]Researchers reliant on Twitter (and its API) would probably appreciate this benefit after costs for Twitter data skyrocketed in 2023 [Stokel-Walker, 2023].

[20]See, for example, Croushore and Stark [2003], Chang and Li [2018] on the perils of different versions of data. See Christensen and Miguel [2018], Chang and Li [2017, 2022] on research reproducibility.

[21]The author of each news item in the TRNA assigns it one or more "topic codes," which reflect the author's subjective assessment about what the author's work is relevant for. I use the topic code "US."

to other news items. These three restrictions give me a sample of approximately 8,000,000 news items.

I then perform the dictionary search outlined in Baker, Bloom, and Davis [2016] on these 8,000,000 news items and re-create their index, with only two differences: (1) I only use TRNA news items, and (2) the normalization of the total monthly news item counts uses the variance of articles based on the entire TRNA sample of 1998 to 2017, whereas Baker, Bloom, and Davis [2016] use a newspaper-specific variance computed from 1985 to 2009.

Figure 7 graphs the two indexes. The red dashed line is the Baker, Bloom, and Davis [2016] index [Economic Policy Uncertainty, 2019], and the blue solid line is my recreation using the TRNA. The indexes show the same general patterns of economic policy uncertainty: an upward trend in uncertainty from 1998 until about 2002, followed by a drop and a lower level of uncertainty in the mid-2000s, and an increase after about 2010. The correlation between these two measures is 0.65, so I believe that the TRNA contains useful information on the news.

4.2 What Does the Thomson Reuters News Archive Say About Expectations of Extensions of the R&D Tax Credit?

The TRNA is a useful complement to looking at CARs because it contains information on expectations of nonmarket participants: politicians, industry analysts, famous individuals, lobbyists, trade groups, and the opinions of the Thomson Reuters writers themselves. TRNA is also a useful complement because, as news appears daily, TRNA measures expectations across the entire time leading up to an extension, not just in the narrow time frame around certain dates.

To search TRNA for expectations about extensions, I use the sample of 8,000,000 news items that I used to recreate the Baker, Bloom, and Davis [2016] index and search for articles in which "R&D," or synonyms, and either: "tax," "credit," "subsidy," or "subsidies" appears in the headline or body of the news item. This search does not contain any term regarding tax expectations and simply pulls any news item that discusses the R&D tax credit. I find 409 news items that match these criteria, dated from 1998 to 2015, which is the year that the R&D tax credit was made statutorily permanent.

Of these 409 news items, 31 give a direct assessment of the level of likelihood the credit would eventually be extended by at least one chamber of Congress. Of these, 30 of 31 (97%) assess that the credit would likely be extended. That said, as this sample focuses on the news items that most clearly state expectations (level of likelihood of extensions) it excludes news items that may indirectly assess the likelihood of extensions but that may still indicate people's expectations. For example, this sample excludes items that make relative statements, such as those that only assess the likelihood of an extension had increased without mentioning the absolute likelihood.

Therefore, I also tally news items that meet a broader definition of support for the credit. In this definition, sentiment that the credit would eventually be extended includes news items where

- There is an introduction, a vote scheduled, or a passage of a bill from committee or from at least one chamber of Congress that would dedicate funds for or extend the R&D tax credit (that is, either a way to pay for the extension or the actual extension advances through the legislative process).
- A proposal for such a bill is laid out.
- An individual or organization is quoted as saying that the individual or organization wants a bill to pass, urges others to pass a bill, supports the credit, will maintain or increase lobbying for the credit, assesses the probability of an eventual extension is more likely than some prior time period, or believes the likelihood had increased.
- A firm's analyst reports a forecast that assumes the R&D tax credit would be extended.

Sentiment that the credit would not be extended is instead the opposite of these categories (for example, a bill that was scheduled for a vote was unscheduled).

There are 237 news items in the TRNA that meet this broader definition. Of these, 220 (93%) exhibit positive sentiment that the credit would be extended.[22] Therefore, I find that, on average, individuals or organizations in the news believed that the R&D tax credit would be extended.[23]

5 Conclusion

Using two nearly independent approaches, I find that people expected extensions of the U.S. R&D tax credit. Therefore, I assert that not all expiring tax policies should count towards measured economic uncertainty, and that the economic effects of certain temporary policies are closer to those of permanent policies. As the U.S. R&D tax credit is reasonably uncontroversial and enjoys support from both major U.S. political parties,[24] it seems most reasonable to expect that at least other temporary tax policies with bipartisan support should not count towards measured policy uncertainty.

With regards to whether people expected extensions of the U.S. R&D tax credit and, therefore, that these extensions should not be considered fiscal shocks, I believe that there are two main caveats to these assertions.

First, it is possible that people assigned a very, very high, but not certain, chance of these extensions. For example, suppose that people believed that there was a 99.99% chance of an extension. Although more than 90% of relevant news items in TRNA report positive sentiment about an extension, and the confidence intervals around the average CARs also tend to indicate at least a 90% chance of an extension, I am not be able to distinguish

[22] Of the remaining 17 news items, 5 have ambiguous sentiment (for example, where the TRNA states that it does not know whether a firm's forecasts assume an extension of the credit) and 12 are negative.

[23] Another potential source of information on expectations is the debt market. However, given that equity holders are the last in line to receive assets from the firm in bankruptcy per 11 U.S.C. § 506(b) and 11 U.S.C. §1126 and my finding of no equity CARs, the debt market investigation is redundant.

[24] I am basing this statement on floor debates from both chambers of Congress. Members from both parties support the tax credit as a tool to create jobs and promote innovation. Opposition to particular extensions of the R&D tax credit, but not necessarily to the concept of the R&D tax credit, was centered on either the effect of the credit on the federal budget deficit or because the proposed tax credit extensions were too short. For example, see Hoyer [2014], Wyden [2014], Sessions [2015].

a near-certain 99.99% expected chance of an extension from a 100% expected chance of an extension. But it also possible that the slightest bit of policy uncertainty caused by a tiny 0.01% chance of no extension would be enough to affect decision-making, and so tax extensions with a 99.99% chance of passage should still be considered fiscal shocks.[25] For given expected chance of an extension, the size of the shock would depend on the uncertainty aversion of people or institutions.

