Financing Entrepreneurship: Tax Incentives for Early-Stage Investors*

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Abstract

Governments often subsidize startups with the goal of spurring entrepreneurship using tax incentives. Exploiting the staggered implementation of angel investor tax credits in 31 U.S. states from 1988 to 2018, we find that these programs increase the number of angel investments and average investment size. However, additional investments flow to lower-quality startups that are launched by less experienced entrepreneurs. Despite short-run propping up due to tax credits, angel-backed firms subsequently perform poorly. We find evidence that entry of new inexperienced investors can explain these results. Overall, our findings suggest that state-level investor tax credits are ineffective in promoting high-quality entrepreneurship.

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1. Introduction

Entrepreneurship is an engine of economic growth. Consequently, it is supported by a wide range of government policies, including direct investments, loan guarantees, and tax credits. This paper studies an important policy tool that has been adopted by more than 12 countries around the world: angel tax credits.[1] These tax incentives subsidize early-stage investors by providing personal income tax credits equal to a certain percentage of their investment, regardless of the investment outcome. While this tax policy has attracted much attention and debate, little is known about its effect on investors and startups.[2]

We provide the first evidence about the impact of angel tax credits on early-stage investment by asking the following questions. How do angel tax credits affect capital allocation decisions by angel investors? Do these tax incentives impact entrepreneurial outcomes? The answers to these questions are important for both academics and policymakers, as more regions propose implementing such tax credits and the global angel market is rapidly expanding (OECD (2011)).

We study the effect of angel tax credits on the quantity and quality of angel investments. First, we expect that angel tax credits will increase the quantity of angel investments if there are many marginal startups seeking capital. In this case, tax incentives could turn previously negative NPV deals into positive investment opportunities. However, if uninvested firms are much worse than those currently receiving capital, tax credits might not sway investors' decisions. Further, while the number of angel-backed firms might increase, the amount invested in a firm may not

[1] Angels are wealthy individuals who invest in early-stage startups in exchange for equity or convertible debt. Countries with angel tax credits include Canada, England, France, Germany, Ireland, Portugal, Spain, Sweden, China, Japan, Brazil, Australia, and 31 states in the U.S.
[2] See, for example, "Should Angel Investors Get Tax Credits to Invest in Small Businesses?," *Wall Street Journal*, 3/9/2012; "The Problem with Tax Credits for Angel Investors," *Bloomberg*, 8/20/2010; "Angel Investment Tax Credit Pricey but Has Defenders," *Minnesota Star Tribune*, 10/31/2015.

change if projects are not scalable. Second, the effect of these tax credits on the quality of startups receiving angel investments is also ambiguous. If the angel market has substantial search or information frictions, then many high-quality firms are neglected by investors and uninvested firms might not be worse than invested ones. On the other hand, if the angel market is efficient in screening deals, the quality of marginal investments will be strictly worse. Moreover, tax credits can induce the entry of new investors with worse access to deals and less experience in screening startups.[3]

It is empirically challenging to estimate the effect of angel investor tax credits on the quantity and the quality of angel investments for several reasons. First, most countries implement these tax credits at the national level, making causal inference difficult. Second, the implementation of tax subsidies targeting early-stage investors might be confounded by economic factors. Third, it is nontrivial to observe angel investments, and the quality and performance of angel-backed firms.

We overcome these empirical challenges by exploiting the staggered introductions and terminations of angel investor tax credits from 1988 to 2018 across 31 states in the U.S. There is substantial heterogeneity in the timing, duration, and size of these tax credit programs, which we hand-collect from state legislation. We find that state-level economic, political, fiscal and entrepreneurial factors do not predict the implementation of angel investor tax credits. This lack of predictability is consistent with the presence of political challenges in the passage of these programs and suggests that the timing of a program in a particular state appears to be unanticipated. Further, we compile a large data set on angel investments by combining Crunchbase,

[3] Prior literature finds assortative matching between investors and entrepreneurs: more experienced investors match with higher-quality firms (Hsu (2004), Sørensen (2007), Ewens, Gorbenko, and Korteweg (2019)).

VentureXpert, VentureSource (referred to as "CVV"), and Form D filings. We augment these investments with financial data on angel-backed firms from the National Establishment Time-Series (NETS) database. We also gather data on startups directly supported by angel tax credit programs in each state using Freedom of Information Act (FOIA) requests. Lastly, we extract data on angel investors from AngelList.

We use a difference-in-differences framework to identify the effect of tax credits on the quantity and quality of angel investments. We include state fixed effects to absorb time-invariant unobserved heterogeneity by state, in addition to year fixed effects to account for macroeconomic shocks. Since most angel tax credit programs restrict eligibility to firms in the high-tech sector, we subset our sample to firms in these industries for most analyses. Additionally, we estimate a generalized difference-in-differences model using the tax credit percentage, which is the maximum tax credit available as a percentage of an angel's investment, as a continuous treatment variable.

We begin by examining the impact of state-level angel tax credits on the extensive and intensive margins of angel investments. We find that these tax credits increase the number of angel investments in a state by approximately 18%. As the tax credit percentage rises, the impact on the number of angel investments also increases. We find that the effect of angel tax credits on angel investments is amplified when programs are less restrictive and when the supply of alternative startup capital is more limited. Using data on investment amounts from Form D filings and CVV, we find that angel tax credits increase the average investment size by 14% to 17%.

