# The Effects of the QSBS Exemption on Entrepreneurship and Innovation

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**Abstract**

This paper studies the impact of capital gains taxation on entrepreneurship and innovation. We exploit a 2010 change that significantly reduced the federal capital gains tax rate on the sale of qualified small business stock (QSBS). This change led to a 12% increase in firm births in eligible industries. The effect is stronger for industries with higher startup exit and STEM employment. Startups also become more likely to adopt employee equity compensation. These findings suggest that the tax change increases prospective entrepreneurs' willingness to become founders and their ability to attract talent. Finally, the QSBS exemption change also promotes startup innovation.

*JEL classification*: G21, G23, G24, K22, L26.

*Keywords*: Qualified Small Business Stock, QSBS, Entrepreneurship, Innovation, Venture Capital

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# 1 Introduction

Taxation has long been considered an important policy tool to promote entrepreneurship and innovation (Stantcheva, 2021), which are key to productivity growth and job creation (Haltiwanger et al., 2013; Adelino et al., 2017). Since the passage of the Small Business Jobs Act in 2010, the Qualified Small Business Stock (QSBS) exemption allows many—but not all—entrepreneurs to own "stock in a company where the price appreciates greatly, ... sell it, and pay no tax on [their] profit" (Weltman, 2017). In this paper, we analyze whether the QSBS exemption, by lowering the long-term capital gains taxes faced by prospective entrepreneurs, their employees, and their investors, increases entrepreneurship and innovation. In doing so, we shed light on a broader, long-standing question: The impact of capital gains taxes on entrepreneurship and innovation.

Our identification strategy leverages the fact that the shareholders of firms operating in certain industries are not eligible for the QSBS exemption. Among these non-eligible industries are health services, engineering, architecture, accounting, finance, insurance, leasing, mining, and hospitality. Thus, these industries provide a plausible counterfactual for how entrepreneurship and innovation in eligible industries would have evolved absent the expansion of the QSBS exemption to 100% of eligible capital gains in 2010. As a result of this expansion, the QSBS exemption went from being virtually irrelevant to eliminating capital gains taxes for the vast majority of entrepreneurs and halving them for the top 0.1%.[1]

Using industry-level panel data from the U.S. Census Business Dynamics Statistics (BDS), our differences-in-differences (diff-in-diff) analyses show that firm births in the treated industries increased by approximately 12% relative to industries in the control group following the QSBS expansion. Importantly, this and all our other conclusions are qualitatively

[1] Under the original version of the QSBS exemption introduced in 1993, only 50% of eligible capital gains were exempt from tax and the rest were taxed at a 28% rate. As a result, the exemption became largely irrelevant in 2003 when the nominal capital gains tax rate was cut to 15%. The exemption only regained its usefulness when it was increased from 50% to 100% of eligible gains between 2009 and 2010.

robust to modeling firm births using a Poisson model (Cohn et al., 2022) and scaling firm births by the total number of firms in an industry.

A potential concern with our diff-in-diff identification strategy is that the expansion of the QSBS exemption to 100% of eligible capital gains took place in the aftermath of the 2008-2009 financial crisis. In particular, if QSBS eligible and non-eligible industries were differentially exposed to the crisis, the parallel trends assumption may be invalidated. Several institutional facts and empirical findings help alleviate this concern. First, the set of QSBS eligible industries was defined back in 1993 when the QSBS exemption was first introduced, and so it was not done in response to the financial crisis. Second, our conclusions are robust to excluding from the analysis those industries arguably most impacted by the crisis (finance, insurance, and construction) or the crisis years (2008-2010). Third, we find no evidence of diverging trends between eligible and non-eligible industries until 2011, the first full year when the 100% QSBS exemption was in effect.

Through what channels does the QSBS exemption increase firm births and thus entrepreneurship? We find evidence consistent with three, non-mutually exclusive channels. First, we show that the 100% exemption's effect on entrepreneurship was concentrated in industries that have a high rate of startup exits (IPOs and M&As). This is consistent with the notion that the QSBS exemption only meaningfully alters prospective entrepreneurs' cost-benefit analysis in industries where they expect to be able to sell their startups' shares—thereby generating a capital gains tax liability. We do not expect to find—and do not find—a significant response in industries where successful entrepreneurs tend to be unable (or unwilling) to sell their shares in an exit event.

Second, we show that the 100% QSBS exemption increased startup employment—but only among employees with a bachelor's or higher degree. Further, we show that the effects of the 100% exemption on entrepreneurship were strongest in industries with a high fraction of STEM employment, the kind of industries that are most dependent on highly educated

employees. These findings support the notion that the expansion of the QSBS exemption not only increased prospective founders' expected (after-tax) payoff from building a successful business, but also these founders' ability to attract highly-educated employees to work for their startups.

A likely reason that the 100% QSBS exemption improved founders' ability to attract talent is that the tax change increased the value of the options and shares that startup employees often receive in their compensation packages. The tax change makes it possible for those in eligible industries to eventually sell their shares with much lower capital gains taxes. Consistent with this hypothesis, a firm-level study based on California startups' equity compensation plan shows that the 2010 QSBS exemption change increased treated startups' propensity to adopt new equity compensation plans.

Third, we show that the 100% QSBS exemption led to an increase in the number of startups raising their first round of venture capital (VC) funding. Thus, by lowering the capital gains taxes that startup investors have to pay when selling the shares of their successful investments, the 100% exemption also made it easier for startups to finance their growth. These extensive-margin findings complement the intensive-margin evidence in Edwards and Todtenhaupt (2020), who show that the 100% exemption allowed startups to raise larger funding rounds—conditional on them having already raised at least one prior round. Importantly, we show that the effects of the 100% QSBS exemption on firm births were similar in industries with high and low equity dependence—and, if anything, larger in industries with low financial dependence (Rajan and Zingales, 1998). Thus, the financing channel is an important but *not* the only channel driving the effects of the 100% QSBS exemption on entrepreneurship.

A key reason motivating policymakers' efforts to increase entrepreneurship is that startups are often responsible for developing and commercializing new innovations, which can play a key role in promoting productivity and economic growth. Our cross-sectional analyses

suggest that the QSBS exemption's effects are particularly pronounced in those industries that tend to be most innovative. But in order to provide more direct evidence on the exemption's effects on innovation, we test whether the 100% QSBS exemption led to an increase in startup patenting. To do so, we use startup data from Form D filings, which we merge to patenting data from the USPTO. Estimating diff-in-diff analyses at the startup-year level, we find that the 100% QSBS exemption led to an increase in the number of eventually granted patent applications filed by startups in eligible industries, as well as in the citations received by those patents. These findings support the notion that the QSBS exemption is particularly helpful to innovative startups.

Our paper makes three key contributions. First, we provide the first direct evidence that the QSBS exemption led to higher entrepreneurship and innovation—two key goals of the policy. This evidence is particularly relevant in light of recent proposals to substantially reduce or eliminate the exemption.[2] Such proposals have been motivated, at least in part, by the paucity of evidence showing any *real* effects of the QSBS exemption on entrepreneurial activity, which has led some scholars to argue that the exemption provides "money for nothing" and is "a giveaway to wealthy investors, startup founders, and their employees" (Viswanathan, 2023).

Second, we shed light on the channels via which the QSBS exemption—and, more generally, capital gains taxes—affect entrepreneurship and innovation. Prior related studies examining the QSBS exemption (Edwards and Todtenhaupt, 2020) and, more generally, capital gains taxes (Dimitrova and Eswar, 2023), have focused on their impact on startups' ability to raise capital. Our paper provides new, extensive-margin evidence on the QSBS exemption's impact on startups' ability to raise their first VC round. But more importantly, we provide evidence on two previously undocumented channels through which the QSBS ex-

[2] See, e.g., `https://techcrunch.com/2021/10/19/bidens-qsbs-tax-plan-would-have-unintended-consequences-for-startups` and `https://www.wsgr.com/en/insights/house-democrats-propose-to-limit-qualified-small-business-stock-tax-exemption.html`.

emption spurs entrepreneurship: By increasing prospective entrepreneurs' after-tax benefit of founding a successful startup, and by making it easier for them to attract highly-educated talent.

Third, our paper shows that reductions in capital gains taxes can be an effective mechanism to promote entrepreneurship and innovation— especially if they are targeted to the entrepreneurial sector. This was by no means a foregone conclusion, for at least two reasons. First, investors in startups are often tax-exempt and thus not subject to capital gains taxes (Poterba, 1989). Second, tax policies aimed at promoting entrepreneurship have at best a mixed success record. For instance, in recent work, Denes et al. (2023) find that while state-level angel investor tax credits do increase angel investments, they have no significant impact on entrepreneurial activity. Our paper shows that the same is not true for the QSBS exemption of capital gains taxation.

# 2 Institutional Background

## 2.1 The QSBS exemption

Section 1202 of the U.S. Internal Revenue Code (IRC), also known as the QSBS exemption, excludes from federal capital gains taxes certain gains from the sale of stock meeting four conditions: (1) The stock must have been issued by a domestic C Corporation; (2) the issuing entity's gross assets must not have exceeded $50 million prior to and immediately after the issuance of the stock (including the capital raised in the issuance); (3) the taxpayer selling the stock must have purchased it directly from the issuing company in exchange for money or as compensation for services, and held it for more than five years;[3] and (4) the issuing entity must use at least 80% of its assets in the active conduct of a qualified trade or business during substantially all of the taxpayer's holding period. A qualified trade or

[3] In the case of stock acquired via stock options, the stock issuance date is the options' exercise date.

business for the purposes of condition (4) is one that does *not* belong to any of the 20 industry sectors listed under Section 1202(e)(3) of the IRC. These 20 excluded sectors, listed in column 1 of Table 1, belong to four broad industries: personal services, financial activities, extracting activities, and hospitality.[4]

If the four QSBS conditions are met, taxpayers can currently exempt from capital gains taxation 100% of their so-called "Section 1202 eligible gains," defined as the greater of $10 million and 10 times the taxpayer's adjusted tax basis in the stock sold (where the tax basis is usually the amount paid for the stock).[5] Any capital gains above these two thresholds are called non-Section 1202 gains, and they are currently taxed as regular capital gains (together with any non-QSBS gains). For long-term capital gains, the current top federal rate is 23.8% (the 20% top capital gains tax rate plus the net investment income (NII) tax of 3.8%).

## 2.2 A brief history of the QSBS exemption

Section 1202 of the IRC first became law in August 1993, when the Revenue Reconciliation Act was signed by President Clinton. Under the 1993 version of Section 1202, eligible gains were defined as described above (same as they are today), but only 50% of Section 1202 eligible gains were exempt from federal capital gains taxes; the remaining 50% of eligible gains were taxed at the then prevailing long-term capital gains rate of 28%. Furthermore, the 50% of Section 1202 eligible gains that were exempt from capital gains taxes were not fully exempt from taxation: 7% of such gains were subject to the alternative minimum tax (AMT) rate of 28%, resulting in an effective 1.96% (= 7% × 28%) AMT rate for such gains.

Over the following years, several changes to the taxation of long-term capital gains all but eliminated the attractiveness of the QSBS exemption. Most notably, Congress decreased

[4] Farming businesses are also ineligible for the QSBS exemption, but we exclude them from all our analyses because they are not well covered in the Census datasets that form the basis of our empirical work.

[5] The $10 million cap is a lifetime limit, meaning that any gains from sales of stock of the same company that a taxpayer has excluded from tax in prior years count against the taxpayer's $10 million cap. By contrast, the 10 times tax basis cap is an annual limit that resets every tax year that stock is sold.

the top federal long-term capital gains tax rate from 28% to 20% in 1997, and then further down to 15% in May 2003. However, the 50% portion of Section 1202 eligible capital gains that were not exempt from capital gains taxation were still taxed at the same 28% tax rate prevailing in 1993. As a result, the effective tax rate on Section 1202 eligible capital gains was 14.98% (= 50% × 1.96% (AMT) + 50% × 28%), virtually identical to the post-May 2003 15% rate for regular long-term capital gains.[6]

The QSBS exemption regained its relevance in February 2009, when the American Recovery and Reinvestment Act (ARRA) increased the portion of Section 1202 eligible gains excluded from capital gains taxation from 50% to 75% for stocks acquired after February 17, 2009. The remaining 25% of Section 1202 gains were still taxed at 28%, and thus the overall rate on Section 1202 gains was 8.47% (= 75% × 1.96% (AMT) + 25% × 28%).

Less than 20 months later, in September 2010, the Small Business Jobs Act (SBJA) further increased the QSBS exemption to 100% of Section 1202 eligible gains for stocks acquired after September 27, 2010; in addition, a companion provision in the SBJA also excluded such QSBS-exempt gains from the AMT. Thus, since late September 2010, the effective federal tax rate on all Section 1202 eligible capital gains has been 0%.[7] This 0% rate on QSBS-eligible gains compared to the 15% top tax rate on regular long-term capital gains from 2003 through 2012. The QSBS exemption became even more attractive in 2013, when the top long-term capital gains tax rate was increased to 20% and the 3.8% NII tax was introduced (QSBS-exempt gains are also exempt from the NII tax).

Our empirical analyses seek to identify the effects on entrepreneurship and innovation of the 2010 QSBS exemption increase from 75% to 100% of Section 1202 eligible capital gains.

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[6] Stock sales qualifying for the QSBS exemption still enjoyed some roll-over benefits and, in some states, state tax benefits.

[7] The changes made to the QSBS exemption in the SBJA were originally temporary, but they were first extended three times, and then finally made permanent in 2015. Congress often uses this gradual approach to legislation to reduce its initial fiscal impact, even when the legislation is a "rare example of bipartisan cooperation," as was the case of the 2010 QSBS changes (Sorin, 2012).

Our focus on the 2010 change is motivated by two facts. First, the 2010 change was larger in both absolute and relative magnitude than its immediate predecessor in 2009. Second, Google search data show that interest in the QSBS exemption spiked in the fourth quarter of 2010, immediately after the 100% QSBS exemption came into effect on September 28, 2010 (see Figure 1). Our focus on the 2010 change is also consistent with Edwards and Todtenhaupt's (2020) analysis of the intensive-margin effect of the QSBS exemption on VC funding. That said, it is important to recognize that our diff-in-diff estimates may capture the joint impact of the 2009 and 2010 QSBS changes—a feature of our research design that we further discuss in Section 4.2.