Second, I have a limited ability to characterize the full path of expectations. The event studies can reasonably say that people expected the extensions on major legislative dates and committee hearing dates. The analysis of the TRNA gives some indication of what expectations were away from these dates. However, the TRNA lacks the sample size to say what expectations were on every single day.

That all said, the main contribution of this paper is that it is the first, to my knowledge, to provide *any* evidence on the expectations of *any* temporary tax policy extension.

There are also unnecessary costs from having tax policies as statutorily temporary when the policies are likely just going to be extended in the future, even if the extensions themselves are not fiscal shocks. Enacting extensions requires multiple bills, which then require more time from policymakers and use up more precious floor time for debate or hearings. Statutorily temporary policies most likely leave more room for wasteful lobbying for an extension. Temporary tax laws may make it more difficult for analysts to predict future firm performance [Hoopes, 2016]. And temporary taxes can increase a firm's tax compliance costs [McBride, 2024]. As such, having effectively (de facto) permanent policies also written as statutorily permanent is probably preferable to having effectively permanent policies written as statutorily temporary.

[25] See Kari, Karikallio, and Pirttilä [2008] for an example of how firms respond to future tax changes.

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A Appendix: R&D Credit Calculation and Background

This section discusses how I use Compustat-CRSP to calculate R&D tax credits by firm-fiscal year. For more details on the credit, see Guenther [2015], Chang [2018].

The calculation of the R&D tax credit's base amount has changed over time, but the formulation was intended to represent the counterfactual amount of research the firm would do in the absence of the credit so that the credit would only apply to additional research caused by the credit. Public Law (PL) 97-34, effective in 1981, created the original R&D tax credit for 25% of QREs over a three-year moving average of QREs (the base amount). Public Law 99-514 (also known as TRA86) reduced the credit rate to 20% but kept the three-year moving average base amount. Unfortunately, the three-year moving average base amount resulted in small and, often, negative marginal credit rates for R&D firms [Hall, 1993, Chang, 2018].

For calculating R&D tax credits, I use 50% of realized Compustat R&D (xrdq) as QREs, which are research expenditures that qualify for the R&D tax credit, and revenue reported (revtq) as gross receipts. The Compustat-CRSP definition of R&D is more broad than what qualifies as QREs under the Internal Revenue Code, so I take the proportion of Compustat-CRSP R&D that are QREs as 50% from Wilson [2009], Chang [2018]. I treat the estimated QREs as in-house, non-basic research following Wilson [2009], Chang [2018], assume firms with positive revenue have sufficient tax liability to claim the credit, prorate bills across fiscal years following Chang [2018], and keep observations that have a fiscal year identifier (fyearq). As firm financial data are only available with a lag, this process assumes that market participants correctly anticipated, in expectation, how much each firm benefited from the extensions.

In 1989, PL 101-239 changed the base amount and provided for separate base amount calculations for startup firms and non-startup (established) firms. The law effectively eliminated the potential for negative marginal rates.

PL 101-239 classified a firm as a startup if the firm had fewer than three taxable years beginning after December 31, 1983 and before January 1, 1989 in which the firm had both gross receipts and QREs. By 1997 a firm was classified as a startup if either: (1) the first taxable year that the firm had both gross receipts and QREs in began after December 31st, 1983, or (2) the firm had fewer than three taxable years with gross receipts and QREs that began after December 31st, 1983 and before January 1st, 1989. The base amount for startups is a fixed-base percentage times the average annual gross receipts of the startup firm for the previous four taxable years. If the firm did not have gross receipts for the previous four taxable years, then the base amount is the fixed-base percentage times the average gross receipts for the years that it has been in existence.[26]

The fixed-base percentage varies for a startup firm's first ten taxable years. The fixed-base percentage starts at 3 percent for the firm's first five taxable years, and changes incrementally to eventually reaching, in the firm's 11th taxable year, the aggregate of the firm's QRE to gross receipts ratio for five of the six taxable years starting from the firm's fifth taxable year to the firm's tenth taxable year.[27] The startup firm can choose which five of six taxable years to use as a fixed-base percentage, so I assume that startup firms choose the five years with the smallest QRE to gross receipts ratios, which would maximize their R&D credit.

For calculating startup values, I assume that firm age is equivalent to the difference between when the firm first appears in Compustat-CRSP and the current year. Because Compustat-CRSP only covers publicly traded firms, I do not observe firms that were in existence before being publicly traded. Therefore, firms could have been filing taxes as non-public firms and I would be underestimating their age.

For established firms, which are all non-startup firms, the credit after 1990 is 20 percent for QREs over an established firm base amount. The base amount for established firms is the product of the established firm fixed-base percentage and the average annual gross receipts for the 4 taxable years before the taxable year that the firm is trying to claim the credit for. The fixed-base percentage, for established firms, is the ratio of QREs to gross receipts for

[26] CFR § 1.41-3 (a).

[27] 26 U.S.C. § 41 (c) (3) (B).

the firm's fiscal years that begin after December 31st, 1983 and before January 1st, 1989.[28]

In computing the fixed-base percentage for the base amount, for both startup and established firms, the fixed-base percentage is rounded to the 1/100th of 1 percent[29] with a maximum of 16 percent[30] and a minimum of 50% of QREs.[31] I annualize taxable years of fewer than 12 months, which I take as two annual reports from Compustat-CRSP that appear less than one calendar year apart.[32,33] I require firms have a non-negative base amount. Negative base amounts can occur because, in some years, gross receipts are negative.

In addition to the regular R&D tax credit, formerly under 26 U.S.C. § 41 (c) (4) firms could instead claim the Alternative Incremental Research Credit (AIRC). The default action is to claim the regular credit, but should a firm choose the AIRC, then the AIRC applied to all taxable years after the first election to use the AIRC, unless the firm received approval from the Secretary of the Treasury.[34] The AIRC corresponded to credit tiers for QREs as a percentage of gross receipts for the firm's previous four taxable years and did not distinguish between startup and established firms. For fiscal years that begin after June 30, 1996 the AIRC was a three-tier credit of 1.65/2.2/2.75 percent of QREs for QREs between [1,1.5)/[1.5,2)/2+ percent of the ratio of the firm's QREs to average gross receipts for the previous four years. The AIRC credit rates increased to 2.65/3.2/3.75 by PL 106-170, Section 502, for amounts paid or incurred after June 30th, 1999[35], which I take as firm fiscal years that begin in July 1999 or later. The AIRC credit rates increased again to 3/4/5 percent by PL 109-432, Section 104 (a) (2) for taxable years ending after December 31, 2006.