Which types of firms receive these additional angel investments induced by tax incentives? To answer this question, we start by examining the impact of angel tax credits on the average quality of angel investments, as measured by pre-investment characteristics of angel-backed firms. We find that after a state introduces angel tax credits, firms receiving angel investments have lower pre-investment sales and sales growth. The results are similar using alternative measures of quality, including employment, employment growth, sales-to-employment ratio, and the fraction of serial entrepreneurs on a startup's founding team. Importantly, the deterioration in quality occurs throughout the distribution, including the right tail. This effect is exacerbated as the tax credit percentage increases. When we split the quantity of angel investments based on pre-investment quality, we find that marginal angel investments flow primarily to low-quality deals and there is no impact on the volume of high-quality deals. These results hold across different samples and different measures of quality.

The key identifying assumption for our empirical design is that, if angel tax credits were not implemented, there would be parallel trends in states with these programs. In a dynamic difference-in-differences specification, we find no pre-treatment differences in angel investment volume before the introduction of angel tax credits. Notably, the effects only appear after the implementation of these programs. We also find that the effects are larger in states with higher tax credit percentages, suggesting that our results are driven by the treatment of angel tax credits, rather than confounding economic conditions or other coincident policy initiatives. Taken together, these findings are consistent with the parallel trends assumption.

To provide additional evidence supporting our identification approach, we implement a triple-difference (DDD) design and use the non-high-tech sector as a placebo group. This allows us to control for state-year fixed effects, eliminating the concern that our results are driven by omitted time-varying confounders at the state-year level, such as unobserved demand shocks, other policy initiatives, or changing entrepreneurship conditions. We find that angel tax credit programs have no effect on the quantity or quality of angel investments in the non-high-tech sector, while the estimated effects for the high-tech sector are similar to our main results. These results suggest that angel tax credits induce the supply of new capital to the high-tech sector, rather than reallocating existing capital.

Next, we examine post-investment performance outcomes for angel-backed firms. We find that the introduction of angel tax credits leads to a short-term propping-up of angel-backed firms in the first two years after angel investments, consistent with the additional capital injection induced by tax subsidies. However, this effect deteriorates and is followed by lower growth and productivity over the next few years. Further, after the introduction of angel tax credits, angel-backed firms are less likely to achieve successful exits through IPOs or high-price mergers and acquisitions. These findings can be explained by either lower firm quality at the time of investment or the treatment effect of receiving subsidized angel capital.

We investigate two non-mutually exclusive channels through which angel tax credits decrease the quality of angel investments. First, a limited supply of high-quality startups might drive additional angel capital to lower-quality startups (*supply channel*). Second, a fixed tax subsidy reduces investors' cost of capital, thereby reducing average screening effort, particularly if there is entry by new, inexperienced investors (*screening channel*).[4]

Using FOIA data provided by 18 states, we compare firms backed by angel tax credits (in-program firms) with eligible out-of-program firms. We find that in-program firms are more likely to shut down and less likely to be acquired or have an IPO than eligible out-of-program firms within the same state-year. This suggests that our results are not solely driven by angel investors efficiently selecting the next best startup. Instead, there are better investment opportunities, yet subsidized investors are passing them by. Next, we examine the impact of angel tax credits on the composition of investors. We find that the adoption of these programs induces entry of first-time

[4] We use screening to broadly refer to both access to deals and deal selection by angel investors.

investors and leads to a decrease in average investor experience.[5] Taken together, while we cannot rule out the supply channel, our findings provide evidence of reduced average screening by angel investors.

Overall, we provide the first evidence about the impact of angel tax credits on the quantity and quality of angel investments. We find that these tax incentives lead to an increase in angel investments along both the extensive and intensive margins, but capital flows to lower-quality firms. Our results suggest that state-level investor tax credits are not effective in boosting high-growth entrepreneurship.[6] These findings are consistent with the view in Lerner (2009) that tax credits for investors at the time of the investment might weaken their incentives. Understanding the type of firms impacted by angel tax credits could inform policymakers about the design and implementation of interventions to support entrepreneurship.

Our paper contributes to the nascent and growing literature on angel financing. One strand of research has studied the causal effect of angel capital on firm outcomes and subsequent financing. Kerr, Lerner and Schoar (2011) and Lerner, Schoar, Sokolinski, and Wilson (2018) show that angel investments improve firm survival, performance, and eventual success. Lindsey and Stein (2019) find that a decrease in the supply of angel investors due to the Dodd-Frank Act leads to a decline in firm entry and a contraction in employment. Hellmann, Schure and Vo (2017) find that angel financing substitutes for follow-on venture capital financing within a firm, consistent with the theory in Hellman and Thiele (2015). In contrast, our paper focuses on the effect of angel tax credits on investors' capital allocation, which highlights their decision-making process and incentives. Bernstein, Korteweg and Laws (2017) also examine how early-stage

[5] In the appendix, we verify that investor experience is positively correlated with successful startup outcomes in our sample.

[6] Appendix C examines aggregate outcomes and finds that angel tax credit programs have no effect on state-level entry, exit, or job creation of nascent firms.

investors make decisions and find that they respond to information about the founding team, rather than firm performance or existing investors. Ewens and Townsend (2019) and Gornall and Strebulaev (2019) study gender biases of early-stage investors.