## 2.3 Assessing the impact on entrepreneurial capital gains

Table 2 explores whether the 2010 QSBS exemption increase meaningfully altered the expected rewards for would-be entrepreneurs, using data from the Federal Reserve's 2010 Survey of Consumer Finances (SCF). To that end, the table describes the unrealized capital gains accrued by those U.S. entrepreneurs most representative of the kind of entrepreneurs likely to benefit from the exemption.[8] Specifically, we focus on individuals who owned and actively managed a privately held business that operated in a QSBS-eligible industry and was started in or before 2005. To be clear, these entrepreneurs were themselves not eligible to take advantage of the 2010 QSBS exemption increase—unless they acquired new stock in their business after September 2010. Rather, we use the SCF to infer the distribution of expected capital gains for an entrepreneur starting an eligible business after 2010 and selling it at least five years later (thereby meeting the QSBS five-year holding period).

Column 1 in Table 2 shows that 32.5% of such entrepreneurs had negative unrealized capital gains in their business at the time of the 2010 SCF, and thus would pay no capital

[8] The SCF oversamples wealthy families (Bricker et al., 2012), and thus the 2010 SCF is well suited to describe U.S. entrepreneurs—including the most successful ones—at the time of the 2010 QSBS change. We use the SCF-provided weights to recover estimates representative of the full population of entrepreneurs.

gains taxes upon its sale. Entrepreneurs whose gains fell between percentiles 32.5 and 40 of the capital gains distribution had, on average, $1,848 in (pre-tax) unrealized capital gains, while those in deciles eight and nine had average gains of $151,148 and $410,008, respectively (see the table for the full distribution). Not surprisingly, the distribution of capital gains has a long right tail, with gains averaging $1.011 million for entrepreneurs between percentiles 90 and 95, $3.090 million between 95 and 99, $9.503 million between 99 and 99.5, $21.391 million between 99.5 and 99.9, and $113.480 million above the 99.9 percentile. The mean across the full distribution is $486,199.

Columns 2 through 11 show the distributions of *after-tax* capital gains (even columns) and implied tax rates (odd columns) for entrepreneurs in the 2010 SCF under different tax regime assumptions—including the different versions of the QSBS exemption.[9] Under the pre-2009 QSBS regime, when only 50% of eligible gains were exempt from tax, the distribution of after-tax capital gains is almost identical with the exemption (column 4) and without (column 2), given the post-2003 standard 15% capital gains rate.

By contrast, under the 100% QSBS exemption introduced in 2010, all eligible entrepreneurs with unrealized capital gains below the 99$^{\text{th}}$ percentile would pay no federal capital gains taxes (column 7)—compared to a 15% rate with no exemption (column 3) or under the pre-2009 50% exemption (column 5). Notably, even the most successful entrepreneurs could expect to benefit substantially from the 100% exemption, with the effective average capital gains tax rate being more than halved from 15% to 7.4% for the top 0.1% of entrepreneurs. As a result, the mean of after-tax capital gains across the full distribution of entrepreneurs increases from around $413,000 under both no exemption or the pre-2009 50% exemption to $472,000 with the 100% exemption—a 14% increase.

The expected benefits of the QSBS exemption become even larger if we use the post-

[9] As we do throughout the paper, we focus on federal taxes. Some states also apply the QSBS exemption to state capital gains taxes, and thus Table 2 provides a lower bound of the exemption's expected benefits.

2012 23.2% top capital gains tax rate for our hypothetical exercise: the mean of after-tax capital gains without exemption falls to $370,483 (column 8), while it stays little changed at $463,680—25% higher—with the 100% exemption (column 10).

Table 2 thus shows that after the QSBS exemption was increased to 100% of eligible capital gains in September 2010, the expected rewards to entrepreneurship grew substantially—but only in QSBS-eligible industries. We next describe the empirical strategy and data we use to identify whether this increase spurred higher entry into entrepreneurship.

# 3 Identification Strategy and Data

## 3.1 Identification strategy

Key to our identification strategy, the QSBS exemption only applies to shares issued by firms operating in qualified industries. Specifically, shares issued by firms belonging to the 20 industry sectors listed in column 1 of Table 1 do *not* qualify for the exemption, which allows us to create a natural control group to identify the exemption's effects on entrepreneurship.

To that end, we analyze the impact of the QSBS exemption on entrepreneurship by estimating the following diff-in-diff specification at the industry-year level:

$$Y_{it} = \beta\ QSBS\ eligible_i \times Post_t + \gamma\ \text{Log (no. large incumbents)}_{it-1} + \delta_i + \zeta_t + \epsilon_{it}, \quad (1)$$

where $i$ denotes 4-digit NAICS (henceforth, NAICS4) industries and $t$ denotes years. The dependent variable $Y$ captures different measures of entrepreneurial activity, discussed in Section 4 below. *QSBS eligible* is an indicator set equal to one if NAICS4 industry $i$ is eligible for the QSBS exemption, and *Post* is an indicator set equal to one if year $t$ is greater than or equal to 2011, the first full year when the 100% QSBS exemption was in effect. We control for time-varying industry trends unrelated to the QSBS exemption by

including as independent variable the logarithm of the number of large incumbents in the industry, measured as the beginning-of-year (i.e., lagged) number of firms with at least 100 employees.[10] We also include NAICS4 ($\delta$) and year ($\zeta$) fixed effects. Our main analysis comprises the 10-year period around 2011, from 2006 through 2015. Throughout the paper, we cluster standard errors at the NAICS4 industry level.

As with any diff-in-diff identification strategy, the key assumption for our diff-in-diff estimator $\beta$ to consistently identify the impact of the 2010 QSBS exemption increase on entrepreneurship is parallel trends (Roberts and Whited, 2013): The industries that do not qualify for the QSBS exemption (our control group) provide a valid counterfactual for how entrepreneurship in eligible industries (our treatment group) would have evolved absent the 2010 QSBS exemption change. While it is not possible to conclusively prove the parallel trends assumption, Section 4.2 below provides several pieces of supportive evidence.

In the second half of the paper, we complement our industry-level analyses by estimating two firm-level versions of Equation (1). Specifically, these firm-level diff-in-diff analyses examine the impact of the 2010 QSBS exemption change on startups' use of equity-based compensation (Section 5.2) and innovation (Section 6).

## 3.2 Data

We now briefly describe the data used in our analyses. Internet Appendix A provides further details on data sources as well as the construction of our sample and variables.

We use the U.S. Census Business Dynamics Statistics (BDS) to create several industry-level measures of entrepreneurial activity during the years surrounding the 2010 QSBS exemption change. We supplement the BDS datasets with data from the Census Quarterly Workforce Indicators (QWI) to measure employment at entrepreneurial firms, as well as information on STEM-related employment from the U.S. Bureau of Labor Statistics.

[10] Firms of this size are unlikely to meet the QSBS exemption $50 million asset size threshold.

We measure an industry-year's startup exit rate by combining data from SDC to measure mergers and acquisitions (M&A) involving privately-held targets with data from Compustat/CRSP, Donald Patton, and Jay Ritter to measure initial public offerings (IPOs). We use data from SDC's VentureXpert to measure VC investments at the NAICS4-year level.

Importantly, we supplement our industry-level analyses by combining three firm-level data sources to investigate the firm-level response to the 2010 QSBS exemption increase. First, we collect data on stock-based compensation plans from Employee Plan Exemption Notices (EPEN) filed by California startups pursuant to Section 25102(o) of the California Corporations Code. California-based firms need to file an EPEN when relying on Federal Rule 701 to exempt compensatory equity issues (including stock options) from SEC registration. Given California's outsize role in high-growth entrepreneurship and VC financing,[11] Section 25102(o) filings provide a valuable (if necessarily incomplete) measure to analyze how the 2010 QSBS exemption change impacted startups' use of equity compensation to attract and retain talent.

Second, we measure startup innovation using patent and citation data from the USPTO's PatentsView files. Patenting data are available for all firms, regardless of their listing status, which makes it possible for us to examine the impact of the 2010 QSBS exemption change on startup-level innovation.

To analyze whether the 2010 QSBS exemption change increased startups' propensity to use equity compensation or apply for patents, we need a dataset of startups whose behavior is susceptible to be impacted by the exemption. The fact that virtually all startups are privately held means that there is no publicly available dataset covering the universe of U.S. startups. Instead, we use data on Form D filers as our third firm-level dataset. When unlisted firms raise private capital (including, but not limited to, venture capital), they typically rely on

[11] For example, California accounts for almost half of venture capital raised and VC investments in the U.S.

Regulation D to exempt the offered securities from SEC registration. Regulation D requires companies to file with the SEC a so-called Form D to provide notice of exempt offerings. In the Form D, issuers must list key demographic information including their legal name, entity type, industry, incorporation state, and incorporation year if within the last five years (Chen and Ewens, 2024). We use this demographic information to match data on Form D filers to the EPEN and patent filing data. Internet Appendix A provides additional details on this matching process as well as on the EPEN, patent, and Form D data.

Although our dataset of Form D filers does not cover the universe of startups, it does allow us to focus our firm-level analyses on high-growth startups that rely on external financing to fund their growth. To further zero in on high-growth startups, we restrict the sample to startups incorporated in Delaware (Guzman and Stern, 2020). Such high-growth startups are of particular interest to policymakers, and they tend to be overrepresented among the set of startups that use equity compensation and innovate. In particular, the set of Form D filers represents a broader set of startups that are likely to consider issuing equity compensation or engaging in innovation than if we just focused on VC-backed startups.

## 3.3 Sample, variable construction, and summary statistics

The industry-year sample we use to estimate Equation (1) is a balanced 10-year panel of 267 NAICS4 industries.[12] Table 1, columns 1 and 2 describe how we map the IRC industries that do not qualify for the QSBS exemption—our control group—into NAICS4 industries. When the mapping is to a two- or three-digit NAICS industry, we include all the corresponding NAICS4 industries in the control group. Of the 267 NAICS4 industries in our sample, 42 (15.7%) do not qualify for the QSBS exemption.

Our key measure of entrepreneurship from the BDS data is the number of firm births (i.e.,

[12] The BDS include several NAICS4 industries dominated by non-profit firms, which we exclude throughout the paper. We also exclude the agricultural sector (NAICS 11) from all our analyses, as it is not well covered in the BDS. See Internet Appendix A for the full list of excluded industries.

the number of firms of zero age) in an industry-year. Table 3, Panel A provides summary statistics for this and the other variables we use in our analyses of the impact of the QSBS exemption on entrepreneurship. The mean number of firm births in our NAICS4-year sample is 1,515, while the median is 331. As discussed below and in Section 4.1, we employ a variety of approaches to address the fact that firm births is a right-skewed count variable.

One of these approaches is to use an industry's firm birth rate instead of the number of firm births as the dependent variable in our analyses. Following prior literature (Lindsey and Stein, 2020), we define an industry's birth rate as the number of firm births scaled by the total number of firms at the beginning of the year. As expected, this variable is less skewed than the firm birth count: The mean firm birth rate in our sample is 7.2% and the median is 6.6%. The beginning-of-year number of large incumbents (firms with at least 100 employees) across the industries in our sample averages 563; the median is 288.

Our firm-level analysis of the impact of the QSBS exemption on startup equity compensation and innovation starts with the set of Delaware-incorporated Form D filers as likely high-growth startups. Specifically, we use the Form D data to identify startups incorporated in Delaware between 2007 and 2009, and we follow each startup for up to six years, from age zero (the incorporation year) through age five. By focusing on startups incorporated between 2007 and 2009, we ensure that our panel can include at least two pre-treatment and two post-treatment observations for each startup.[13] We drop all observations after a startup has raised over $50 million according to its Form D filings, as these startup-years are unlikely to meet the QSBS $50 million gross assets threshold. We then match each panel observation to the EPEN and patent filing data to measure the startups' equity compensation and patenting activity, respectively. We restrict our equity compensation analysis to startups located in California because we only have equity compensation data for that state.

[13] Recall that the first treatment year in all our diff-in-diff analyses is 2011, the first full year when the 100% QSBS exemption was in effect.

Our equity compensation analysis sample includes 5,802 startup-year observations of 993 unique California-based Form D filers. The patenting analysis sample is larger as it does not require startups to be in California: 17,117 startup-year observations involving 2,916 Form D filers. Column 3 in Table 1 shows how IRC industries that do not qualify for the QSBS exemption are mapped to the industry categories listed in Form D. This mapping results in a control group of startups that do not qualify for the QSBS exemption consisting of 8.8% and 12.6% of the observations in the equity compensation and patenting samples, respectively.

Table 3, Panel B provides summary statistics for the key variables in the equity compensation analysis. We find that 21.8% of the startup-year observations in the sample have a compensation plan for their employees that includes stock and/or option grants. The mean and median startup age in the sample are 2.5 and 2 years old, respectively.

We also investigate how the QSBS exemption change impacted startups' propensity to offer a stock compensation plan for the first time to their employees. When doing so, our sample includes only observations of startups that have not offered a stock compensation plan before. Of these, 21.6% correspond to startup-years that file their first-ever stock compensation plan.

Table 3, Panel C provides summary statistics for the patenting analysis sample. As is common in the literature, we use two patenting measures that aim to capture the quantity and quality of a startup's innovation, respectively: The number of patents granted to a startup and the number of citations received by these patents within five years. We measure a startup's patenting activity as of the patent filing year, rather than the grant year, to more closely capture the year when the innovation is developed.

On average, startups in our innovation sample file 0.3 eventually-granted patent applications per year. The median startup-year in our sample has no patenting activity, as only 12.2% of startup-years in our sample file at least one successful application. The average startup-year in our sample files for patents that end up receiving 2.4 citations over the fol-

lowing five years. If we focus on startup-years that file at least one successful application, the average number of five-year citations received by the patents filed by these startup-years is 19.8. The mean and median startup age in the innovation sample are the same as in the California-based equity compensation sample: 2.5 and 2 years old, respectively.

# 4 The QSBS Exemption's Impact on Entrepreneurship

In this section, we begin by analyzing the baseline impact of the 2010 QSBS exemption change on industry-level entrepreneurship. We then discuss different threats to our identification strategy, and how we address them.