For calculating whether a firm took the regular credit or the AIRC, I assume that if a firm's AIRC in a given fiscal year would be $1 million more than the regular credit, then the firm switches to AIRC. I assume that waivers from the Secretary of the Treasury are not

[28] 26 U.S.C. § 41 (c) (3) (A).
[29] 26 U.S.C. § 41 (c) (3) (D).
[30] 26 U.S.C. § 41 (c) (3) (C).
[31] 26 U.S.C. § 41 (c) (2)
[32] 26 U.S.C. § 41 (f) (4).
[33] CFR § 1.41-3 (d).
[34] 26 U.S.C. § 41 (c) (4) (B).
[35] U.S. PL 106-170, Section 502 (c) (3).

granted, so an AIRC election is binding.

PL 109-432 also introduced the Alternative Simplified Credit (ASC). Starting for taxable years that included January 1, 2007, firms that had not yet elected the AIRC could then either elect the AIRC or the ASC. Claiming the ASC, like claiming the AIRC, bound the firm to claiming the ASC for all subsequent taxable years, unless the firm obtained a waiver from the Secretary of the Treasury. For taxable years ending before January 1, 2009, the ASC was 12 percent of QREs over a three-year moving average of the firm's QREs, or 6 percent if the firm had no QREs in any of the previous three taxable years.

During the transitional period of 2007 to 2009, firms could either be on the regular credit, the AIRC, or the ASC. And in the transitional period for fiscal years that included January 1, 2007, firms that had previously opted into the AIRC could switch to the ASC without consent from the Secretary of the Treasury.[36] During this transitional period, I classify firms that were on the AIRC as switching to the ASC if the ASC would have given the firm more than $1 million in credit compared to the regular credit. Otherwise I leave the firm as on the AIRC. If the firm is on the regular credit, then I switch the firm to the ASC if the ASC gave the firm more than $1 million in extra credit. Therefore, for firm fiscal years that encompassed January 1, 2007, firms could be eligible for a combination of the regular credit and ASC, or the AIRC and ASC. Credits were prorated based on the number of days that the firm fiscal years were pre-January 1, 2007 vs. post-January 1, 2007.

PL 110-343 Section 301 (1) (b) terminated the AIRC, restricting its election to taxable years that begin on or before December 31, 2008, and (1) (c) of the same law increased the ASC base rate from 12 to 14 percent for taxable years that end on or after January 1, 2009.

[36] PL 109-432 Section 104 (c) (2).

B Appendix: Thomson Reuters News Archive Details and Data Cleaning

This appendix briefly describes the data and cleaning process for the Thomson Reuters News Archive (TRNA).

The version of the TRNA I use is from December 2017, which is the most up to date version that the Board of Governors of the Federal Reserve System has access to as of July 2019 [Thomson Reuters, 2017]. The raw data from Thomson Reuters (TR, Refinitiv as of October 2018) in this version of the TRNA are a series of large .xml files that do not have delimited fields.[37] The raw data were turned into a usable database with delimited fields and associated metadata thanks to a herculean effort by former Federal Reserve research assistant (RA) Sarah (Saka) Alder, with help from former Federal Reserve RAs Nathan Mislang, and Martin Sicilian. In what follows, I refer to the data cleaning procedures as done by Adler, Mislang, and Sicilian though I am using their database as-is to create indexes and run text analysis. Adler, Mislang, and Sicilian deserve the credit for creating the database and I am responsible for any mistakes in the analysis of this paper that come about due to an error in processing the .xml files.

This procedure is specific to the version of the TRNA from December 2017 and is simply one way to turn the .xml files into a usable database. The data use contract for the TRNA requires me to state that this procedure is not meant to be a definitive, authoritative, official, or "best way" to structure the .xml files. The following procedure is the way that Adler, Mislang, and Sicilian proceeded and, therefore, how I am using the TRNA. Other researchers who have used the TRNA, such as Heston and Sinha [2017], Calomiris and Mamaysky [2019], may have parsed the data differently. Furthermore, TR may be making updates to the version of the TRNA that it sells to potential clients that may alter the database structure (such as adding or removing fields) in ways that I cannot foresee, which is another reason why

[37] In computer/data science terms, the raw data are "unstructured".

having a well-documented and stable local version of the database is useful for research reproducibility.

The TRNA's unit of observation is a "news item". News items encompass traditional news articles and also pieces of news that are not necessarily articles, such as: transcripts of speeches, links to other sources, or forecasts of firm profits that do not have associated commentary with them.

Often, the way news is processed is that there will be an initial report of the news and, as new information becomes available, the initial report may be updated. Updates to the initial news item can be large, which would imply a complete rewrite of the news item, or minor, which leave only a few parts of the initial news item changed. While some news items in the TRNA can be identified as updates by having case-sensitive word "UPDATE" in the news item headline, there is no built-in field in TRNA that links the update news items to the initial news item: the only thing visible is whether a news item has "UPDATE" in the headline or not. As such, I treat both non-update and update news items as separate news items when performing my dictionary searches.

The TRNA has no dedicated indicator for identifying news items that are summaries of or links to other news items, which I exclude from my analysis. However, these news items tend to come with unique types of auxiliary text. I infer that a news item is a summary when the headline or body contains one or more of the following phrases (not case sensitive): "multimedia reuters top news visit," "*top news*," "top news tab," "top stories," "for latest top breaking news across all markets," "breakingviews," "top news summaries on other subjects," "access to some items may depend on subscription level," "up-to-the-minute headlines," "how to find the information you need," "msg terminated," or a sequence of 63 periods.

The synonyms I use for "United States" are: "US," "U.S.," "USA," "U.S.A.," "US of A," "U.S. of A," "U.S of A," "United States," and "America" (not case sensitive).