Next, our findings add to the literature on government subsidies targeting entrepreneurship. Several studies examine government subsidies through tax credits for research and development (Babina and Howell (2019) and Fazio, Guzman, and Stern (2019)), the impact of capital gains taxes on venture capital investments (Poterba (1989) and Gompers and Lerner (1998)), and government-backed venture capital (Brander, Egan, and Hellmann (2010), Lerner (2010), Brander, Du, and Hellmann (2015), and Denes (2019)). Relatedly, González-Uribe and Paravisini (2019) evaluate the combined effects of U.K. investor tax credits *and* capital gains tax credits on firm investment and capital structure decisions. In a concurrent paper, Howell and Mezzanotti (2019) examine U.S. state angel tax credit programs for a subset of 12 states from 2002 to 2016 and find that there is no measurable effect on state-level entrepreneurial outcomes. Our paper instead focuses on how angel tax credits impact investor incentives and deal selection, and highlights the potential adverse effects when large subsidies do not vary with investment outcomes.

Lastly, we contribute to a broad literature on entrepreneurial finance. Capital is commonly provided to nascent firms by venture capitalists (Gompers, Gornall, Kaplan, and Strebulaev (2019)). These investors impact startup success (Puri and Zarutskie (2012)) and their innovative activities through monitoring (Bernstein, Giroud, and Townsend (2016)). Recent studies also highlight the importance of banks (Hellman, Lindsey, and Puri (2007), Robb and Robinson (2012), González-Uribe and Mann (2017), Hochberg, Serrano, and Ziedonis (2018), and Davis, Morse, and Wang (2019)) and accelerators (González-Uribe and Leatherbee (2017), González-Uribe and

Reyes (2019), and Fehder and Hochberg (2019)) in providing startups with capital. We study the role of angel investors as a rising source of capital for startups.

2. Angel investor tax credits

2.1. Institutional background

Governments frequently alter tax policies with the goal of boosting investment in new firms, particularly those with high-growth potential. Tax breaks for investors tend to be offered either at the time of the investment (often referred to as investor tax credits) or on capital gains from successful exits (commonly called capital gains tax credits). Over the last three decades, 31 states in the U.S. have introduced and passed legislation for 36 programs providing accredited angel investors[7] with tax credits. We hand collect data from state legislation on each program's effective dates and details about its implementation. Table A1 in the appendix provides details on each program's effective period, tax credit percentage and restrictions. While there is no corresponding federal tax credit in the U.S., legislation was recently proposed by Senator Christopher Murphy.

State-level angel tax credits reduce the state income tax of an investor. For example, suppose that an investor earns $250,000 in a particular year and invests $20,000 in a local startup. If the state tax rate is 5% on all income, then the investor pays annual state taxes of $12,500. Assuming that the state implemented an angel tax credit program with a tax credit[8] of 35%, the investor can reduce her state taxes by $7,000, which is a decline of 56% relative to her annual state taxes. Importantly, this type of investment tax credit is not contingent on the eventual outcome of

[7] We refer to accredited angel investors as angels throughout the paper.
[8] This is the maximum tax credit percentage available to an investor. The tax credit available to a particular investor will depend on her state tax liability. For ease of discussion, we refer to this as tax credit percentage.

the startup, which differentiates it from a capital gains tax credit that is only generated when an investment provides a capital gain. It follows that angel tax credits can be viewed as a fixed subsidy to investors.

New Jersey is an example of a state recently passing and extending legislation on tax credits for angel investors. Governor Chris Christie, a Republican, signed the Angel Investor Tax Credit Act into law in 2013. This law provided an angel tax credit of 10%, which was recently revised to 20% in 2019 by Governor Phil Murphy, a Democrat. Bipartisan support is common for these types of tax credits. The New Jersey law sets eligibility criteria for investments. A firm must have fewer than 225 employees, with at least 75% located in the state. Additionally, the law targets the information technology, advanced materials, biotechnology and life science, medical devices, and renewable energy industries. The focus on high-tech industries is a frequent feature of angel tax credit programs and guides our empirical design. Tax credits are available to accredited investors and their pass-through entities. An accredited investor is defined as a person who earned income of more than $200,000 (or $300,000 with a spouse) or has a net worth over $1 million. Since July 2010, net worth excludes home equity (Lindsey and Stein (2019)).[9] For New Jersey, the minimum holding period is two years, with the exception of an IPO, merger or acquisition. The cap on tax credits for the program is $0.5 million per investment and $25 million total per year. With a tax credit of 20%, this supports up to $2.5 million per angel investment, and $125 million of total annual angel investments.

Although New Jersey is a typical example of a state angel tax credit program, these programs differ across states in terms of the tax credit percentage and eligibility requirements. Table 1 provides summary statistics for the 36 angel tax credit programs in our sample. The mean

[9] The tax implications might differ for accredited investors compared to pass-through entities. Angel investor tax credits are more likely provided to individuals because most programs include investment caps.