## 4.1 Baseline impact

Table 4 shows the results of estimating Equation (1) to study the impact of the QSBS exemption on entrepreneurship. Our measure of entrepreneurship, the number of annual firm births in each NAICS4 industry, is a right-skewed count variable. A common approach to deal with right-skewness in the dependent variable is to estimate OLS regressions with the dependent variable log-transformed. We follow this approach in column 1. We find that the annual number of firm births in QSBS-eligible industries is 13.8% ($=e^{0.129}-1$) higher than in non-eligible industries after the QSBS exemption increase to 100% of eligible capital gains in late 2010 ($p = 0.004$). This represents an additional 209 and 46 firm births in the average and median industry-year, respectively. We find similar results if we do not control for the lagged number of large incumbents in the industry (column 2, $p = 0.037$).

A drawback of using the log-transformation to address the right-skewness of firm births is that it effectively excludes from the analysis industry-years with zero firm births. That said, there are only five NAICS4 industry-years with zero firm births in our sample, so their

exclusion is unlikely to make any major practical difference.[14] However, for completeness, in column 3 we also estimate Equation (1) using the logarithm of one plus the number of firm births as the dependent variable. This produces a diff-in-diff point estimate similar to those in columns 1 and 2 ($p = 0.005$).

A concern with the log-of-one-plus transformation is that it produces estimates that lack meaningful economic interpretation. An alternative approach when working with a count dependent variable like ours is to estimate a Poisson model. Unlike the log-of-one-plus transformation, Poisson models produce estimates that have the same semi-elasticity interpretation as those produced by the log transformation (Cohn et al., 2022). Column 4 of Table 4 reports the results of estimating Equation (1) using a Poisson model with the number of firm births in an industry-year as the dependent variable. In this case, we find that after the 2010 QSBS change, the number of firm births in treated industries is 6.3% ($=e^{0.061} - 1$) higher than in QSBS-excluded industries ($p = 0.033$).

Our last approach to address the skewness of firm births is to scale the number of births by the total number of firms in an industry at the beginning of the year, and then estimate an OLS model with this firm birth rate as the dependent variable (Lindsey and Stein, 2020). The estimate in column 5 of Table 4 shows that after the 2010 QSBS change, the firm birth rate in treated industries is 0.85 percentage points higher than in control industries ($p < 0.001$). This represents an increase of 11.8% relative to the average firm birth rate of 7.2% in our sample.

Taken together, the results in Table 4 show that the 2010 QSBS exemption change led to an approximate 10% increase in annual firm births in eligible industries relative to industries that were excluded from the exemption when it was originally enacted in 1993. Specifically, the estimated magnitude of the increase in new firm formation ranges from 6.3% (Poisson

[14] Alternatively, the log models in columns 1 and 2 can be seen as capturing the intensive margin effect of the QSBS exemption change on entrepreneurship.

model) to 13.8% (log-transformed OLS model).

In all entrepreneurship analyses that follow, we continue to present results based on the three main models we report in Table 4: the log-transformed OLS model, the Poisson model, and the firm birth rate OLS model.

## 4.2 Threats to identification

For our diff-in-diff estimates to identify the causal effect of the 2010 QSBS exemption increase to 100% of eligible capital gains, the parallel trends assumption needs to be satisfied: In the absence of the QSBS exemption increase, the average post-2010 change in firm births would have been the same for both QSBS-eligible and excluded industries (Roberts and Whited, 2013). Although this assumption is not directly testable, in this section we present several pieces of evidence consistent with it.

First, we estimate a dynamic version of Equation (1) where we replace the interaction term $QSBS\ eligible \times Post$ with a set of interactions between the treatment variable $QSBS\ eligible$ and indicators for each sample year, with 2009 serving as the base year. Figure 2 plots the coefficient estimates and 95% confidence intervals for each of these interaction terms, estimated using our three main models: log-transformed OLS, Poisson, and firm birth rate OLS.

Using the log model, Panel A shows that the coefficient estimates on the $QSBS\ eligible$ interaction terms for years 2006 through 2008 are close to zero (as is, by construction, the interaction term for 2009), with only the coefficient estimate for 2008 being marginally significant ($p$=0.09) and the other $p$ values above 0.3. In contrast, starting in 2010 (the year the QSBS exemption increased to 100% of eligible capital gains), the coefficients on the interaction terms are all positive and significant at the 5% level or better, with the only exception 2013 ($p = 0.148$).

Panels B and C show consistent results when estimating Poisson and firm birth rate

OLS models, respectively: In both panels, the interaction terms for years 2006 through 2008 are all small and insignificant, with $p$ values ranging from 0.215 to 0.928. Conversely, after 2010, the interaction terms are uniformly positive, though the often large standard errors mean that not all individual year interactions are statistically significant. The biggest difference between the three models lies in the interaction for the year 2010: It is positive and statistically significant in the log model but insignificant in the Poisson model (notably) and the firm birth rate model. The 100% QSBS exemption came into effect in late September 2010 and was preceded by an increase from 50% to 75% of eligible capital gains in February 2009, which likely explains why some of our models begin to capture an impact in 2010.

The evidence in Figure 2 thus supports the parallel trends assumption that there were no differential trends in firm births in QSBS-eligible relative to ineligible industries before 2010. Moreover, the magnitude of the increase in firm births in the years following 2010 in Figure 2 aligns with the corresponding average estimates in Table 4. Taken together, these results are consistent with our interpretation that the 2010 QSBS exemption change led to an increase in entrepreneurship in eligible industries.

Second, to further alleviate the concern that differential pre-trends in QSBS-eligible and ineligible industries may threaten the parallel trends assumption, Table 5 shows the results of estimating a series of placebo diff-in-diff models. Specifically, we falsely assume that the QSBS change took place in 2005 or 2006 and estimate models analogous to Equation (1) using a 10-year sample centered around these pseudo-treatment years.[15]

Columns 1-3 of Table 5 report the results of the placebo test for the pseudo-treatment year 2005 estimated using our three main models (log-transformed OLS, Poisson, and firm birth rate OLS). In columns 1 and 2, the coefficients on the interaction term *QSBS eligible* × *Post 2005* are both negative—the opposite of what we find in our actual diff-in-diff tests

[15] We select 2005 and 2006 as the pseudo-treatment years to ensure no overlap (in the case of 2005) or only one year of overlap (in the case of 2006) between the post-pseudo-treatment period and the actual post-2010 treatment period.

in Table 4. In column 3, the estimated interaction coefficient is positive but insignificant ($p = 0.78$). The analogous estimates when we use 2006 as the pseudo-treatment year in columns 4-6 are all insignificant ($p = 0.483$, 0.628 and 0.192, respectively). The results in Table 5 thus reinforce the finding in Figure 2 that firm birth trends in QSBS-eligible and ineligible industries had *not* started to differ before the QSBS exemption increase in 2010, consistent with the parallel trends assumption.

Another potential concern is that the 2010 QSBS exemption change took place in the aftermath of the 2008 financial crisis, and so part of the effects we attribute to the exemption change may in fact reflect natural post-crisis recovery. To be sure, our diff-in-diff identification strategy ensures that our estimated QSBS effects are not confounded by economy-wide trends, since such general trends would by definition affect both our treatment and control groups. Yet one may still worry that the crisis disproportionally impacted QSBS-eligible industries, in which case we could be confounding a particularly strong post-crisis rebound in these industries with the effects of the QSBS change. Two facts help alleviate this concern. First, the set of QSBS-eligible industries was defined when the exemption was initially enacted back in 1993 and it has not changed since then, all but ruling out the possibility that the 2010 QSBS change targeted industries particularly impacted by the crisis. Second, Figure 2 shows no differential pre-trends for QSBS-eligible and ineligible industries, indicating no disparate impact of the crisis on our treatment and control groups.

Be that as it may, Table 6 presents two additional pieces of evidence that directly address the threat to our identification strategy posed by the 2008 financial crisis. First, we re-estimate Equation (1) after excluding from the sample all NAICS4 industries in the finance, insurance, and construction sectors, as these three sectors are often seen as having been at the epicenter of the 2008 financial crisis. Columns 1-3 report the results with our three main models. In all three columns, we continue to find an increase in firm births in QSBS eligible industries relative to ineligible industries following the 2010 QSBS exemption change (with

$p = 0.067$, 0.064 and 0.005, respectively). The point estimates are only slightly smaller than their counterparts in Table 4. Second, columns 4-6 of Table 6 show that our baseline results are also robust to excluding the crisis years (2008–2010) from our sample (with $p = 0.040$, 0.093 and 0.0002, respectively). In this case, the point estimates tend to be slightly larger than their counterparts in Table 4.

Overall, the evidence in Figure 2 and Tables 5 and 6 supports the parallel trends assumption required for our diff-in-diff models to identify the causal impact of the 2010 QSBS change on new firm formation. Accordingly, the results in this section support a causal interpretation of our baseline finding in Table 4 that the 2010 QSBS exemption increase to 100% of eligible capital gains led to an approximate 10% increase in annual firm births. Our findings thus support the conclusion that capital gains tax incentives such as those provided by the QSBS exemption can be an effective policy tool to foster entrepreneurship.

# 5 Potential Channels

Having documented a significant impact of the 2010 QSBS exemption change on entrepreneurship, we now turn to investigating the drivers that help explain this effect. We examine three potential channels involving the main stakeholders in the entrepreneurial process—entrepreneurs, startup employees, and investors—and analyze how the 2010 QSBS change impacted these stakeholders' incentives to engage in entrepreneurship.

## 5.1 Rewards earned by entrepreneurs

A key rationale behind the QSBS exemption when it was enacted in 1993 was "to encourage entrepreneurs and investors to start and operate businesses that would generate economic activity and employment" (Cantley, 2012, p. 1131). Speaking on the floor of the U.S. Senate in 1992 in support of an early draft of what would become the QSBS exemption,

Senator Kerry of Massachusetts noted: "We want to reward the startup entrepreneur who will commercialize the next generation of technology in the United States..." (U.S. Senate, 1992, p. 27819).

Our analysis of the 2010 SCF data in Table 2 shows that the 2010 QSBS exemption change substantially increased entrepreneurs' expected after-tax capital gains. This change effectively eliminated federal capital gains taxes for all but the top 0.5% of entrepreneurs and halved the average tax rate for those in the top 0.1%. These findings support the hypothesis that a key mechanism underlying our results in Section 4 is that the QSBS increase "caused[d] more potential business start-ups to commence because the owners who take the risk of starting and running a business will have a tax-free sale at the end of the line" (Cantley, 2012, p. 1157)—in line with policymakers' motivation when enacting the increase.

However, not all prospective entrepreneurs are equally influenced by a reduction in capital gains taxes when deciding whether to start a business. Entrepreneurs generally earn income from three primary sources: (1) capital gains from selling their ownership stake, (2) profit distributions, and (3) salary and other compensation. A reduction in capital gains taxes should have the greatest impact on those who expect to derive a substantial portion of their income from selling their shares—usually through an IPO or a business sale. Thus, if the increase in firm births reported in Section 4 was partly driven by the QSBS exemption encouraging prospective entrepreneurs to start businesses by increasing their expected financial returns, the effect should be stronger in industries where entrepreneurs are more likely to exit by selling shares through an IPO or M&A transaction.

We test this prediction in Table 7. Specifically, for each NAICS4 industry, we compute the annual number of acquisitions of privately-held firms and IPOs, averaged over the period 2006–2010 before the QSBS exemption change, and then scale it by the average number of firms of age 1 – 10 in that industry during the same period (i.e., those at a life stage when

the exits are likely to take place). With this industry-level exit rate variable, we then investigate whether the QSBS exemption has a differential impact on entry into entrepreneurship. We start to run a subsample analysis by restricting the sample to industries with exit rate above the sample median. The estimation results are reported in columns 1-3. In all three specifications, the coefficients are positive and statistically significant. These estimates suggest that the 2010 QSBS exemption increase led to more entrepreneurial activities in sectors with more startup exits. The economic magnitudes are also large: the treated industries experienced a 26% ($=e^{0.229}-1$) higher level of entrepreneurship (column 1) than the control industries. Next, we restrict the sample to the industries with exit rate below the sample median. In contrast, the estimation results, reported in columns 4-6 of Table 7, show that the 2010 QSBS exemption change has a much weaker impact on entrepreneurship, both statistically and economically. Put together, the results in the first six columns of Table 7 show that the QSBS exemption had a larger impact on entry into entrepreneurship in sectors with more startup exits. We further confirm this finding by estimating a triple difference regression. The estimation results, reported in columns 7-9 of Table 7, show that the coefficients are positive and statistically significant in all three columns ($p$ = 0.009, 0.006 and 0.013, respectively). Thus, these estimations further reinforce our earlier findings that the QSBS exemption increase had a larger impact on entrepreneurship in sectors with higher exit rate.

In summary, the results in Table 7 show that the 2010 QSBS exemption change produces stronger effects on entry into entrepreneurship in sectors where entrepreneur exits are more common. As startup exit is the main channel through which entrepreneurs realize capital gains and thus possibly benefit from the QSBS exemption, our results in this section suggest that the 2010 QSBS exemption change has incentivized entrepreneurs to start more new businesses.

## 5.2 Compensation earned by startup employees

The 2010 QSBS exemption change can also benefit employees working in QSBS-eligible industries, and make it easier for startups in these industries to recruit and retain talents. To study this channel, we first document that the effect of the QSBS exemption on entrepreneurship is stronger in high-tech and high human capital intensity industries. These industries tend to rely on equity compensation such as restricted stock units (RSUs) or stock options to attract and retain high-skilled employees. To provide more direct evidence on the employee channel, we further take advantage of a new equity compensation dataset and study startups' use of equity compensation at the firm level.