The synonyms I use for for "R&D" are: "R'N'D," "R+D," "R & D," "R N D," "R

+ D," "R and D," "R&E," "R'N'E," "R+E," "R & E," "R N E," "R + E," "R and E," "Research&Development," "Research & Development," "Research and Development," "Research&Experimentation," "Research & Experimentation," and "Research and Experimentation" (not case sensitive).

The .xml files do not have delimited fields but do have consecutive blocks of text that contain separate news items. Adler, Mislang, and Sicilian execute a series of regular expressions to parse the consecutive blocks of text into a series of fields associated with each news item. Table 1 lists the regular expressions Adler, Mislang, and Sicilian use to create fields. Two fields —Item ID and CoID—are of unknown use and three fields—Alert, Update, and Wordcount—are derivatives of other fields. After parsing with the regular expressions, Adler, Mislang, and Sicilian removed or replaced certain extraneous characters from select fields, shown in Table 2 and dropped news items when the body had fewer than six characters. I use the field IdnTime to date news items.[38]

[38] IdnTime is the time, in GMT to the millisecond, that the news item transmitted to TR hits its London servers. Information is disseminated to the public shortly thereafter. There may be a few milliseconds of delay in transmission to and from the London servers, depending on the location.

C Tables

Table 1: Thomson Reuters News Archive Fields

Field Name	Description	Regular Expression
Alert	“ALERT” in headline	N/A
Attribution	Abbreviation of the organization that authored the item	“<provider qcode=\“NS: (.*?)\” />”
Body	Non-headline text of news item.	“(?s)<body>(.+)</body>”
CoID	Unknown use	“<subject qcode=\“R :(.*?)\” />”
Headline	Headline of a news item	“(?s)<headline>(.*?) </headline>”
IdnTime	Date and time (milliseconds GMT) that news item was published	“(?s)<TimeStamp>(.*?) </TimeStamp>”
Item ID	Unknown use	“(?s)<Id>(.*?)</Id>”
Lang	Language of news item	“(?s)<language tag=\“(.*?)” .>”
Named Item	News item that is part of a routine report	“<instanceOf qcode=\ “(.*?)\” />”
PNAC	Numeric identifier for a news item PNAC with IdnTime uniquely identify a news item.	“(?s)<altId(.*?)>(.*?)</altId>”
Prod	Codes used by TR to route news	“(?s)<Code>NP:(.*?)</Code>”
Story Timestamp	Creation date and time (GMT) When the first version of a news item was published	“(?s)<firstCreated>(.*?) </firstCreated>”
TakeSequence	News item location in the update list	“(?s)<TakeSequence>(.*?) </TakeSequence>”
Timestamp	Version date and time (GMT) when the current version of news item was published	“(?s)<versionCreated>(.+) </versionCreated>”
Topic Code	Classification by news item writers of the topic of the news item	“<subject qcode=\“N2 :(.*?)\” /?”
Update	“UPDATE” in headline	N/A
Wordcount	Character length of Body	N/A

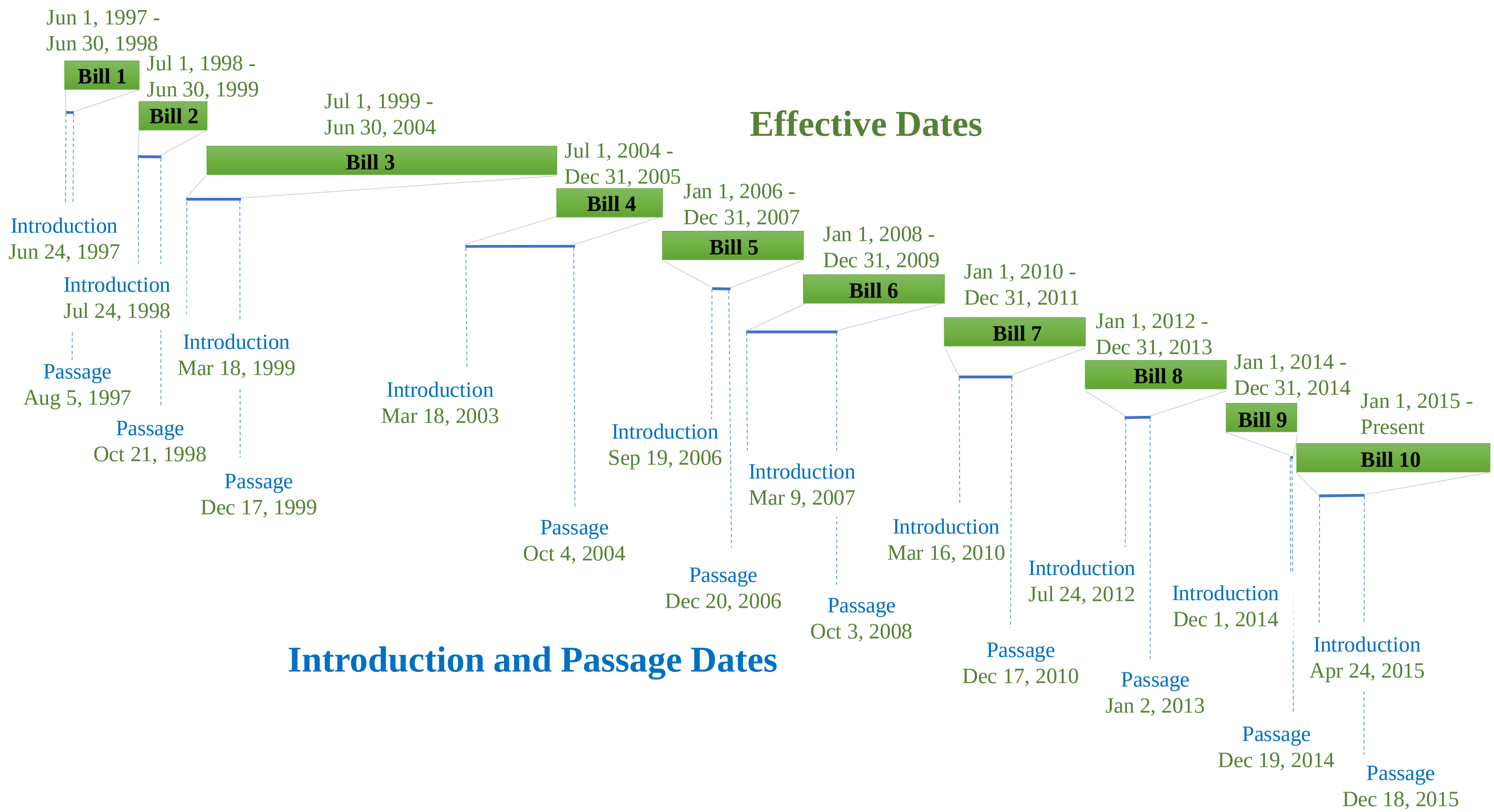
Note: Carriage returns in the regular expression column that are not explicit are for display purposes and were not used in the parsing of fields.