(median) for the tax credit percentage is 34% (33%). The majority of programs set the maximum tax credit between 20% and 40%, with just three programs below 20% and only one program above 60%.[10] Angel tax credit programs generally place restrictions on the firms and the investments that are eligible to participate in the programs. These restrictions can include age caps (31% of programs), employment caps (39%), revenue caps (47%), assets caps (22%), and minimum investment holding period (50%). These programs also often do not allow participation by owners and their families (61%), full-time employees (22%), or executives and officers (33%), with the intent of targeting outside investors. States allocate, on average, $9.0 million to support tax credits each year. Tax credits are generally non-refundable (72% of programs) and non-transferrable (72%). Though these tax credits generally reduce a taxpayer's income liability for the current year, most programs allow excess credits to be carried forward to future taxable years (89%). We incorporate program heterogeneity into our analysis using the tax credit percentage and program restrictiveness.

Panel A of Figure 1 provides a map of states with angel tax credit programs. The blue shading indicates the tax credit percentage, with darker shades representing larger tax credits. The figure highlights that angel tax credits are prevalent across the U.S. The extent of these programs is particularly notable since they would not occur in states without an income tax, which are shaded in grey and include Alaska, Florida, Nevada, South Dakota, Texas, Washington and Wyoming.[11]

Panel B of Figure 1 shows the introduction and termination of these programs. In 1988, Maine introduced the Seed Capital Tax Credit Program, which is one of the earliest angel tax credit programs and remains ongoing. A steady progression of states started programs during the

[10] From 2001 to 2009, Hawaii offered an angel tax credit of 100%, which essentially guaranteed returns for investors. This tax credit was later revised to 80%.

[11] While there is no personal income tax for Tennessee and New Hampshire, these states tax investment income.

following three decades. Colorado, Maryland, Minnesota, North Dakota and Ohio passed more than one version of an angel tax credit. Though the pace of program introductions increased recently, the geography appears to be dispersed and the program duration varies substantially from just one year to three decades.

2.2. Why are angel tax credit programs enacted?

Angel tax credit programs have often been touted as "relatively simple and cost-effective for states" (Kousky and Tuomi (2015)) and proponents argue that they promote job creation, innovation, and economic growth.[12] In light of this, a concern may be that states introduce angel tax credit programs in times of local economic stagnation, which could pose a threat to our identification strategy. To address this concern, we estimate a predictive regression by examining whether state economic, political, fiscal, or entrepreneurial factors predict the implementation of angel tax credit programs. The outcome is *ATC*, which is an indicator variable equaling one if a state introduces an angel tax credit program in a given year. Alternatively, we also use a continuous dependent variable *Tax credit percentage*, which is the maximum tax credit percentage available in a state-year with an angel tax credit program and is set to zero if there is no program in place in a state-year. We omit the years after a program starts.

We incorporate several state-level variables, which are lagged by one year in the regression. Specifically, we include: (1) Gross State Product (GSP) growth, natural log of state income per capita, natural log of state population and state unemployment rate from the Bureau of Economic Analysis (BEA); (2) indicators for whether a state is controlled by Republicans or Democrats (i.e., a single party controls both the legislative and executive branches) from the

[12] Tuomi and Boxer (2015) conduct case studies of two angel tax credit programs in the U.S. (Maryland and Wisconsin) and find suggestive evidence that these programs generate benefits that outweigh the costs.

National Conference of State Legislatures (NCSL); (3) state fiscal conditions including revenue to GSP, expenditure to GSP, and debt to GSP from the Annual Survey of State and Local Government Finances collected by the Census Bureau; (4) indicators for whether a state has personal income tax, state maximum personal income tax rate, and state long-term capital gains tax rate from the National Bureau of Economic Research (NBER), and an indicator for whether at least one neighboring state has an angel tax credit program; and (5) state-level establishment entry rate, exit rate, and net job creation rate from the Business Dynamics Statistics (BDS) produced by the Census Bureau, and state-level total venture capital volume from VentureXpert scaled by the number of young firms (age 0 to 5) from BDS. Additional details for these variables are provided in Appendix A.

Table 2 provides the estimates for the predictive regression. Each specification includes year fixed effects. In column 1, we find that, with the exception of the state income tax indicator, lagged state economic, political and fiscal measures do not significantly predict the introduction of angel tax credit programs. Column 3 incorporates entrepreneurship variables, which include establishment entry and exit rates, net job creation rate and venture capital volume. These variables do not have significant predictive power. Columns 5 and 7 replace the outcome with *Tax credit percentage*, and report comparable estimates to columns 1 and 3, respectively. The even-numbered columns augment the specifications with state fixed effects to absorb time-invariant state characteristics that might be correlated with the likelihood of adopting tax credit programs. We find that the maximum state personal income tax rate negatively predicts *ATC* and *Tax credit percentage*, suggesting that there might be complementarities for the role of tax cuts and tax credit programs in stimulating a state's economy. Overall, state economic, political, fiscal, and entrepreneurial conditions do not seem to drive the passage of angel tax credit programs. This provides support that the timing of a program within a particular state appears to be largely unpredictable.