We first explore how the QSBS exemption effect depends on the technology intensity of each industry. Understanding these heterogeneous effects does not only shed light on the employee channel, but also help us assess the true effect of the QSBS policy change due to the outsized role played by high-tech firms in promoting economic growth and job creation (Decker et al., 2014; Guzman and Stern, 2020). We proxy the industry technology intensity by a continuous measure – the fraction of STEM employment (i.e., *STEM %* in the regression table). Because workers in STEM-related job functions are often highly skilled and work on job tasks that are more technology-oriented, the fraction of STEM employment in a sector is strongly correlated with the technology intensity in an industry (Goldschlag and Miranda, 2020; Kim, 2020). The STEM employment information is available for almost all of our sample ($2560/2700 = 94.8\%$).[16]

With this proxy, we first run subsample analysis by restricting the sample to the sectors with the fraction of STEM employment above the sample median (i.e., high STEM employment). Similar to before, we run OLS regressions with the natural logarithm of the number of firm births and firm birth rate as the dependent variables, and also a Poisson regression

[16] We retrieve the STEM employment information from the U.S. Bureau of Labor Statistics. The earliest data available is from 2013, from which we construct our proxy. See more details at: `https://www.bls.gov/oes/additional.htm`

with the raw count of firm births as the dependent variable. Reported in Table 8, the coefficients in the first three columns are all positive and statistically significant at the five percent level. These findings indicate that the 2010 QSBS exemption change led to a higher number of firm births in high-tech sectors eligible for the QSBS exemption relative to high-tech sectors that are ineligible. The economic magnitude is especially large. For example, the estimate in column 1 suggests that the treated industries experienced a 26% ($=e^{0.233}-1$) higher number of firm births than the control industries following the 2010 QSBS exemption change. Next, we restrict the sample to the low STEM employment (i.e., low technology intensity) sectors and repeat our exercises. The estimation results, reported in columns 4-6 of Table 8, show statistically insignificant estimates across the three different specifications. Lastly, we run a triple difference (i.e., DDD) regression over the full sample to verify the differential impact of the QSBS exemption on entrepreneurship. Specifically, we include a triple interaction term between the fraction of STEM employment and the main interaction term $QSBS\ eligible \times Post$ in Equation (1). We also include the interaction between the fraction of STEM employment and the *Post* indicator. The estimation results are reported in columns 7-9 of Table 8. The coefficients on the triple interaction term are all positive and economically large. The estimates are also statistically significant in two of the three columns. These findings demonstrate that the QSBS exemption has a significantly larger impact on entrepreneurship in high technology intensity sectors than in the other sectors.[17] As discussed earlier, these results are interesting by themselves because high-tech industries play a more important role in the economy and thus the QSBS exemption could produce a multiplier effect for the economy by benefiting the high-tech industries.

The stronger impact of the 2010 QSBS exemption change on entrepreneurship in more

[17] We also conduct a similar exercise by using a dummy variable proxy – *High-tech*. We identify 14 out of 270 NAICS4 industries in our baseline sample as high-tech sectors (Goldschlag and Miranda, 2020; Kim, 2020) and find that the QSBS exemption led to a higher number of firm births in high-tech industries (see Table IA.2).

technology intensive industries is also consistent with our hypothesis that the 2010 QSBS exemption change increased the value of employee equity compensation and made it easier for startups to attract highly-educated talent in the high-tech industries. These employee benefits could lower the barriers to entrepreneurship entry and encourage more new firm formations. We next examine startup equity compensation directly.

Our equity compensation data is available for startups operating in California, a state with the most concentrated high-growth entrepreneurship and innovation in the U.S. We compare California startups in QSBS-eligible industries with California startups that operate in other industries and examine the change in their likelihood to use equity compensation around the 2010 QSBS exemption change. The regression results are reported in Table 9. Columns 1-3 measure startups' use of equity compensation using a dummy variable indicating whether the startup creates an employee equity compensation plan in a given year. Because startups' use of equity compensation may vary with their life cycle and overall economic conditions, column 1 estimates an OLS regression with firm age and year fixed effects. The coefficient estimate on the main interaction term $QSBS\ eligible \times Post$ is positive and statistically significant at the five percent level. The estimate translates to a 10% increase relative to the mean in the use of equity compensation for QSBS-eligible startups compared to the control startups. To control for time-invariant startup characteristics, column 2 further includes firm fixed effects, and shows a very similar estimate. Column 3 replaces the firm age fixed effects in column 1 with the natural logarithm of one plus the firm age as a control, and again delivers an almost identical estimate.

Our measure of startups' use of equity compensation is based on the creation of equity compensation plans. Creating an equity compensation plan can be costly and complicated as it typically requires investor approval and is accompanied with external equity financing. Instead of creating more equity compensation plans as shown by columns 1-3 of Table 9, startups may increase the size of their equity compensation plan or simply issue more equity

compensation under existing plans in response to the 2010 QSBS exemption change. To deal with this concern, we also measure startups' use of equity compensation using their first equity compensation plan only. The estimation results are reported in columns 4-5 of Table 9. Here, we observe an even larger effect. The 2010 QSBS exemption change led to a 30% increase (relative to the mean) in the likelihood of creating a first equity compensation plan by QSBS-eligible startups relative to the control startups (columns 4-5). Therefore, our estimates document an extensive-margin effect that startups that have not issued equity compensation before are more likely to use it after the 2010 QSBS exemption change.

Overall, our findings in Table 9 suggest that the 2010 QSBS exemption change led to an increase in startups' use of equity compensation. In combination with the results in Table 8, our findings in this section provide evidence consistent with the employee channel that the 2010 QSBS exemption change made it easier for startups to recruit talent and thus spur entrepreneurship.[18]

## 5.3 Returns earned by investors

Lastly, the QSBS exemption also applies to the stocks purchased by early-stage investors, e.g., either angel or VC investors if they are not tax-exempt. Therefore, the 2010 QSBS exemption change can increase the after-tax capital gains for early-stage investors, which would make it easier for startups to raise financing and thus promote entrepreneurship. To test this prediction, we rely on VC financing data, and examine whether the 2010 QSBS exemption increase impacts VC financing.

We focus on the first VC round as it is more likely to feature angel investors and other non-tax-exempt investors (or LPs) and startups at this stage are also more likely to be under $50 million in assets and meet the QSBS exemption requirements. We first compute

[18] We also document real effects of the 2010 QSBS exemption change on employment, and find that it had a positive impact on the employment of skilled workers for entrepreneurial firms that are more likely to qualify for the QSBS exemption, see Table IA.3.

the number of startups funded by VCs at the NAICS4 industry-year level, and then estimate an OLS regression with the natural logarithm of the number of VC-funded startups as the dependent variable. The coefficient estimate on the interaction term $QSBS\ eligible \times Post$, reported in column 1 of Table 10, is positive and statistically significant at the five percent level. The result indicates that the 2010 QSBS exemption change led to a higher number of startups funded by VCs in the treated industries relative to the control industries. This finding is consistent with the idea that the 2010 QSBS exemption change increases early-stage investors' after-tax capital gains and the investors become more motivated to invest in startups following the 2010 QSBS exemption change. Column 2 assesses the robustness of our results by estimating a Poisson model, and delivers a similar message. We further estimate an OLS regression with the natural logarithm of the total dollar amount of VC funding provided in the first round of financing as the dependent variable in column 3. The result remains positive and statistically significant. In column 4, we study the changes in the average amount of VC funds raised per startup conditional on funding. The coefficient estimate is positive but not statistically significant. Therefore, an average startup does not appear to raise more capital conditional on funding.

The results in Table 10 show that the 2010 QSBS exemption increase led to a higher number of startups funded by VCs at the early stage.[19] Therefore, the results present evidence consistent with the investor channel that the 2010 QSBS exemption change may have encouraged entrepreneurship by increasing the availability of funding and reducing the financial constraints of startups.

One caveat with the VC financing analysis in Table 10 is that the volume of VC financing captures the equilibrium effects of both the supply of and demand for venture capital (e.g.,

[19] We also repeat the exercises in Table 10 by using the second or later VC rounds, and do not find a significant estimate. Consistent with our hypothesis, this suggests that the impact of the 2010 QSBS exemption change on VC financing is mostly concentrated in the early stage and at the extensive margin in terms of more new startups funded by VCs.

the number of entrepreneurs seeking VC financing). To better understand this issue, we conduct additional analysis in Table IA.4 in the Internet Appendix using industry external financing needs (Rajan and Zingales, 1998). The results show that the impact of the 2010 QSBS exemption change on entrepreneurship is also present in industries with low external financing needs. This suggests that the investor channel itself cannot fully explain our main findings and there are other channels such as those discussed in Subsections 5.1 and 5.2 at play as well.

# 6 Impact on Innovation

In this last section, we document additional real effects of the 2010 QSBS exemption change on startups using a firm-level analysis. Specifically, the 2010 QSBS exemption change could facilitate startup innovation because our earlier findings in Section 5 show that the exemption increased the resources available for startups to innovate, i.e., by making it easier to attract and retain talents and raise new capital. The 2010 QSBS exemption change could also promote startup innovation by strengthening managers' incentive to grow the firms. Due to a lower capital gains tax after the 2010 QSBS exemption change, the managers could benefit more from the startup growth either through their equity appreciation or potentially additional incentive packages such as stock options that they may receive.

We start to estimate the impact of the 2010 QSBS exemption increase on the quantity of patents startups produce. The results are reported in columns 1-3 of Table 11. We first estimate a Poisson model with the count of patents filed by a startup in each year as the dependent variable in column 1. We control for firm age fixed effects in the regression as startup innovation activity is highly correlated with startup life cycle. The coefficient in column 1 is positive and statistically significant at the one percent level. The estimate indicates a 22.8% ($=e^{0.205}-1$) increase in the number of patents filed by a QSBS-eligible

startup after the 2010 QSBS exemption change relative to a control startup. Therefore, the estimation suggests that the 2010 QSBS exemption change had a positive impact on startup innovation. In column 2, we replace the firm age fixed effects with the natural logarithm of one plus the firm age as a control. The coefficient on the main interaction term barely changes. Not surprisingly, the coefficient on the firm age control is positive and significant, confirming that the scale of innovation is positively correlated with firm age. In column 3, we remove firm fixed effects and focus on cross-firm comparison. The estimate again delivers a similar message. In the last three columns of Table 11, we assess the robustness of our results by considering the number of citation-weighted patents filed by a startup in a year as the dependent variable. We find significant estimates in all three columns. Therefore, the results in Table 11 show that the 2010 QSBS exemption change has elevated the innovation activities of existing startups.

The firm-level analysis in Table 11 documents some additional real effects of the 2010 QSBS exemption change on startups. The analysis also indicates that the 2010 QSBS exemption change does not only increase the number of startups but also improves the quality of entrepreneurial activities.

# 7 Conclusion

The QSBS exemption allows certain entrepreneurs, their employees, and their investors to sell shares of their companies without paying any—or only greatly reduced—capital gains taxes. Using a diff-in-diff identification strategy, we show that the QSBS exemption increase in 2010 led to a 12% increase in firm births in industries eligible for the exemption relative to ineligible industries. We show that the exemption's effect on entrepreneurship is concentrated in industries that have a high rate of startup exits, and in high technology intensity industries. The exemption also led to an increase in startups' use of equity compensation.

These findings suggest that the QSBS exemption spurred entrepreneurship by increasing prospective entrepreneurs' after-tax benefit of founding a successful startup and by making it easier for them to attract talent. In addition, we show that the QSBS exemption increased startups' ability to raise their first round of venture capital.

Taken together, our findings suggest that the 2010 QSBS exemption change increases both the willingness of prospective entrepreneurs to become founders and their ability to raise the resources they need to be successful. Finally, we also show that the QSBS exemption led to higher patenting in treated startups, thus suggesting that it was particularly helpful to innovative startups.

While our results point to several significant benefits of the QSBS exemption, there are also important costs in the form of foregone tax revenue (Viswanathan, 2023). We leave an analysis of these costs—necessary for a complete welfare analysis of the QSBS exemption—for future research.

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Figure 1: Google searches for QSBS

This figure plots the trend of Google searches for the phrase "QSBS" or "Qualified Small Business Stock" by quarter over the period 2006–2015. The trend is indexed to 100 at the fourth quarter of 2010 when the number of searches reaches the maximum during our sample period. The vertical line represents the four quarter of 2010, the first quarter after the QSBS exemption change. The data for the plot are retrieved from Google Trends: `https://trends.google.com/trends/?geo=US`.

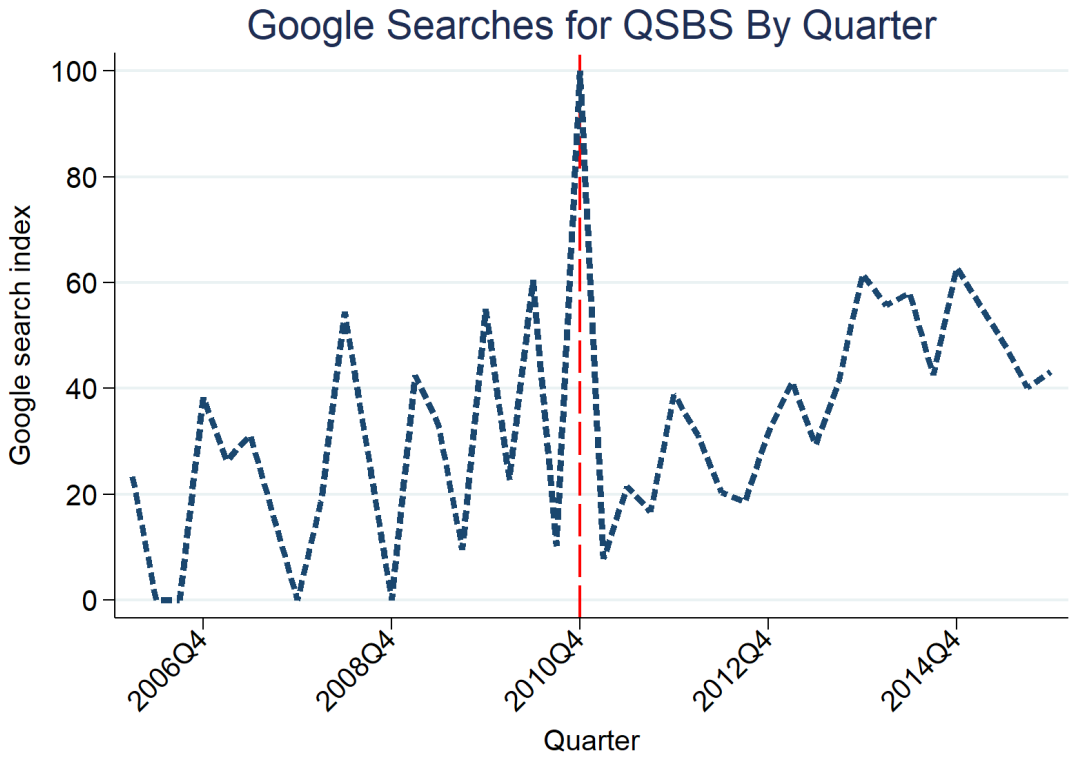
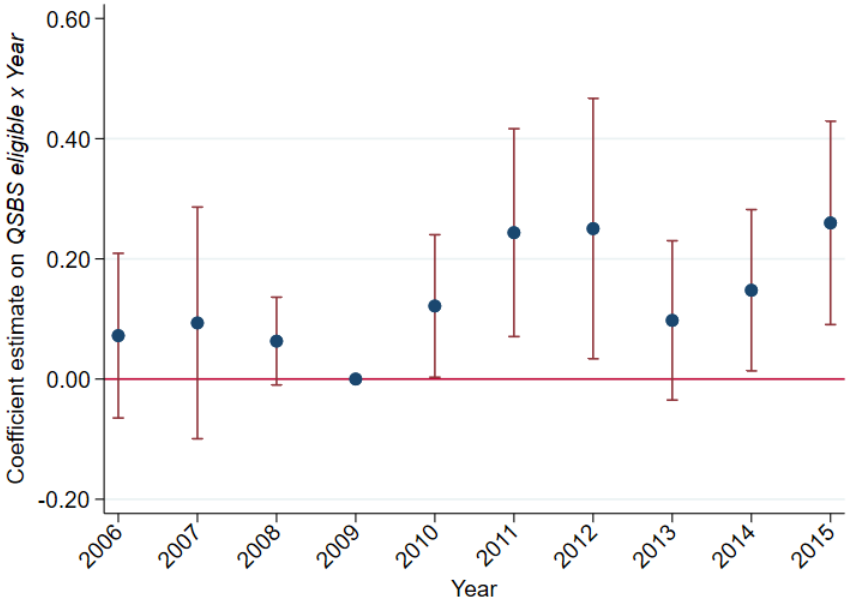