Table 2: Thomson Reuters News Archive Character Replacement

Field	Replacement
Headline	Replace "|" and "\n" with " ". Replace "\r" with ""
Item ID	Replace "|" and " " with ""
Named Item	Replace "|" with " "
Topic Code	Replace "|" with " "
CoID	Replace "|" with " "
All Fields	Replace "\\" with " ".

D Figures

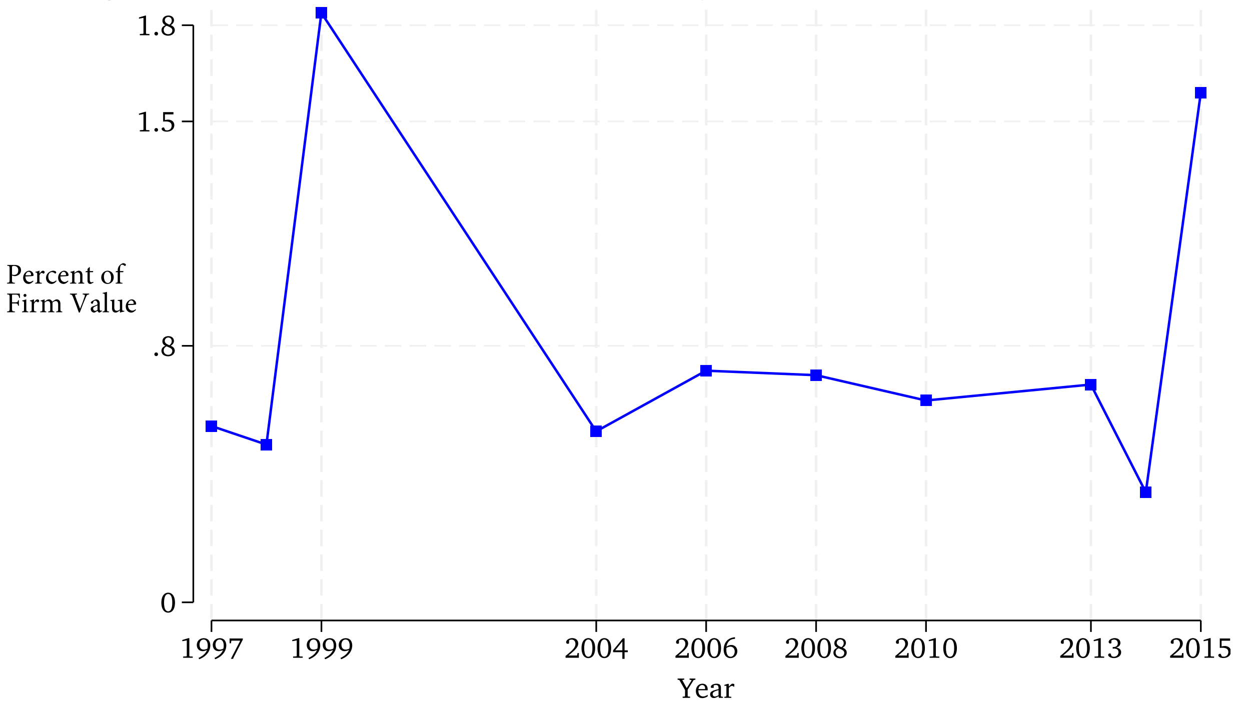
Figure 1: The U.S. R&D Tax Credit Was Extended 10 Times from 1996 to 2015



Description: This figure provides bill introduction dates, passage dates, and effective time periods for extensions of the U.S. research and development (R&D) tax credit since 1997. The green effective bar for Bill #10 is scaled to September 30, 2017. Sources: United States Congress [2015], U.S. Government Publishing Office [2015].

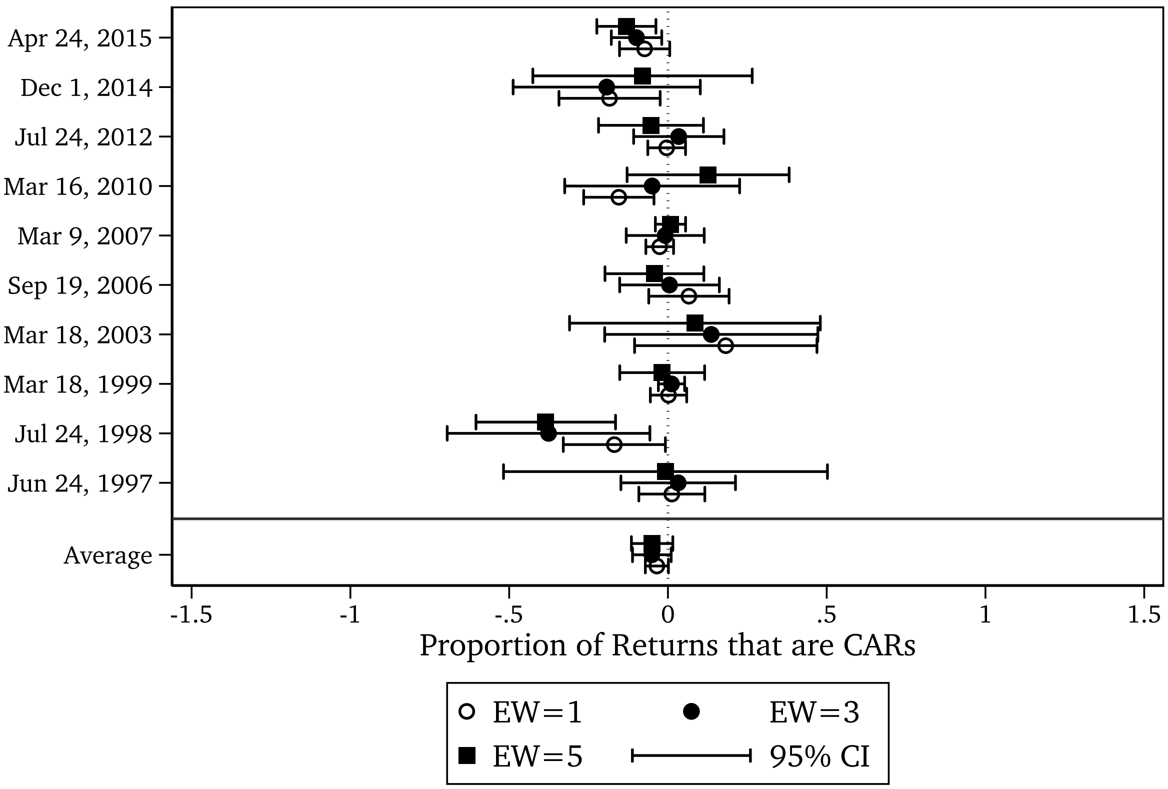
Interpretation: The R&D tax credit was extended 10 times from 1997 to 2015. Extensions were passed after the credit had expired. There is a large amount of variability between when a bill is introduced and when it is passed.