The lack of predictability for tax credits targeting angel investors is consistent with the presence of considerable frictions in the passage of these programs. To implement an angel tax credit, there is an extended discussion and debate of the proposed legislation, which could be followed by negotiations, passage and implementation of the program. Frictions might be present at each stage of this process. Some states discussed introducing these programs, but a law was never proposed (e.g., Idaho and Montana). Other states proposed bills, but they did not pass the legislature (e.g., Mississippi and Pennsylvania). Even if a state legislature passes a program, several states failed to implement the program due to lack of funding or resistance after its passage (i.e., Delaware, Massachusetts, Michigan and Missouri).[13]

3. Data, samples, and key measures

3.1. Data

Angel investments are notoriously difficult to observe in the U.S. There is no comprehensive data set on angel investments, and much of what is known about the size of the angel market relies on estimates from surveys (Shane (2009) and Lindsey and Stein (2019)). To overcome this challenge, we form a novel data set on angel investments by combining data from Crunchbase, Thomson Reuters VentureXpert, Dow Jones VentureSource, which we collectively refer to as “CVV,” and Form D filings available through the U.S. Securities and Exchange Commission (SEC).

[13] For example, the Missouri House of Representatives passed legislation in 2014, but it did not advance because of a controversial amendment tacked on by the lobbying group Missouri Right to Life to bar investment in companies that do stem cell research (Moxley (2014)).

Crunchbase tracks startup financings using crowdsourcing and news aggregation. It is considered by investors and analysts alike to be the most comprehensive data set of early-stage startup activities, particularly since 2010. VentureXpert and VentureSource are commercial databases for investments in startups and mainly capture firms that eventually received venture capital financing.[14] To isolate investments by angel investors in these data sets, we restrict to rounds where either the round type or the investor type includes early-stage investors. For example, we include both explicitly identified angel rounds, in addition to those rounds backed by angel investors, in our classification.[15] Appendix B provides our detailed classification criteria.[16]

Our second main source of angel investment data is Form D filings. Form D is a notice of an exempt offering of securities under Regulation D and allows firms to raise capital without registering their securities (pursuant to Section 4(2) of the Securities Act of 1933). The majority of offerings under Regulation D are through Rule 506, which preempts state securities law and allows startups to raise money from an unlimited number of accredited investors and up to 35 non-accredited investors (Bauguess, Gullapalli, and Ivanov (2018)).[17] Prior to March 2008, Form D filings were paper-based and are not available on SEC's EDGAR (Electronic Data Gathering, Analysis and Retrieval). We use a Freedom of Information Act (FOIA) request to obtain these non-electronic Form D records from 1992 to 2008. We also extract electronically-filed Form D data from EDGAR. Additionally, we use a FOIA request to obtain the addresses of all non-electronic filers. Investment details, such as investment amount, security type, and issuer's industry, are only available for electronic filings from March 2008 onwards. To capture unique

[14] To alleviate a concern about coverage of angel investments in VentureXpert and VentureSource, we start the sample in 2010 and find similar results.
[15] We restrict to the following round type or investor type: "angel," "angel group," "angel fund," "individual," "micro," "pre-seed," "seed," "convertible note," "equity crowdfunding," or "accelerator."
[16] Our results are robust to restricting to investments explicitly classified as angel investments.
[17] Regulation D also contains Rule 504 and 505, which do not preempt state securities laws and impose a $5 million issuance cap. These exemptions are rarely used because they do not offer preemption of state securities laws.

offerings and information available at the time of offering, we drop amendments and only keep original filings. We also drop financial issuers and pooled investment funds. Lastly, we include only the first three issuances by each firm to more precisely identify angel investments.[18]

We combine angel investments from the above data sources and disambiguate the data to eliminate duplicate coverage of the same investments in multiple sources, using the following order of VentureXpert, VentureSource, Crunchbase and Form D filings.[19] This process generates 199,144 angel investments from 1985 to 2017. We match these angel investments to the National Establishment Time-Series (NETS) database, based on firm name, address, and founding year. This allows us to observe the performance of angel-backed firms over time. The NETS database provides annual sales and employment data for 54.8 million firms and 58.9 million establishments in the U.S. from 1990 to 2014. Matching with NETS yields a sample of 129,568 angel investments.

Despite our best efforts to compile a comprehensive data set on angel investments, we acknowledge that our data cannot capture the entire U.S. angel market and provide a few caveats.[20] First, while Crunchbase covers startups backed by all financing sources, most firms in VentureXpert and VentureSource eventually received institutional capital. In Panel E of Table A2, we obtain similar results if we drop deals in VentureXpert and VentureSource. Second, not all angel investments trigger a Form D filing. Though there are regulatory penalties not filing this form, it does not appear to be strictly enforced in practice. Additionally, Regulation D is not the only way firms can obtain registration exemption. For example, firms can claim exemption through Rule 147, Regulation A, and more recently Regulation Crowdfunding. However, Regulation D is

[18] Our results are similar if we include only the first issuance or the first two issuances by each firm.
[19] We find similar results using different orderings to disambiguate our data.
[20] In fact, due to the limited observability of angel investments, there is no consensus on the size of this market (Shane (2009)).

the most widely used regulation for conducting an unregistered securities offering (Bauguess, Gullapalli, and Ivanov (2018)).

To compare startups that qualify for angel tax credits with those that do not, we submit FOIA requests to each of the 31 states with an angel tax credit program in our sample. We received data on qualified businesses from 18 out of the 31 states. The remaining 13 states either did not respond after multiple requests or do not maintain records of qualified businesses. We then manually match the FOIA lists of in-program firms with our angel investments data. Of the 4,718 firms provided through the FOIA requests, we match 1,069 firms to our angel investment data set.