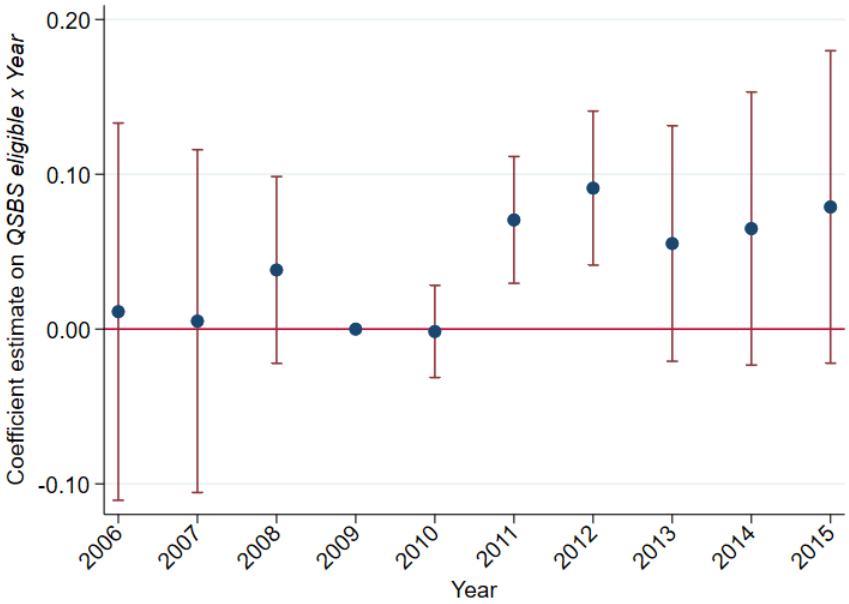
Figure 2: Dynamic estimation of the impact on entrepreneurship

This figure plots the coefficients for the interaction terms of each sample year and the treatment variable estimated from three dynamic models at the NAICS4-year level: OLS regressions with the natural logarithm of the number of firm births (Panel A) and firm birth rate (Panel C) as the dependent variables, and a Poisson regression with the number of firm births as the dependent variable (Panel B). The 2009 interaction term is the excluded category, reported as zero in the figure. The vertical red solid lines represent the 95% confidence interval for the coefficient estimates with standard errors clustered by NAICS4 industries.

Panel A: Log model




Panel B: Poisson model



Panel C: Firm birth rate

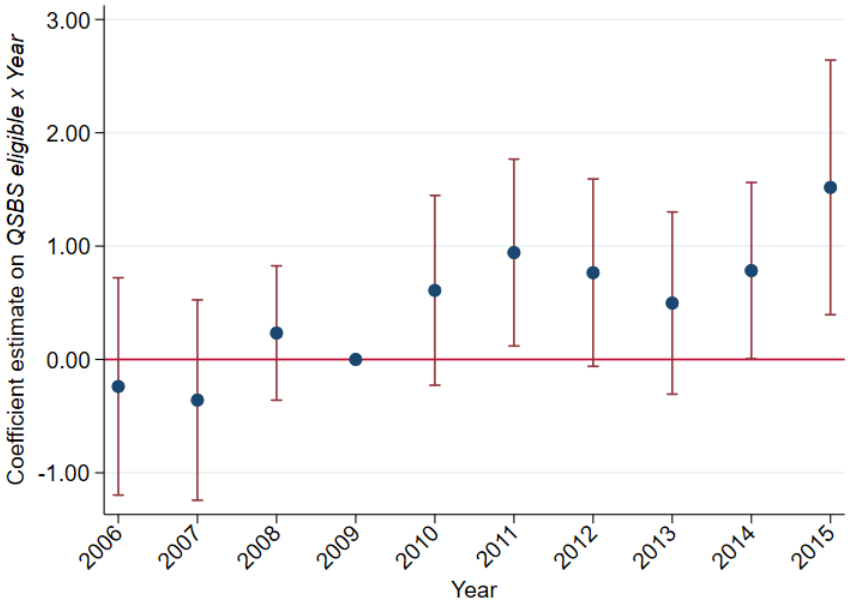


Figure 3: Dynamic estimation of the impact on patenting

This figure plots the coefficients for the interaction terms of each sample year and the treatment variable estimated from a dynamic model at the startup-year level. The specification is a Poisson regression with the number of patents filed by a startup in each year as the dependent variable. The 2009 interaction term is the excluded category, reported as zero in the figure. The vertical red solid lines represent the 95% confidence interval for the coefficient estimates with standard errors clustered by Form D industry group.

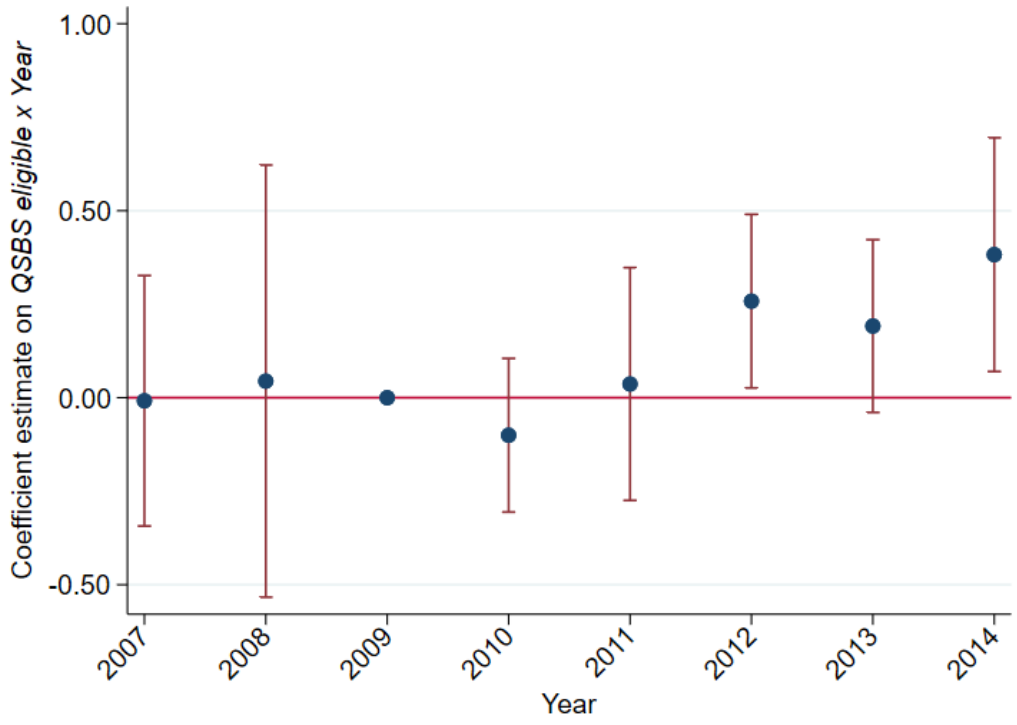


Table 1: Industries not eligible for the QSBS exemption

The table presents industries that are not qualified for the QSBS exemption. Specifically, column 1 presents the original excluded industries listed under Section 1202(e)(3) of the Internal Revenue Code (IRC). Columns 2 and 3 report the corresponding industries we identified using the 2017 NAICS and Form D industry classifications, respectively.

| | **Excluded industries as listed in IRC** | **NAICS codes** | **Form D industries** |
|---|---|---|---|
| | (1) | (2) | (3) |
| *Personal* | Health | 621, 622, 6231 | Hospitals & Physicians, Other Health Care |
| *services* | Law | 5411 | |
| | Engineering | 5413 | |
| | Architecture | 5413 | |
| | Accounting | 5412 | |
| | Actuarial science | 524 | |
| | Performing arts | 7111 | |
| | Consulting | 5416 | |
| | Athletics | 7112 | |
| | Financial services | 522, 523, 525 | Other Banking & Financial Services |
| | Brokerage | 523, 5312, 5313 | |
| *Financial* | Banking | 521, 522 | Commercial Banking, Investment Banking |
| *activities* | Insurance | 524 | Insurance, Health Insurance |
| | Financing | 522, 523, 525 | REITS & Finance |
| | Leasing | 53 | Commercial Real Estate, Residential Real Estate, Other Real Estate |
| | Investing | 523, 525 | Investing |
| *Extracting* | Extracting Activities | 21 | Coal Mining, Oil & Gas |
| *Hospitality* | Hotels | 7211 | Lodging & Conventions |
| | Motels | 7211 | |
| | Restaurants | 722 | Restaurants |

Table 2: Quantifying the impact of the QSBS exemption on entrepreneurial capital gains

This table estimates the distribution of both pre- and after-tax capital gains (CG) for entrepreneurs likely to qualify for the QSBS exemption under different tax regimes. Specifically, we focus on individuals who (1) owned a privately held business in a QSBS-eligible industry, (2) had an active management role in the business, and (3) had started the business in or before 2005. Because of the increase in top capital gains tax rate from 15% to 20% and the enactment of net investment income tax in 2013 (3.8%), we compute after-tax capital gains and the respective effective tax rate using tax rates before and after 2013. When calculating means, we set the capital gains and the capital gains tax rate to zero and missing, respectively, for entrepreneurs with negative gains. All dollar figures are in real dollars of year 2010 purchasing power.

| | | Pre 2013 tax rates | | | | | | 2013 & later tax rates | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Standard CG rates | | 50% QSBS exclusion | | 100% QSBS exclusion | | Standard CG rates | | 100% QSBS exclusion | |
| Percentile | Pre-tax CG | After-tax CG | CG tax rate | After-tax CG | CG tax rate | After-tax CG | CG tax rate | After-tax CG | CG tax rate | After-tax CG | CG tax rate |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
| [0, 32.5] | $\leq 0$ | $\leq 0$ | n/a | $\leq 0$ | n/a | $\leq 0$ | n/a | $\leq 0$ | n/a | $\leq 0$ | n/a |
| (32.5, 40] | 1,848 | 1,571 | 15.00% | 1,571 | 14.98% | 1,848 | 0.00% | 1,408 | 23.80% | 1,848 | 0.00% |
| (40, 50] | 9,723 | 8,265 | 15.00% | 8,267 | 14.98% | 9,723 | 0.00% | 7,409 | 23.80% | 9,723 | 0.00% |
| (50, 60] | 23,893 | 20,309 | 15.00% | 20,313 | 14.98% | 23,893 | 0.00% | 18,206 | 23.80% | 23,893 | 0.00% |
| (60, 70] | 50,162 | 42,638 | 15.00% | 42,648 | 14.98% | 50,162 | 0.00% | 38,223 | 23.80% | 50,162 | 0.00% |
| (70, 80] | 151,148 | 128,476 | 15.00% | 128,506 | 14.98% | 151,148 | 0.00% | 115,175 | 23.80% | 151,148 | 0.00% |
| (80, 90] | 410,008 | 348,506 | 15.00% | 348,588 | 14.98% | 410,008 | 0.00% | 312,426 | 23.80% | 410,008 | 0.00% |
| (90, 95] | 1,011,109 | 859,443 | 15.00% | 859,645 | 14.98% | 1,011,109 | 0.00% | 770,465 | 23.80% | 1,011,109 | 0.00% |
| (95, 99] | 3,090,470 | 2,626,900 | 15.00% | 2,627,518 | 14.98% | 3,090,470 | 0.00% | 2,354,938 | 23.80% | 3,090,470 | 0.00% |
| (99, 99.5] | 9,503,366 | 8,077,861 | 15.00% | 8,079,731 | 14.98% | 9,480,462 | 0.20% | 7,241,565 | 23.80% | 9,467,024 | 0.31% |
| (99.5, 99.9] | 21,391,024 | 18,182,370 | 15.00% | 18,185,414 | 14.99% | 20,466,132 | 4.09% | 16,299,960 | 23.80% | 19,923,530 | 6.49% |
| (99.9, 100] | 113,480,480 | 96,458,408 | 15.00% | 96,467,320 | 14.99% | 103,143,856 | 7.42% | 86,472,128 | 23.80% | 97,079,704 | 11.77% |
| Mean | 486,199 | 413,269 | 15.00% | 413,347 | 14.98% | 472,006 | 0.04% | 370,483 | 23.80% | 463,680 | 0.06% |

## Table 3: Summary statistics

This table presents summary statistics for the analysis of entrepreneurship (Panel A), equity compensation (Panel B), and innovation (Panel C). "No. firm births" is the number of new firms founded in a NAICS4 industry each year (in thousands); "Firm birth rate" is the number of firm births scaled by the total number of firms at the beginning of the year (in percentages); "Any equity compensation that year?" is a dummy variable indicating whether a firm has created an equity compensation plan in that year; "No. patents" is the total number of patents filed by a startup in each year that are eventually granted; "QSBS eligible" is a dummy treatment variable indicating whether the firms are in an industry eligible for the QSBS exemption; "Post" is set to be one if the observation is after 2010, and zero otherwise. See additional variable definitions in Table IA.1.