Figure 2: Estimated Increase in Market Equity Under Unexpected Extensions



Description: This figure plots estimates of the average effect of unexpected R&D tax credit extensions by bill passage year, assuming that R&D tax credit extensions are valued at the market to book ratio twenty trading days before passage times the book value of the extension for the current fiscal year, while future fiscal years are discounted by 15% per year with proration for partial fiscal years. Calculations using legislative text and Compustat-CRSP [United States Congress, 2015, U.S. Government Publishing Office, 2015, Center for Research in Security Prices, 2016].
Interpretation: The mean effect of unexpected R&D tax credit extensions on the market equity of R&D credit claiming firms is eighty basis points.

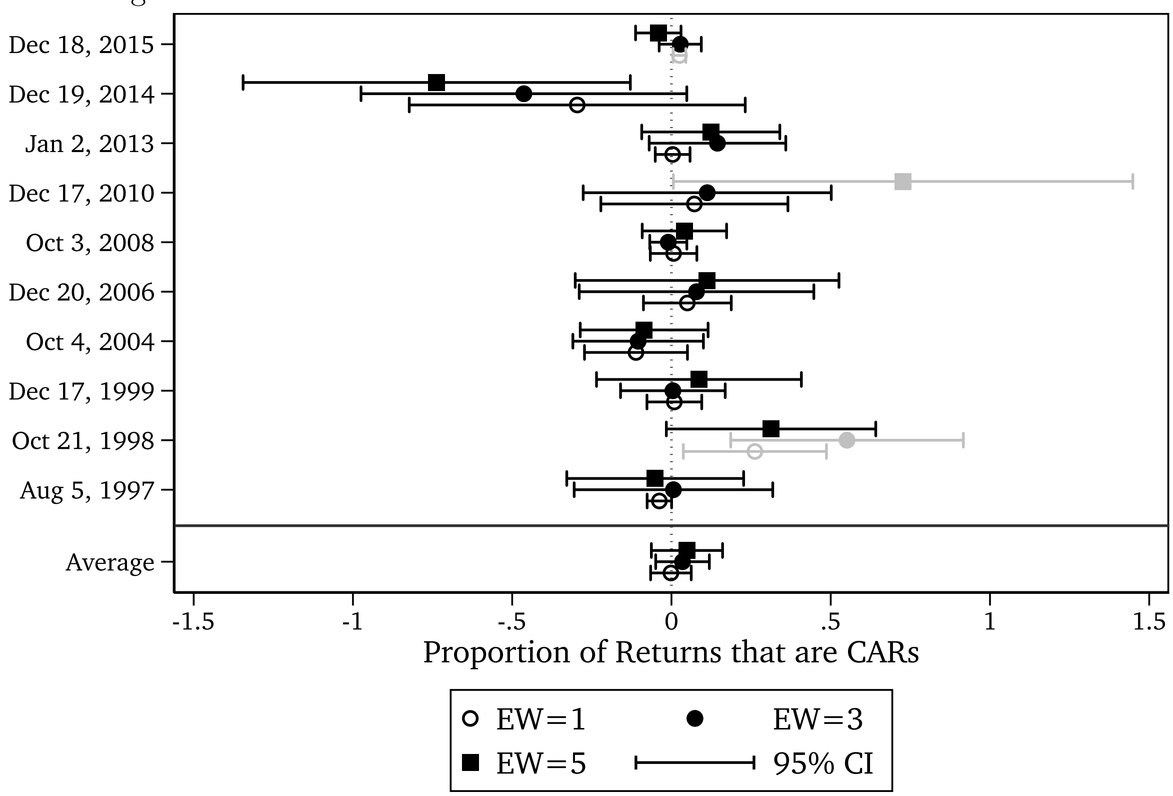
Figure 3: On Average, There Are No Statistically Significant Cumulative Abnormal Returns on Bill Introduction Dates



Description: This figure plots estimates of β from equation (1), which measures what proportion of cumulative returns are cumulative "abnormal" returns (CARs), in that I can attribute the return to the research and development tax credit extensions instead of to normal market variation, around each bill introduction date. The three estimates for each introduction date correspond to three event windows (EWs) of $\pm$ 1 (hollow circle), $\pm$ 3 (solid circle), and $\pm$ 5 (square) trading days. Whiskers denote 95% confidence intervals (CIs). Black estimates indicate the result is not statistically greater than zero at the 5% level, whereas light gray estimates indicate the result is significant.

Interpretation: These results suggest that, on average, the market anticipated the extensions. The point estimates of β all hover around zero, none of the estimates of β are statistically significant, and the averages of β by event window size, shown in the last row, are also about zero.