Lastly, we collect data from AngelList to study the effect of angel tax credits on entry by new investors. We also obtain annual data on state-level business and employment outcomes from the Business Dynamics Statistics (BDS) provided by the Census Bureau to evaluate the effect of angel tax credits on aggregate outcomes.

3.2. Samples

Our main sample consists of all angel-backed firms matched to NETS with investment years from 1993 to 2016. We start the sample in 1993 because Form D data is incomplete in 1992. Additionally, we require up to two years of pre-investment data from NETS to measure deal quality. Given that our NETS data covers 1990 to 2014, our sample ends in 2016.

For analyses that do not require NETS data, such as those examining exit outcomes and entrepreneur experience, we use the CVV subsample, which has a longer time-series from 1985 to 2016. We start this subsample in 1985 because the coverage of CVV is relatively poor before 1985 and the first angel tax credit program began in 1988. Accordingly, there are at least three pre-treatment years in the sample.

Since tax credit programs primarily target the high-tech sector (information technology, biotech, and renewable energies), our analyses generally focus on angel investments in these sectors. The sample for the baseline specification is collapsed to a state-year panel of angel investment volume and average deal quality in the high-tech sector.

3.3. Key measures

We focus on the effect of angel tax credit programs on three sets of outcomes: quantity of angel investments, quality of angel investments at the time of investment, and performance of angel-backed firms after investment.

Our main quantity measure is the number of angel investment rounds in each state-year. To examine the intensive margin, we also use a subsample of angel investments when the amount of capital deployed per deal is observed in the CVV and Form D samples. We use the total amount of capital raised in the round, since we cannot observe the amount invested by a particular investor.

We measure the quality of angel investments using sales and employment data from NETS. Specifically, we use a firm's sales, employment, sales growth, employment growth, and sales-to-employment ratio in the year before investment as measures of deal quality. For firms in the CVV sample, we are also able to observe entrepreneurs' past experience at the time of investment. Prior literature documents that founders' past entrepreneurship experience is a strong predictor of venture success (Hsu (2007) and Lafontaine and Shaw (2016)). Accordingly, we use the fraction of serial entrepreneurs on the founding team as a supplementary measure of deal quality.

Lastly, we examine the post-investment performance of angel-backed firms by measuring their eventual exit outcomes. Using CVV data, we construct an indicator variable equaling one if a firm has an IPO or a high-price merger or acquisition (M&A), which is defined as at least 1.25

times the total invested capital (Ewens and Marx (2017)).[21] We also construct a generalized categorical variable of success that ranks exit outcomes in the following order: IPO or high-price M&A (value of 1), low-price M&A (value of 0.5), ongoing (value of 0), M&A with undisclosed price (value of −0.5), and shutdown or living dead (value of −1).[22] Additionally, we examine whether a startup has a subsequent financing round after the angel round as another measure of short-term success. The ability to raise additional financing indicates that a startup demonstrates sufficient promise. Finally, we use post-investment sales, employment, sales and employment growth, and sales-to-employment ratio from NETS to examine performance.[23]

3.4. Summary statistics

Table 3 provides summary statistics for our samples. It presents the statistics for angel investment quantity, average ex-ante quality, average ex-post performance, aggregate outcomes and controls at the state-year level. Appendix A provides detailed definitions of all variables. In our main sample from 1993 to 2016, approximately 25% of state-years have an active angel tax credit program. The average angel-backed firm is 5.4 years old at the time of investment, has about $200,000 in sales, seven employees, a sales growth rate of 72%, an employment growth rate of 45%, and generates nearly $27,000 in sales per employee in the year before investment. On average, 5% of the founders on a founding-team are serial entrepreneurs. The average sales growth over the five years after receiving an angel investment is 23%, employment growth is 16%, average sales are $0.8 million, and average employment is 11 employees. In the median state-year, about 3% of

[21] We obtain similar results when defining a high-price M&A as at least 2 times the total invested capital.
[22] We rank an M&A with an undisclosed price as a worse outcome than ongoing because many of these acquisitions are in fact hidden failures (Puri and Zarutskie (2012), Ewens and Marx (2017)). We define "living dead" as a startup with no financing for two years since its last round.
[23] We do not use firm exits in NETS as a measure of performance. First, NETS exit is imprecise (Crane and Decker (2019)). The aggregate exit rates in NETS are much lower than those in the Census BDS. Second, NETS does not distinguish between successful exits (such as IPO or M&A) and failures.

angel-backed firms successfully exit through an IPO or high-price M&A, with 14% of these firms raising an additional round of financing.