Panel A: For the analysis of entrepreneurship

| | N | Mean | Std. Dev. | 5-%ile | 25-%ile | 50-%ile | 75-%ile | 95-%ile |
|---|---|---|---|---|---|---|---|---|
| No. firm births | 2,670 | 1.51 | 3.53 | 0.01 | 0.07 | 0.33 | 1.26 | 7.63 |
| Firm birth rate | 2,670 | 7.20 | 3.54 | 2.67 | 4.47 | 6.62 | 9.17 | 14.34 |
| QSBS eligible | 2,670 | 0.84 | 0.36 | 0.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Post | 2,670 | 0.50 | 0.50 | 0.00 | 0.00 | 0.50 | 1.00 | 1.00 |
| No. large incumbents | 2,670 | 0.56 | 0.81 | 0.03 | 0.14 | 0.29 | 0.66 | 2.05 |

Panel B: For the analysis of equity compensation

| | N | Mean | Std. Dev. | 5-%ile | 25-%ile | 50-%ile | 75-%ile | 95-%ile |
|---|---|---|---|---|---|---|---|---|
| Any equity compensation that year? | 5,802 | 0.22 | 0.41 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| First year with equity compensation? | 3,308 | 0.21 | 0.41 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| QSBS eligible | 5,802 | 0.91 | 0.28 | 0.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Post | 5,802 | 0.50 | 0.50 | 0.00 | 0.00 | 1.00 | 1.00 | 1.00 |
| Age | 5,802 | 2.46 | 1.70 | 0.00 | 1.00 | 2.00 | 4.00 | 5.00 |

Panel C: For the analysis of innovation

| | N | Mean | Std. Dev. | 5-%ile | 25-%ile | 50-%ile | 75-%ile | 95-%ile |
|---|---|---|---|---|---|---|---|---|
| No. patents | 17,117 | 0.30 | 1.16 | 0.00 | 0.00 | 0.00 | 0.00 | 2.00 |
| No. patent citations | 17,117 | 2.41 | 15.50 | 0.00 | 0.00 | 0.00 | 0.00 | 8.00 |
| QSBS eligible | 17,117 | 0.87 | 0.33 | 0.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Post | 17,117 | 0.50 | 0.50 | 0.00 | 0.00 | 1.00 | 1.00 | 1.00 |
| Age | 17,117 | 2.47 | 1.70 | 0.00 | 1.00 | 2.00 | 4.00 | 5.00 |

Table 4: Impact of the QSBS exemption on entrepreneurship

This table presents diff-in-diff analyses examining the impact of the QSBS exemption on entrepreneurial activities at the NAICS4-year level. The sample period is over 2006–2015. All columns are OLS regressions except column 4, which is a Poisson regression. The dependent variable in columns 1 and 2 is the natural logarithm of the number of firm births each year; in column 3, it is the natural logarithm of one plus the number of firm births each year; in column 4, it is the number of firm births each year; in column 5, it is the firm birth rate, defined, following Lindsey and Stein (2020), as the number of firm births scaled by the total number of firms at the beginning of the year (where the latter is calculated as the total number of firms at the end of the year minus firm births plus firm deaths in that year). "QSBS eligible" is a dummy treatment variable indicating whether the new firms are in the sectors eligible for the QSBS exemption. "Post" is set to be one if the observation is after 2010, and zero otherwise. "Log(no. large incumbents)" is the lagged natural logarithm of the number of incumbent firms with at least 100 employees. All regressions include NAICS4 industry and year fixed effects. ***, **, and * correspond to statistical significance at the 1%, 5%, and 10% levels, respectively. Standard errors in parentheses are clustered by NAICS4 industry.

| *Dependent variable:* | Log (no. firm births) | Log (no. firm births) | Log (1 + no. firm births) | No. firm births | Firm birth rate |
|---|---|---|---|---|---|
| *Model:* | OLS | OLS | OLS | Poisson | OLS |
| | (1) | (2) | (3) | (4) | (5) |
| QSBS eligible × Post | 0.129*** | 0.101** | 0.121*** | 0.061** | 0.851*** |
| | (0.045) | (0.048) | (0.043) | (0.029) | (0.217) |
| Log (no. large incumbents) | 0.518*** | | 0.517*** | 0.464*** | 0.157 |
| | (0.074) | | (0.073) | (0.121) | (0.462) |
| Industry FE | Yes | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes | Yes |
| Observations | 2,665 | 2,665 | 2,670 | 2,670 | 2,670 |
| $F$ or $\chi^2$ statistic | 25.3 | 4.4 | 25.3 | 15.9 | 8.3 |

Table 5: Placebo tests

This table presents the placebo diff-in-diff estimation results at the NAICS4-year level. We assume the QSBS exemption change was made in some pseudo-treatment year, and then conduct the placebo test based on a 10-year sample around the pseudo-treatment year. Columns 1-3 report the estimations for the pseudo-treatment year 2005; columns 4-6 report the estimations for the pseudo-treatment year 2006. All columns are OLS regressions except columns 2 and 5, which are a Poisson regression. The dependent variables are the natural logarithm of the number of firm births in columns 1 and 4, the number of firm births in columns 2 and 5, and firm birth rate in columns 3 and 6. "QSBS eligible" is a dummy treatment variable indicating whether the new firms are in the sectors eligible for the QSBS exemption. "Post 2005" ("Post 2006") is set to be one if the observation is after the pseudo-treatment year 2005 (2006), and zero otherwise. "Log(no. large incumbents)" is the lagged natural logarithm of the number of incumbent firms with at least 100 employees. All regressions include NAICS4 industry and year fixed effects. ***, **, and * correspond to statistical significance at the 1%, 5%, and 10% levels, respectively. Standard errors in parentheses are clustered by NAICS4 industry.

| *Pseudo treatment year:* | 2005 | | | 2006 | | |
|---|---|---|---|---|---|---|
| *Dependent variable:* | Log (no. firm births) | No. firm births | Firm birth rate | Log (no. firm births) | No. firm births | Firm birth rate |
| *Model:* | OLS | Poisson | OLS | OLS | Poisson | OLS |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| QSBS eligible × Post 2005 | −0.022 | −0.041* | 0.103 | | | |
| | (0.034) | (0.022) | (0.369) | | | |
| QSBS eligible × Post 2006 | | | | 0.028 | −0.017 | 0.506 |
| | | | | (0.039) | (0.035) | (0.387) |
| Log (no. large incumbents) | 0.510*** | 0.218** | −0.191 | 0.525*** | 0.329*** | −0.058 |
| | (0.070) | (0.100) | (0.488) | (0.064) | (0.093) | (0.489) |
| Industry FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 2,669 | 2,670 | 2,670 | 2,668 | 2,670 | 2,670 |
| $F$ or $\chi^2$ statistic | 29.4 | 9.6 | 0.2 | 34.2 | 14.8 | 1.0 |

## Table 6: Financial crisis robustness checks

This table provides robustness checks for our baseline results by excluding from our sample the industries or years that are more prone to the influence of the 2008-2009 financial crisis. Specifically, in columns 1-3, we exclude the sectors – finance, insurance, and construction; and in columns 4-6, we exclude the 2008–2010 period. All columns are OLS regressions except columns 2 and 5, which are a Poisson regression. The dependent variables are the natural logarithm of the number of firm births in columns 1 and 4, the number of firm births in columns 2 and 5, and firm birth rate in columns 3 and 6. "QSBS eligible" is a dummy treatment variable indicating whether the new firms are in the sectors eligible for the QSBS exemption. "Post" is set to be one if the observation is after 2010, and zero otherwise. "Log(no. large incumbents)" is the lagged natural logarithm of the number of incumbent firms with at least 100 employees. All regressions include NAICS4 industry and year fixed effects. ***, **, and * correspond to statistical significance at the 1%, 5%, and 10% levels, respectively. Standard errors in parentheses are clustered by NAICS4 industry.

| | Exclude finance, insurance, construction | | | Exclude 2008–2010 | | |
|---|---|---|---|---|---|---|
| *Dependent variable:* | Log (no. firm births) | No. firm births | Firm birth rate | Log (no. firm births) | No. firm births | Firm birth rate |
| *Model:* | OLS | Poisson | OLS | OLS | Poisson | OLS |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| QSBS eligible × Post | 0.090* | 0.054* | 0.768*** | 0.122** | 0.079* | 1.220*** |
| | (0.049) | (0.029) | (0.269) | (0.059) | (0.047) | (0.327) |
| Log (no. large incumbents) | 0.486*** | 0.563*** | −0.261 | 0.573*** | 0.592*** | 0.480 |
| | (0.078) | (0.099) | (0.517) | (0.084) | (0.138) | (0.530) |
| Industry FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 2,406 | 2,410 | 2,410 | 1,865 | 1,869 | 1,869 |
| $F$ or $\chi^2$ statistic | 19.3 | 32.6 | 5.3 | 23.0 | 19.6 | 7.0 |

Table 7: Heterogeneous impact on entrepreneurship by exit rate

This table presents analyses examining the heterogeneous impact of the QSBS exemption on entrepreneurship by industry exit rate, which is measured as the number of exits (M&As and IPOs) in an industry scaled by the total number of firms of age 1 – 10. We first run a subsample analysis by restricting the sample to the industries with high exit rate (columns 1-3) and low exit rate (columns 4-6), respectively; and then run a triple difference (DDD) analysis over the full sample with the exit rate as an additional interaction variable (columns 7-9). All columns are OLS regressions except columns 2, 5 and 8, which are a Poisson regression. The dependent variables are the natural logarithm of the number of firm births in columns 1, 4 and 7, the number of firm births in columns 2, 5 and 8, and firm birth rate in columns 3, 6 and 9. "QSBS eligible" is a dummy treatment variable indicating whether the new firms are in the sectors eligible for the QSBS exemption. "Post" is set to be one if the observation is after 2010, and zero otherwise. All regressions include NAICS4 industry and year fixed effects. ***, **, and * correspond to statistical significance at the 1%, 5%, and 10% levels, respectively. Standard errors in parentheses are clustered by NAICS4 industry.

| | High exit rate | | | Low exit rate | | | High vs. low exit rate | | |
|---|---|---|---|---|---|---|---|---|---|
| *Dependent variable:* | Log (no. firm births) | No. firm births | Firm birth rate | Log (no. firm births) | No. firm births | Firm birth rate | Log (no. firm births) | No. firm births | Firm birth rate |
| *Model:* | OLS | Poisson | OLS | OLS | Poisson | OLS | OLS | Poisson | OLS |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| Exit rate × QSBS elig. × Post | | | | | | | 0.040*** | 0.054*** | 0.493** |
| | | | | | | | (0.015) | (0.020) | (0.196) |
| QSBS eligible × Post | 0.229*** | 0.104* | 2.145** | 0.029 | 0.058* | 0.369 | 0.055 | 0.051* | 0.275 |
| | (0.075) | (0.062) | (0.862) | (0.042) | (0.032) | (0.314) | (0.036) | (0.030) | (0.291) |
| Exit rate × Post | | | | | | | −0.026** | −0.026 | −0.353* |
| | | | | | | | (0.012) | (0.018) | (0.184) |
| Log (no. large incumbents) | 0.489*** | 0.619*** | 0.498 | 0.571*** | 0.446*** | 0.490 | 0.521*** | 0.460*** | 0.345 |
| | (0.104) | (0.142) | (0.866) | (0.102) | (0.136) | (0.642) | (0.073) | (0.121) | (0.495) |
| Observations | 1,325 | 1,330 | 1,330 | 1,340 | 1,340 | 1,340 | 2,665 | 2,670 | 2,670 |
| $F$ or $\chi^2$ statistic | 12.7 | 20.0 | 4.2 | 16.6 | 12.0 | 0.8 | 15.5 | 33.1 | 4.5 |

Table 8: Heterogeneous impact on entrepreneurship by industry STEM employment

This table presents analyses examining the heterogeneous impact of the QSBS exemption on entrepreneurship by industry technology intensity, which we proxy using a continuous variable – the fraction of STEM employment (i.e., *STEM %*). We first run a subsample analysis by restricting the sample to the industries with high (columns 1-3) and low STEM employment (columns 4-6), respectively; and then run a triple difference (DDD) analysis over the full sample with *STEM %* as an additional interaction variable (columns 7-9). All columns are OLS regressions except columns 2, 5 and 8, which are a Poisson regression. The dependent variables are the natural logarithm of the number of firm births in columns 1, 4 and 7, the number of firm births in columns 2, 5 and 8, and firm birth rate in columns 3, 6 and 9. "QSBS eligible" is a dummy treatment variable indicating whether the new firms are in the sectors eligible for the QSBS exemption. "Post" is set to be one if the observation is after 2010, and zero otherwise. All regressions include NAICS4 industry and year fixed effects. ***, **, and * correspond to statistical significance at the 1%, 5%, and 10% levels, respectively. Standard errors in parentheses are clustered by NAICS4 industry.

| | High STEM employment | | | Low STEM employment | | | High vs. low STEM employment | | |
|---|---|---|---|---|---|---|---|---|---|
| *Dependent variable:* | Log (no. firm births) | No. firm births | Firm birth rate | Log (no. firm births) | No. firm births | Firm birth rate | Log (no. firm births) | No. firm births | Firm birth rate |
| *Model:* | OLS | Poisson | OLS | OLS | Poisson | OLS | OLS | Poisson | OLS |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| STEM % × QSBS elig. × Post | | | | | | | 0.372* | 0.214** | 2.805 |
| | | | | | | | (0.219) | (0.091) | (1.898) |
| QSBS eligible × Post | 0.233*** | 0.118** | 1.523*** | 0.039 | 0.033 | 0.432 | 0.085* | 0.048 | 0.677** |
| | (0.079) | (0.050) | (0.294) | (0.036) | (0.030) | (0.302) | (0.044) | (0.032) | (0.261) |
| STEM % × Post | | | | | | | −0.150 | −0.124* | −1.279 |
| | | | | | | | (0.166) | (0.072) | (1.457) |
| Log (no. large incumbents) | 0.686*** | 0.960*** | 1.467* | 0.455*** | 0.348*** | −0.731 | 0.522*** | 0.456*** | 0.083 |
| | (0.119) | (0.197) | (0.840) | (0.081) | (0.130) | (0.606) | (0.075) | (0.127) | (0.516) |
| Observations | 1,236 | 1,240 | 1,240 | 1,290 | 1,290 | 1,290 | 2,526 | 2,530 | 2,530 |
| $F$ or $\chi^2$ statistic | 17.6 | 29.9 | 13.7 | 15.8 | 7.9 | 1.9 | 12.9 | 34.1 | 4.6 |