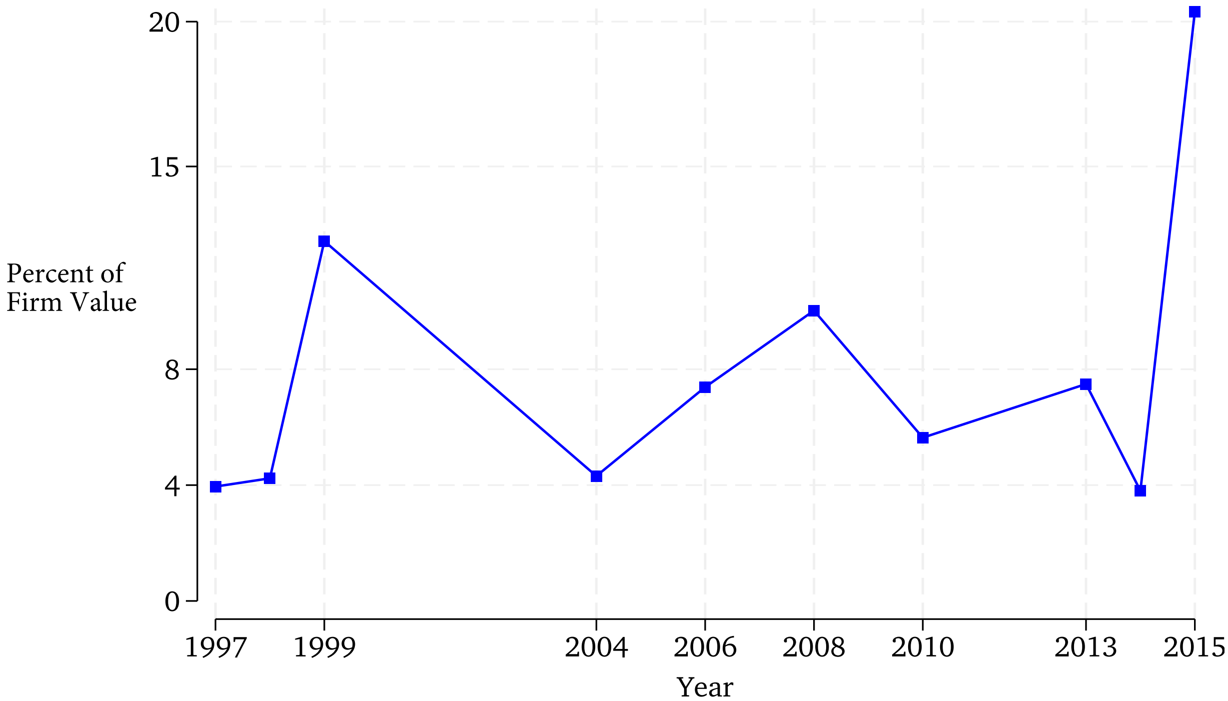
Figure 4: On Average There Are No Statistically Significant Cumulative Abnormal Returns on Bill Passage Dates



Description: This figure plots estimates of β from equation (1), which measures what proportion of cumulative returns are cumulative "abnormal" returns (CARs), in that I can attribute the return to the research and development tax credit extensions instead of normal market variation, around each bill passage date. The three estimates for each passage date correspond to three event windows (EWs) of ± 1 (hollow circle), ± 3 (solid circle), and ± 5 (square) trading days. Whiskers denote 95% confidence intervals (CIs). Black estimates indicate the result is not statistically greater than zero at the 5% level, whereas light gray estimates indicate the result is significant.

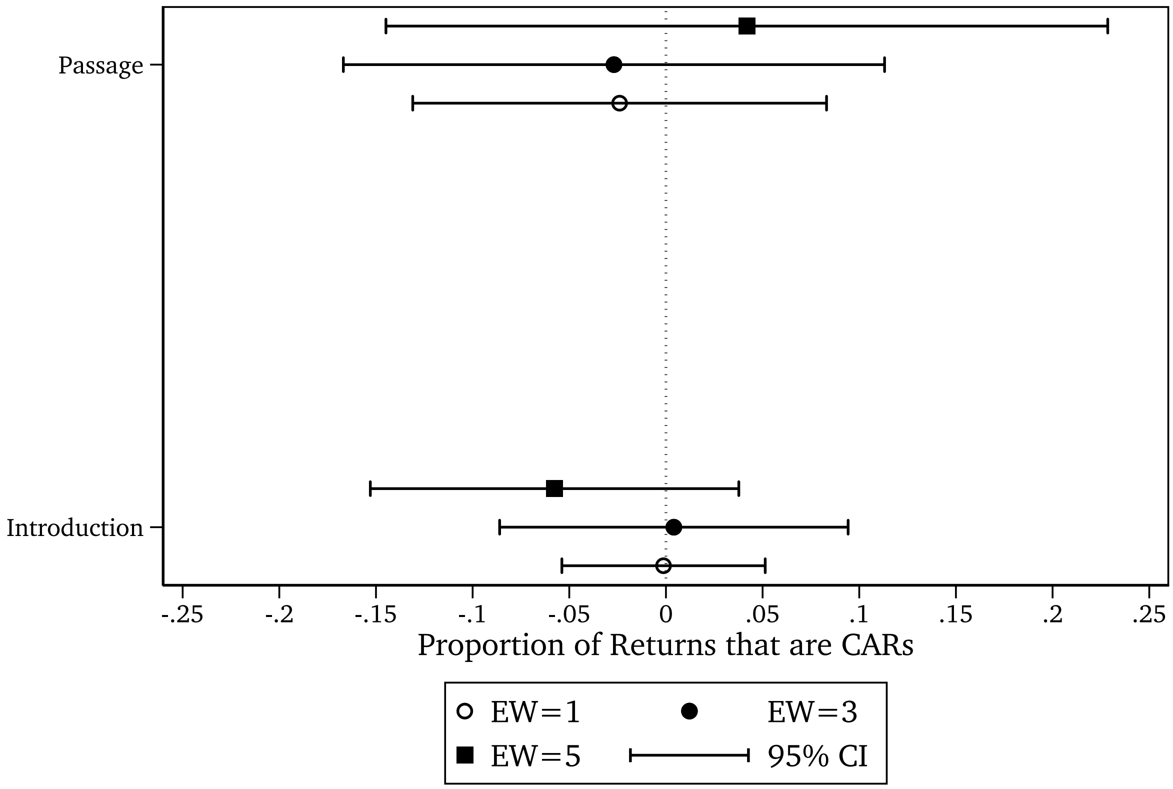
Interpretation: These results suggest that, on average, the market anticipated the extensions. There is a statistically significant increase in CARs for the second extension, passed on October 21, 1998, which suggests that the market was somewhat surprised by this extension. The point estimates suggest that the market assigned about a 70% chance of this extension. But, on average, as shown in the last row, there is no evidence of surprises on bill passage dates.