4. Identification strategy

Our empirical approach is a difference-in-differences design, exploiting the staggered introduction and expiration of 36 angel tax credit programs in 31 states from 1988 to 2018. Specifically, we estimate the following specification:

$$Volume_{st}\ or\ Quality_{st} = \alpha_s + \alpha_t + \beta \cdot ATC_{st} + \gamma' \cdot X_{st} + \varepsilon_{st}, \quad (1)$$

where ATC_{st} is an indicator equaling one if state *s* has an angel tax credit program in year *t*. X_{st} is a vector of state-year levels of the following controls[24]: Gross State Product (GSP) growth, natural log of income per capital, natural log of population, indicators for whether a state is controlled by Republicans or Democrats, ratio of revenue to GSP, ratio of expenditure to GSP, ratio of debt to GSP, an indicator for whether a state has personal income tax, and the maximum state personal income tax rate. Though Table 2 suggests that state-level economic conditions do not predict the introduction of angel tax credit programs, we include these controls to alleviate a concern that our findings could be driven by broader entrepreneurial trends. To absorb unobserved time-invariant state heterogeneity, all regressions include state fixed effects. Additionally, we include year fixed effects to capture aggregate temporal variation. Standard errors are clustered by state (Bertrand, Duflo, and Mullainathan (2004)). The coefficient of interest is β, which captures the marginal effect of angel tax credits on the volume and quality of angel investments.

Additionally, we estimate a generalized difference-in-differences model. This approach exploits variation in the size of tax credits across programs by replacing ATC_{st} in equation (1) with

[24] Most of the results are provided with and without controls.

a continuous treatment variable, *Tax credit percentage*$_{st}$. This variable equals the maximum tax credit percentage available in a particular state-year when there is an angel tax credit program. If there is no such program in place, it is set to zero. Overall, we identify the effect of angel tax credit programs on volume and quality of angel investments using variation in the availability of these tax credits across states and time, in addition to exploiting variation in the size of the tax incentives offered by these programs.[25]

5. Angel tax credits and the quantity of angel investments

5.1. Extensive margin

Do tax credits increase the number of startups receiving angel-backed investments? While this is one of the primary intentions of angel tax credit programs, it is not ex-ante clear whether investors respond to these tax incentives. On the one hand, tax credits subsidize angel investors by returning a guaranteed amount of invested capital. This could provide an incentive for existing angel investors to invest in additional deals and potentially encourage the entry of new investors, particularly if there are many promising uninvested projects. On the other hand, if uninvested firms are much worse than those receiving capital, then tax subsidies might not sway investors' decisions. It is an open and unanswered question about the response by angel investors to state-level tax credits.

5.1.1. Baseline results

Panel A of Table 4 reports the difference-in-differences estimates using equation (1) for the effect of angel tax credits on the number of angel investments. In column 1, we find that angel

[25] Section 7 discusses additional identification tests, including a triple-difference (DDD) approach that compares the high-tech sector with the non-high-tech sector.

tax credits significantly increase angel investments[26] by 17.5%. Column 2 includes state-year level controls such as Gross State Product (GSP) growth, natural log of income per capital, natural log of population, ratio of revenue to GSP, ratio of expenditure to GSP, ratio of debt to GSP, an indicator for whether a state has personal income tax, and the state maximum personal income tax rate. The estimates are quite similar to column 1, which suggests that state-level economic activity does not drive the relationship between angel tax credits and the volume of angel investments.

We then examine the impact of the size of the tax credits on the quantity of angel capital invested. Section 2 discusses variation in the implementation of angel tax credit programs. A key difference across programs is the extent to which investors can claim tax credits. To capture this variation, we construct a continuous variable, *Tax credit percentage*, which is defined as the maximum tax credit percentage available for a particular angel tax credit program. Column 3 finds that the number of angel investments significantly increases with a program's tax credit percentage. A 10-percentage-point increase in the tax credit percentage significantly increases the number of angel-backed firms by 5.6%. In column 4, we obtain statistically and economically similar results when we include state-level controls.

We highlight that the findings above capture two effects of angel tax credits on the quantity on angel investments. First, angel tax credits lead to additional investment in firms directly benefiting from these tax subsidies. Second, an investor who receives a tax credit for one of her investments could become more willing to invest in other deals. Subsequently, angel tax credits might lead to a reallocation of an investor's portfolio due to spillover effects.

[26] When the outcome is a natural logarithm, we report the exponentiated coefficient minus one.

5.1.2. Cross-sectional heterogeneity

This subsection examines heterogeneity in the effect of angel tax credits on angel investment volume. We first explore the role of program design. Using hand-collected data on the implementation of angel tax credit programs, we construct *Program flexibility* to measure the presence and strictness of the 16 restrictions in Table 1. For each non-binary restriction, we rank programs from least to most strict and assign the highest rank to programs without this restriction. These rank values are then normalized to the unit interval. We also construct indicator variables for programs that do not exclude insider investors and for each of the non-refundable, non-transferable, and no carry forward restrictions. To form the *Program flexibility* index, we sum these 16 variables and then standardize the index by subtracting its mean and dividing by its standard deviation prior to interacting it with our treatment variables.

Panel B of Table 4 examines the role of program flexibility in angel tax credits' effect on angel investment volume. If the increase in investment is driven by angel tax credits, we should expect a larger effect on investment for more flexible programs. Column 1 reports that an average angel tax credit program increases the number of angel investments by 15.8%, which is similar to the estimate in column 1 of Panel A. Additionally, we find that the effect of angel tax credits on angel investment volume increases with program flexibility. A one-standard-deviation increase in program flexibility leads to an additional 12.7% increase in the quantity of investments. Column 2 shows that the results are similar when we include state-level controls. When we use tax credit percentage as the treatment, we find similar and significant results in columns 3 and 4. These results suggest that less restrictive programs are more effective in encouraging angel investments.