Table 9: Impact of the QSBS exemption on equity compensation

This table presents diff-in-diff analyses examining the impact of the QSBS exemption on startup equity compensation at the startup-year level. Columns 1-3 report OLS estimations with a dummy variable indicating whether a startup creates an employee equity compensation plan (or employee benefit plan) in a given year as the dependent variable; columns 4-5 focus on startups' first equity compensation plan (if any) and report OLS estimations with a dummy variable indicating whether a startup creates a first employee equity compensation plan in a given year as the dependent variable. "QSBS eligible" is a dummy treatment variable indicating whether the startups are in the sectors eligible for the QSBS exemption. "Post" is set to be one if the observation is after 2010, and zero otherwise. The control variables include the natural logarithm of one plus firm age, startup fixed effects, startup age and year fixed effects. ***, **, and * correspond to statistical significance at the 1%, 5%, and 10% levels, respectively. Standard errors in parentheses are clustered by Form D industry group.

| *Dependent variable:* | Any equity compensation that year? | | | First year with equity compensation? | |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| QSBS eligible × Post | 0.021** | 0.020* | 0.023** | 0.065*** | 0.065*** |
| | (0.008) | (0.010) | (0.008) | (0.016) | (0.017) |
| QSBS eligible | −0.025 | | −0.026 | −0.016 | −0.017 |
| | (0.035) | | (0.035) | (0.045) | (0.045) |
| Log(1 + firm age) | | | 0.007 | | −0.014 |
| | | | (0.032) | | (0.037) |
| Firm FE | No | Yes | No | No | No |
| Firm age FE | Yes | Yes | No | Yes | No |
| Year FE | Yes | Yes | Yes | Yes | Yes |
| Observations | 5,802 | 5,802 | 5,802 | 3,308 | 3,308 |
| $F$ statistic | 3.9 | 3.8 | 2.9 | 23.5 | 23.1 |

Table 10: Impact of the QSBS exemption on VC financing

This table presents diff-in-diff analyses examining the impact of the QSBS exemption on startups' first round of VC financing at the NAICS4-year level. The sample period is over 2006–2015. All columns are OLS regressions except column 2, which is a Poisson regression. The dependent variables are the natural logarithm of the number of firms that raised their first VC financing in column 1, the number of firms that raised their first VC financing in column 2, the natural logarithm of the total amount of capital raised in startups' first VC financing in column 3, and the natural logarithm of the average amount of capital raised by each startup in its first VC financing in column 4. "QSBS eligible" is a dummy treatment variable indicating whether the VC-backed startups are in the sectors eligible for the QSBS exemption. "Post" is set to be one if the observation is after 2010, and zero otherwise. All regressions include NAICS4 industry and year fixed effects. ***, **, and * correspond to statistical significance at the 1%, 5%, and 10% levels, respectively. Standard errors in parentheses are clustered by NAICS4 industry.

| *Dependent variable:* | Log (no. firms raising first VC round) | No. firms raising first VC round | Log (total $ raised in first VC rounds) | Log (avg. $ raised per firm in first VC rounds) |
|---|---|---|---|---|
| *Model:* | OLS | Poisson | OLS | OLS |
| | (1) | (2) | (3) | (4) |
| QSBS eligible × Post | 0.225** | 0.400*** | 0.491* | 0.299 |
| | (0.108) | (0.111) | (0.260) | (0.195) |
| Log (no. large incumbents) | −0.164 | −0.038 | −1.376** | −0.950** |
| | (0.315) | (0.409) | (0.596) | (0.425) |
| Industry FE | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes |
| Observations | 1,381 | 2,670 | 1,263 | 1,263 |
| $F$ or $\chi^2$ statistic | 2.3 | 13.1 | 5.0 | 3.8 |

Table 11: Impact of the QSBS exemption on patenting

This table presents diff-in-diff analyses examining the impact of the QSBS exemption on startup patenting at the startup-year level. All columns are Poisson estimations. The dependent variables are measures of startups' patenting activities: the total number of patents filed each year that are eventually granted (columns 1-3), and the total number of citations received by the patents filed by a startup each year (columns 5 and 6). "QSBS eligible" is a dummy treatment variable indicating whether the startups are in the sectors eligible for the QSBS exemption. "Post" is set to be one if the observation is after 2010, and zero otherwise. The control variables include the natural logarithm of one plus firm age, startup fixed effects, startup age and year fixed effects. ***, **, and * correspond to statistical significance at the 1%, 5%, and 10% levels, respectively. Standard errors in parentheses are clustered by Form D industry group.

| *Dependent variable:* | No. patents | | | No. patent citations | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| QSBS eligible × Post | 0.205*** | 0.207*** | 0.237*** | 0.346*** | 0.347*** | 0.331** |
| | (0.041) | (0.039) | (0.067) | (0.075) | (0.072) | (0.133) |
| QSBS eligible | | | −0.212 | | | −0.288 |
| | | | (0.310) | | | (0.284) |
| Log(1 + firm age) | | 1.350*** | | | 2.062*** | |
| | | (0.212) | | | (0.460) | |
| Firm FE | Yes | Yes | No | Yes | Yes | No |
| Firm age FE | Yes | No | Yes | Yes | No | Yes |
| Year FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 17,117 | 17,117 | 17,117 | 17,117 | 17,117 | 17,117 |
| $\chi^2$ statistic | 25.3 | 75.1 | 12.7 | 21.4 | 44.3 | 6.2 |

# Internet Appendix

## A Additional Data Details

In this section, we provide additional details for the main data sources that we use in this paper: Census BDS data, California Employee Plan Exemption Notice (EPEN) filings, and USPTO patent data.

### A.1 Census BDS data

We retrieve the Business Dynamics Statistics (BDS) data at the 4 digit NAICS-firm age-year level from the Census website.[1] To form the entrepreneurship sample used in this study, we took several steps. First, the BDS data impose left-censoring when the reported value is below a certain threshold. For example, when the number of firms in a cell is smaller than 3, it is not reported. In these cases, we replace the missing value with a mid-point value 1.5.

Second, the BDS data has a broad coverage of industries in the U.S. economy, and we impose several industry filters to focus on the analysis of entrepreneurship. Specifically, we exclude several industries dominated by non-profit firms: Monetary Authorities-Central Bank (5211), Individual and Family Services (non-profit) (6241), Community Food and Housing, and Emergency and Other Relief Services (non-profit) (6242), Religious, Grant-making, Civic, Professional, and Similar Organizations (non-profit) (8131 - 8139). We also exclude industries that are not clearly eligible or ineligible for the QSBS exemption: Management of Companies and Enterprises (5511), Independent Artists, Writers, and Performers (7115), and Other Professional, Scientific, and Technical Services (5419). Lastly, we exclude two industries with NAICS4 code 1100 and 5250 because they are not valid codes according to the official 2017 NAICS code and cannot be validated against the NAICS coding sys-

[1] See `https://www.census.gov/data/datasets/time-series/econ/bds/bds-datasets.html`.

tem. We also combine two NAICS4 industries (4522 and 4523) due to the change in NAICS classification from NAICS-2012 to NAICS-2017.

## A.2 California Employee Plan Exemption Notice (EPEN) filings

The Securities Act of 1933 requires every offer or sale of securities to be registered with the Securities and Exchange Commission (SEC), unless exempted. Private companies can rely on SEC Rule 701 to claim exemption from the registration requirement at the federal level when they issue stock or stock options to their employees. However, they may be still subject to state-level regulations in states where they operate.

The counterpart of Federal Rule 701 in California is Corporations Code section 25102(o), which allows companies to claim exemption when they offer equity compensation to California-based employees. To claim the California exemption, companies have to file the so-called Section 25102(o) Notice filings, or Employee Plan Exemption Notice (EPEN) filings with the Department of Financial Protection and Innovation in California. We collect the universe of these filings over the period 2003–2017. There are 37,890 such filings.

The Section 25102(o) exemption is considered as a "transaction" exemption, and all the securities subject to a given equity compensation plan can be issued as part of the same transaction. In other words, a single filing can exempt all securities issuable under an equity compensation plan.[2] Therefore, the EPEN filings capture companies' adoption of equity compensation plans. Each EPEN filing reports demographic information on the company including name, incorporation state, and address. It also reports information on the type of security issued under the plan such as stock, stock option, or a flexible type involving both stock or options.

To identify EPEN filings belonging to startups, we match these filings with form D data. We exclude form D filings by pooled investment fund, or business trust. We also focus on

[2] An increase in the number of securities subject to a given plan could trigger a second notice filing.

form D filings for which we can identify the founding year of the firm. We match EPEN filings with form D data using a fuzzy string-matching algorithm based on company name. We standardize company names, ensuring legal-entity-type identifiers (e.g., "LLC," "Inc," etc.) are formatted consistently across the databases. To further ensure the validity of the name matches, we manually inspect the final set of matched companies by name. To improve the matching, we also exclude EPEN filings that were made before a company's founding year, and that indicate a different incorporation state from the form D data. We identify 7,612 EPEN filings by firms that also filed an electronic form D.

## A.3 USPTO patent data

We retrieve USPTO patent data from PatentsView, a database created through a program funded by the U.S. Patent and Trademark Office (Marco et al., 2015). We focus on a set of innovation outcomes that include patent quantity (i.e., frequency of filings), and patent quality (i.e., forward citation counts). To study startup innovation, we also match the USPTO patent data with form D database. To increase the accuracy of the matching, we standardize company names in both databases, and merge the two databsases based on company name and the headquarters state. In total, we identify 271,131 patent filings by firms that also filed an electronic form D.

## A.4 Variable definitions

In this section, we provide definitions for the main variables used in the paper.

Table IA.1: Description of variables

| **Variable** | **Definition and source** |
|---|---|
| *No. firm births* | the number of firms of age zero in each NAICS4-year cell. Source: BDS. |
| *Firm birth rate* | the number of firms of age zero scaled by the total number of firms at the beginning of the year where the latter is computed as the number of total firms at the end of the year minus firm births plus firm deaths during the year. Source: BDS. |
| *No. large incumbents* | the number of firms with at least 100 employees in each NAICS4-year cell. Source: BDS. |
| *Any equity compensation that year?* | a dummy variable indicating whether a startup creates an employee equity compensation plan in a given year. Source: California EPEN filings. |
| *First year with equity compensation?* | a dummy variable indicating whether a startup creates a first employee equity compensation plan in a given year. Source: California EPEN filings. |
| *No. patents* | the total number of patents filed each year that are eventually granted. Source: USPTO. |
| *No. patent citations* | the total number of citations received by the patents filed by a startup each year. We require the filing date of the citing patent to be within five years of the filing date of the cited patent. Source: USPTO. |
| *Exit rate* | the number of startup exits (acquisitions of private firms and IPOs) scaled by the total number of firms of age 1 – 10 in each NAICS4-year cell. Source: SDC and Census. |
| *STEM %* | the fraction of STEM employment in each NAICS4-year cell. Source: Bureau of Labor Statistics. |

| Variable | Definition and source |
|---|---|
| *No. firms raising first VC round* | the number of firms that raised their first VC financing in each NAICS4-year cell. Source: SDC VentureXpert.[3] |
| *Total $ raised in first VC rounds* | the total amount of capital raised in startups' first VC financing in each NAICS4-year cell. Source: SDC VentureXpert.[3] |
| *Avg. $ raised per firm in first VC rounds* | the average amount of capital raised by each startup in its first VC financing in each NAICS4-year cell. Source: SDC VentureXpert.[3] |

[3] VentureXpert data only provide SIC industry codes. We use an employment-weighted cross-walk from SIC4 to NAICS4 industries to aggregate the VentureXpert data to the NAICS4-year level. See `https://www.bls.gov/ces/naics/sic-4-digit-to-naics-2002-ratios.htm`.

# B Legislative history of the QSBS exemption

## B.1 The original enactment of Section 1202 in 1993

The original QSBS exemption (i.e., Section 1202 of the Internal Revenue Code) was enacted in 1993 as part of the Revenue Reconciliation Act of 1993 (Title XIII of the broader Omnibus Budget Reconciliation Act of 1993). This tax provision was passed at the time when Bill Clinton just won the U.S. presidential election one year earlier, and the Democrats controlled both Houses of Congress.

Perhaps as the first hint of the QSBS exemption, President Clinton said in his first State of the Union speech in February, 1993:

> Because small businesses generate most of our nation's jobs, our plan includes the boldest targeted incentives for small business in history. We propose a permanent investment tax credit for small business, and new rewards for entrepreneurs who take risks.

To move forward with the legislative process, on February 17, 1993, the Clinton administration submitted its revenue proposals to the Congress. The revenue proposal included a first draft of the QSBS exemption entitled "Provide Targeted Capital Gains Exclusion".[4] Primarily to encourage investments, the proposal argued that:"Small businesses are important to economic growth and job creation...A preferential tax rate for long-term commitments of capital to small businesses would encourage investments in innovation and growth." The QSBS exemption draft in the proposal is already quite similar to the final version enacted in 1993, but also has some notable differences. For example, the size threshold for a qualified small business is $25 million (instead of $50 million), and the cap for eligible gains is the greater of ten times the investor's basis in the stock or $1 million (instead of $10 million). Without discussing the rationale, the draft also excluded some industries from the QSBS

[4] See `https://home.treasury.gov/system/files/131/General-Explanations-FY1994.pdf`

exemption (the same list as it is today).[5]

Although the QSBS exemption provision provided tax relief, the overall revenue plan of the Clinton Administration aimed to increase taxes and reduce spending, which was strongly opposed by congressional Republicans. However, because the Congress was controlled by the Democrats, with a very narrow margin, it eventually passed an overall bill (i.e., the Omnibus Budget Reconciliation Act) that included the QSBS exemption provision.