Figure 5: Estimated Increase in Market Equity Under Unexpected Extensions for High-R&D Firms



Description: This figure plots estimates of the effect of R&D tax credit extensions on the portfolio of high-R&D credit claiming firms by bill passage date, where high R&D credit claiming is the top decile of R&D credit claimed in the fiscal year of bill passage to book value of assets in the fiscal year prior to passage. This figure assumes that R&D tax credit extensions are valued at the market to book ratio times the book value of the extension for the current year, while future years are discounted by 15% per year. Calculations using legislative text and Compustat-CRSP [United States Congress, 2015, U.S. Government Publishing Office, 2015, Center for Research in Security Prices, 2016].
Interpretation:The mean effect across all extensions for high-R&D credit claiming firms is about eight percentage points, which is ten times more than the mean effect for all R&D credit claiming firms.

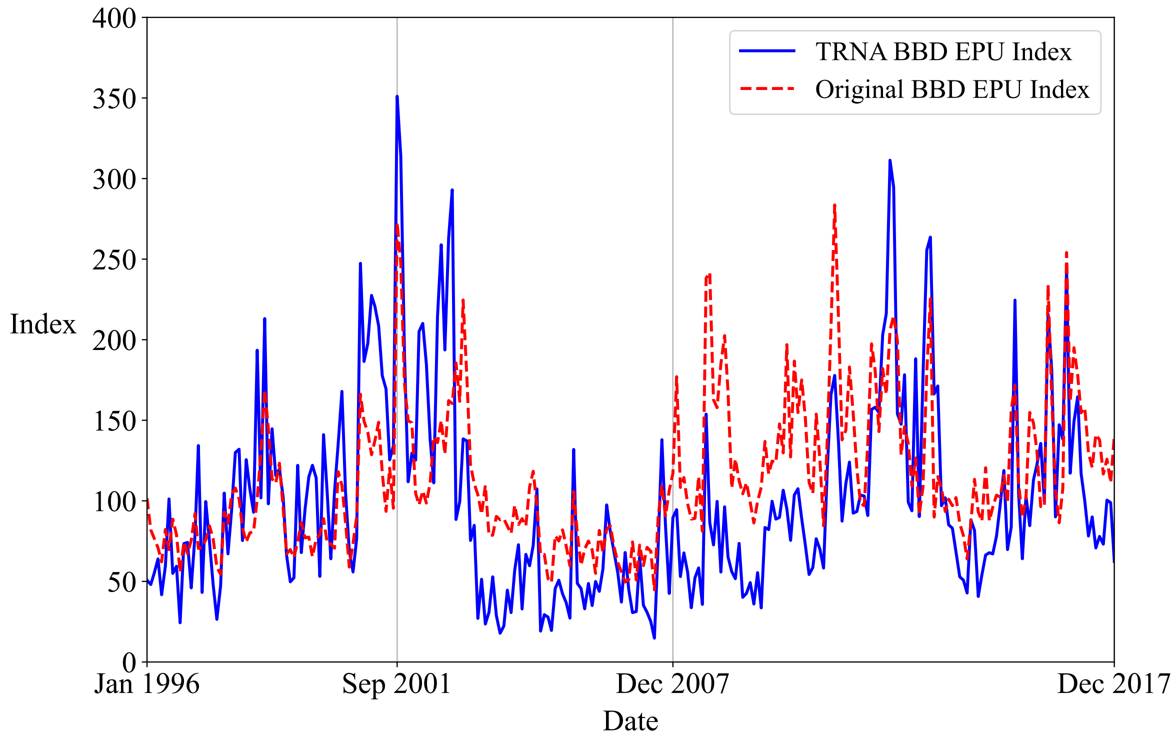
Figure 6: High-R&D Intensity Firms Also Show No Abnormal Returns



Description: This figure plots estimates of the average β from equation (1), averaged across event dates separately for the 10 bill introduction and the 10 passage dates, for research and development (R&D) credit-claiming firms in the top decile of claimed R&D credit to book assets. This set of firms is high-R&D intensity and should benefit the most from a R&D tax credit extension. β measures what proportion of cumulative returns are cumulative "abnormal" returns (CARs), in that I can attribute the return to the R&D tax credit extensions instead of normal market variation. The three estimates for bill introduction and passages dates correspond to three event windows (EWs) of $\pm$ 1 (hollow circle), $\pm$ 3 (solid circle), and $\pm$ 5 (square) trading days. Whiskers denote 95% confidence intervals (CIs). Black estimates indicate the result is not statistically greater than zero at the 5% level, whereas light gray estimates indicate the result is significant.

Interpretation: The CAR tests for high-R&D intensity firms also yield zero CARs for both bill introduction and passage dates, which gives additional evidence that the market anticipated the extensions to become law.

Figure 7: Policy Uncertainty Using Thomson Reuters Tracks Baker, Bloom, and Davis's News-Based Economic Policy Uncertainty Index



Description: This figure plots the monthly U.S. news-based economic policy uncertainty (EPU) index of Baker, Bloom, and Davis [2016] (BBD), the red dashed line [Economic Policy Uncertainty, 2019], which uses a count of major U.S. newspaper articles that mention policy uncertainty, against a similarly constructed U.S. news-based economic policy uncertainty index using the Thomson Reuters News Archive (TRNA [Thomson Reuters, 2017], blue solid line).
Interpretation: The TRNA index tracks the original BBD index (correlation = 0.65), suggesting that the TRNA is a potentially valuable source of news.