## B.2 Exclusion rate increases in 2009 and 2010

Not long after the passage of the original QSBS exemption, it quickly became unattractive and then almost totally irrelevant after a few reductions in the long-term capital gains tax rate (see Table 2). This was the case until almost twenty years later when the Obama administration subsequently passed two new pieces of legislation – the American Recovery and Reinvestment Act of 2009 and the Small Business Jobs Act of 2010 in response to the Great Recession. These two legislation increased the exclusion rate of the QSBS exemption from 50% in the original provision to 100%. While increasing the exclusion rate, neither of these recent legal changes modified the industry eligibility for the QSBS exemption that had been in place since 1993. This important feature rules out the possibility that the recent changes specifically targeted the industries more negatively impacted by the 2008 financial crisis.

The recent legal changes, especially the Small Business Jobs Act of 2010 also included many other provisions that are related to small businesses, such as an increase in the 7(a) program's loan limit, and adjustments of SBA size standards (Brown et al., 2024). However, none of these provisions is targeting capital gains taxes specifically, or has impacted the same set of industries as the QSBS exemption does.

[5] Before the Clinton administration, similar provisions to the QSBS exemption were also introduced in the Congress by other bills such as H.R. 4210 that was passed by the Congress in 1992 and vetoed by President Bush, and H.R. 11 that was passed by the Senate.

# C Additional Tables

## Table IA.2: Heterogeneous impact on entrepreneurship by technology intensity

This table presents analyses examining the heterogeneous impact of the QSBS exemption on entrepreneurship by industry technology intensity, which we proxy using a dummy variable – *High-tech*. We first run a subsample analysis by restricting the sample to the high-tech (columns 1-3) and low-tech industries (columns 4-6), respectively; and then run a triple difference (DDD) analysis over the full sample with *High-tech* as an additional interaction variable (columns 7-9). All columns are OLS regressions except columns 2, 5 and 8, which are a Poisson regression. The dependent variables are the natural logarithm of the number of firm births in columns 1, 4 and 7, the number of firm births in columns 2, 5 and 8, and firm birth rate in columns 3, 6 and 9. "QSBS eligible" is a dummy treatment variable indicating whether the new firms are in the sectors eligible for the QSBS exemption. "Post" is set to be one if the observation is after 2010, and zero otherwise. All regressions include NAICS4 industry and year fixed effects. ***, **, and * correspond to statistical significance at the 1%, 5%, and 10% levels, respectively. Standard errors in parentheses are clustered by NAICS4 industry.

| | High-tech ind. | | | Low-tech ind. | | | High vs. low tech | | |
|---|---|---|---|---|---|---|---|---|---|
| *Dependent variable:* | Log (no. firm births) | No. firm births | Firm birth rate | Log (no. firm births) | No. firm births | Firm birth rate | Log (no. firm births) | No. firm births | Firm birth rate |
| *Model:* | OLS | Poisson | OLS | OLS | Poisson | OLS | OLS | Poisson | OLS |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| High-tech × QSBS elig. × Post | | | | | | | 0.112 | 0.156*** | 0.353 |
| | | | | | | | (0.084) | (0.053) | (0.755) |
| QSBS eligible × Post | 0.231*** | 0.157*** | 1.566** | 0.122*** | 0.050 | 1.222** | 0.123*** | 0.050 | 1.225** |
| | (0.074) | (0.045) | (0.619) | (0.047) | (0.031) | (0.487) | (0.047) | (0.031) | (0.486) |
| High-tech × Post | | | | | | | 0.009 | −0.089*** | 0.290 |
| | | | | | | | (0.049) | (0.023) | (0.539) |
| Log (no. large incumbents) | 0.800*** | 0.751*** | 1.144 | 0.491*** | 0.440*** | 0.246 | 0.506*** | 0.446*** | 0.297 |
| | (0.158) | (0.162) | (1.378) | (0.075) | (0.128) | (0.561) | (0.073) | (0.125) | (0.541) |
| Observations | 140 | 140 | 140 | 2,525 | 2,530 | 2,530 | 2,665 | 2,670 | 2,670 |
| $F$ or $\chi^2$ statistic | 13.9 | 125.2 | 3.3 | 21.9 | 12.0 | 3.6 | 15.1 | 183.8 | 4.4 |

Table IA.3: Heterogeneous impact of the QSBS exemption on employment

This table presents analyses examining the heterogeneous impact of the QSBS exemption on employment by firm age (Panel A) and firm size (Panel B). Specifically, Panel A reports OLS estimations for employment of firms in three age groups: 0-3 years (columns 1 and 4), 4-10 years (columns 2 and 5), and 11 years or older (columns 3 and 6). The analysis is also broken down by employee education: workers with a bachelor's degree or higher (columns 1 - 3) vs. all other workers (columns 4 - 6). Panel B focuses on the employment of workers with a bachelor's degree or higher and reports OLS estimations for employment of firms in five size groups (as measured by the number of workers with a bachelor's degree or higher): 0-19 employees (columns 1 and 2), 20-49 employees (column 3), 50-249 employees (column 4), 250-499 employees (column 5), and 500 employees or more (column 6). "QSBS eligible" is a dummy treatment variable indicating whether the employers are in the sectors eligible for the QSBS exemption. "Post" is set to be one if the observation is after 2010, and zero otherwise. "Log(total employment in large incumbents)" is the lagged natural logarithm of the number of total employment at firms with at least 250 employees. All regressions include NAICS4 industry and year fixed effects. ***, **, and * correspond to statistical significance at the 1%, 5% and 10% levels, respectively. Standard errors in parentheses are clustered by NAICS4 industry.

Panel A: Breakdown by firm age

| *Employee education:* | Employees with a bachelor's or higher degree | | | All other employees (no bachelor's degree) | | |
|---|---|---|---|---|---|---|
| *Dependent variable:* | Log(total industry employment) | | | Log(total industry employment) | | |
| *Firm age (years):* | 0–3 yrs | 4–10 yrs | 11+ yrs | 0–3 yrs | 4–10 yrs | 11+ yrs |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| QSBS eligible × Post | 0.094 | 0.088 | 0.054* | 0.020 | 0.022 | −0.015 |
| | (0.057) | (0.073) | (0.032) | (0.047) | (0.063) | (0.021) |
| Log (total employment in large incumbents) | 0.330*** | 0.466*** | 0.427*** | 0.333*** | 0.497*** | 0.419*** |
| | (0.090) | (0.084) | (0.058) | (0.086) | (0.091) | (0.048) |
| Industry FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 2,697 | 2,699 | 2,708 | 2,705 | 2,705 | 2,708 |
| $F$ or $\chi^2$ statistic | 7.1 | 15.5 | 28.9 | 7.5 | 15.8 | 38.7 |

Panel B: Breakdown by firm size

| *Employee education:* | Employees with a bachelor's or higher degree | | | | | |
|---|---|---|---|---|---|---|
| *Dependent variable:* | Log(total industry employment) | | | | | |
| *Firm size (employees):* | 0–19 emp | 0–19 emp | 20–49 emp | 50-249 emp | 250-499 emp | 500+ emp |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| QSBS eligible × Post | 0.119*** | 0.102** | 0.056 | 0.088 | 0.001 | 0.022 |
| | (0.042) | (0.045) | (0.046) | (0.073) | (0.053) | (0.083) |
| Log (total employment in large incumbents) | 0.208*** | | | | | |
| | (0.057) | | | | | |
| Industry FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 2,708 | 2,710 | 2,684 | 2,694 | 2,631 | 2,703 |
| $F$ or $\chi^2$ statistic | 7.3 | 5.1 | 1.5 | 1.5 | 0.0 | 0.1 |

Table IA.4: Heterogeneous impact on entrepreneurship by external financing needs

This table presents analyses examining the heterogeneous impact of the QSBS exemption on entrepreneurship by industry external financing needs, which we proxy using both external financial dependence (Panel A), and external equity dependence (Panel B). In each panel, we first run a subsample analysis by restricting the sample to the industries with high (columns 1-3) and low external financing needs (columns 4-6), respectively; and then run a triple difference (DDD) analysis over the full sample with the external financing needs measure as an additional interaction variable (columns 7-9). All columns are OLS regressions except columns 2, 5 and 8, which are a Poisson regression. The dependent variables are the natural logarithm of the number of firm births in columns 1, 4 and 7, the number of firm births in columns 2, 5 and 8, and firm birth rate in columns 3, 6 and 9. "QSBS eligible" is a dummy treatment variable indicating whether the new firms are in the sectors eligible for the QSBS exemption. "Post" is set to be one if the observation is after 2010, and zero otherwise. All regressions include NAICS4 industry and year fixed effects. ***, **, and * correspond to statistical significance at the 1%, 5%, and 10% levels, respectively. Standard errors in parentheses are clustered by NAICS4 industry.

Panel A: External financial dependence

| | High external financial dependence | | | Low external financial dependence | | | High vs. low ext. financial dependence | | |
|---|---|---|---|---|---|---|---|---|---|
| *Dependent variable:* | Log (no. firm births) | No. firm births | Firm birth rate | Log (no. firm births) | No. firm births | Firm birth rate | Log (no. firm births) | No. firm births | Firm birth rate |
| *Model:* | OLS | Poisson | OLS | OLS | Poisson | OLS | OLS | Poisson | OLS |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| Fin. dep. × QSBS elig. × Post | | | | | | | −0.025** | −0.023*** | −0.146 |
| | | | | | | | (0.011) | (0.005) | (0.127) |
| QSBS eligible × Post | 0.058 | 0.028 | 0.796** | 0.250*** | 0.101*** | 2.293** | 0.082* | −0.001 | 1.116*** |
| | (0.045) | (0.048) | (0.335) | (0.081) | (0.038) | (0.914) | (0.044) | (0.034) | (0.307) |
| Fin. dep. × Post | | | | | | | 0.019** | 0.010*** | 0.112 |
| | | | | | | | (0.009) | (0.004) | (0.121) |
| Log (no. large incumbents) | 0.634*** | 0.564*** | 0.361 | 0.722*** | 0.452* | 2.113* | 0.679*** | 0.577*** | 1.265 |
| | (0.128) | (0.187) | (0.832) | (0.135) | (0.232) | (1.217) | (0.096) | (0.114) | (0.780) |
| Observations | 1,029 | 1,030 | 1,030 | 1,039 | 1,040 | 1,040 | 2,068 | 2,070 | 2,070 |
| $F$ or $\chi^2$ statistic | 12.4 | 9.1 | 2.9 | 14.9 | 7.7 | 3.2 | 13.9 | 46.4 | 3.8 |

Panel B: External equity dependence

| | High external equity dependence | | | Low external equity dependence | | | High vs. low ext. equity dependence | | |
|---|---|---|---|---|---|---|---|---|---|
| *Dependent variable:* | Log (no. firm births) | No. firm births | Firm birth rate | Log (no. firm births) | No. firm births | Firm birth rate | Log (no. firm births) | No. firm births | Firm birth rate |
| *Model:* | OLS | Poisson | OLS | OLS | Poisson | OLS | OLS | Poisson | OLS |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| Equity dep. × QSBS elig. × Post | | | | | | | 0.035 | −0.015 | −0.340 |
| | | | | | | | (0.052) | (0.013) | (0.518) |
| QSBS eligible × Post | 0.136** | 0.095** | 0.942*** | 0.180** | 0.096** | 2.244** | 0.166*** | 0.067** | 1.464*** |
| | (0.063) | (0.046) | (0.336) | (0.074) | (0.042) | (1.008) | (0.052) | (0.033) | (0.415) |
| Equity dep. × Post | | | | | | | −0.038 | 0.010 | 0.349 |
| | | | | | | | (0.051) | (0.013) | (0.515) |
| Log (no. large incumbents) | 0.574*** | 0.272 | −0.146 | 0.760*** | 0.769*** | 2.385** | 0.669*** | 0.478*** | 1.237 |
| | (0.138) | (0.204) | (0.895) | (0.133) | (0.157) | (1.179) | (0.094) | (0.173) | (0.762) |
| Observations | 1,029 | 1,030 | 1,030 | 1,039 | 1,040 | 1,040 | 2,068 | 2,070 | 2,070 |
| $F$ or $\chi^2$ statistic | 10.0 | 7.0 | 4.2 | 16.9 | 24.6 | 2.8 | 14.2 | 19.4 | 4.6 |

## Table IA.5: Firm deaths

This table presents diff-in-diff analyses examining the impact of the QSBS exemption on firm deaths at the NAICS4-year level. The sample period is over 2006–2015. All columns are OLS regressions except column 4, which is a Poisson regression. The dependent variable in columns 1 and 2 is the natural logarithm of the number of firm deaths each year; in column 3, it is the natural logarithm of one plus the number of firm deaths each year; in column 4, it is the number of firm deaths each year. "QSBS eligible" is a dummy treatment variable indicating whether the firms are in the sectors eligible for the QSBS exemption. "Post" is set to be one if the observation is after 2010, and zero otherwise. "Log(no. large incumbents)" is the lagged natural logarithm of the number of incumbent firms with at least 100 employees. All regressions include NAICS4 industry and year fixed effects. ***, **, and * correspond to statistical significance at the 1%, 5%, and 10% levels, respectively. Standard errors in parentheses are clustered by NAICS4 industry.

| *Dependent variable:* | Log (no. firm deaths) | Log (no. firm deaths) | Log (1 + no. firm deaths) | No. firm deaths |
|---|---|---|---|---|
| *Model:* | OLS | OLS | OLS | Poisson |
| | (1) | (2) | (3) | (4) |
| QSBS eligible × Post | −0.023 | −0.064 | 0.028 | −0.001 |
| | (0.038) | (0.046) | (0.058) | (0.045) |
| Log (no. large incumbents) | 0.688*** | | 0.756*** | 0.637*** |
| | (0.071) | | (0.092) | (0.133) |
| Industry FE | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes |
| Observations | 2,649 | 2,649 | 2,670 | 2,670 |
| $F$ or $\chi^2$ statistic | 49.7 | 1.9 | 43.9 | 24.2 |