Next, we evaluate the effect of angel tax credits on angel investment in states with a lower supply of venture capital financing. We construct a state-year level measure of venture capital supply, *VC supply*, which is the aggregate venture capital investment amount (excluding angel and seed rounds identified in our main sample) scaled by the total number of young firms (of age 0 to 5) in a state-year. This measure captures the supply of venture capital relative to the number of young firms. Similar to *Program flexibility*, we standardize *VC supply* by subtracting its mean and dividing by its standard deviation. Panel C of Table 4 presents the results. We find that angel tax credits have a weaker effect on angel investment volume in states with an ample supply of venture capital. This is consistent with angel financing and venture capital being substitutes (Hellmann, Schure and Vo (2017)), and suggests that angel tax credit programs are particularly effective in states with a lower supply of venture capital and where firms may face more limited options in raising early-stage capital.

5.1.3. Dynamics

In this subsection, we estimate a dynamic difference-in-differences specification by interacting *ATC* with indicators for each year before and after the implementation of an angel tax credit program. The year before the introduction of an angel tax credit program is omitted as the base year. We drop state-years after a state has terminated its angel tax credit program.

Figure 2 plots the dynamics of the coefficients with 95% confidence intervals. Before a program begins, there is no differential trend in the number of angel investments between treated and control states. In the year after a program is implemented, the figure shows a marked increase in angel investments, which continues to the end of the event window.

Table 5 presents the dynamic difference-in-differences results. Column 2 corresponds to Figure 2. Prior to the start of a program, all estimates are statistically indistinguishable from zero and economically small. After an angel investor tax credit is implemented, we find that the number of angel investments increases starting in year *t*+1. The estimate of 20.0% is close to our baseline estimate with controls of 18.4%. The estimates are economically similar for the following years, though not statistically significant in years *t*+3 and *t*+4. The effect appears to increase as the programs continue and jumps to 35.8% and 37.3% in year *t*+5 and *t*+6, respectively. Overall, these results support the parallel trends assumption of our identification strategy.

5.2. Intensive margin

While angel tax credits increase the number of angel investments, it could be that the amount of capital received by a particular firm does not change or even decreases. If the amount of investment is determined by project-specific demand, we should not expect any increase on the intensive margin. Further, to minimize dilution, entrepreneurs might prefer to only raise the expected capital required in each fundraising round (Myers and Majluf (1984)). Angel investors could also prefer expanding the number of their investments rather than providing additional capital per investment to be diversified. Conversely, angel tax credits could increase the amount of capital provided to invested firms if projects are scalable. It is important for policymakers to evaluate if angel tax credits direct more capital to previously angel-backed firms, in addition to expanding the number of angel-backed startups.

We can observe the amount invested in an angel round in the Form D data starting in 2009 and in the CVV data. Table 6 examines the effect of angel tax credits on average investment amount using these two subsamples. Panel A reports the estimates for the sample of Form D filings from 2009 to 2016. In columns 1 and 2, we find that the introduction of angel tax credits increases the average investment amount by 13.8% to 17.0%. Columns 3 and 4 show that a 10-percentage-point increase in the tax credit percentage increases the average investment amount by 3.7% to

4.4%. Panel B examines investments from CVV and, since we are examining the intensive margin, restricts the sample to state-years with investments in these data. While this sample differs from the Form D sample, we find notably comparable estimates across specifications. Columns 1 and 2 shows that angel tax credits increase the average investment amount by 25.0% to 27.4%. In columns 3 and 4, we find that a 10-percentage-point increase in the tax credit percentage increases the average investment amount by about 5%. These estimates are comparable to those obtained from Form D filings, alleviating the concern that our results might be driven by a particular sample.

Taken together, the results in this section suggest that angel investors respond to tax credit incentives by both investing in more startups and investing larger amounts. These results provide the first evidence that angel tax credits significantly affect the deployment of capital to startup firms.

6. Angel tax credits and the quality of angel investments

Though we find evidence that angel tax credits increase the volume of angel investments, it is unclear where these additional investments flow. A common goal of government subsidies is to direct investment to high-growth entrepreneurship that contribute the most to economic growth. This section studies how subsidies through angel tax credits affect the quality of angel investments. We focus on the average quality of angel-backed firms at the time of investment, and then examine the type of firms receiving marginal investments.

6.1. Ex-ante quality

Table 7 estimates the effect of angel tax credits on the average quality of angel-backed firms at the time of investment. We estimate the difference-in-differences specification in equation (1) at the state-year level for high-tech sectors. In Panel A, the dependent variables are the average firm characteristics from NETS in the year before angel investment, as detailed in Section 3.3. Column 1 shows that the average pre-investment sales for angel-backed firms are 41.6% lower when a state implements an angel tax credit, representing an economically substantial decrease in a firm's quality as measured by ex-ante sales. Column 2 reports that a 10-percentage-point increase in the tax credit percentage reduces pre-investment sales by 13.0%. In column 3, we find that startups have an 18.7-percentage-point lower pre-investment sales growth in states with angel tax credits, which is large relative to an average pre-investment sales growth of 72%. The estimate for *Tax credit percentage* remains negative, though it is statistically insignificant.

An alternative measure of startup quality is employment. We repeat the previous analyses using pre-investment employment and employment growth. Columns 5 and 7 show that pre-investment employment is 12.5% lower and employment growth drops by 12.6 percentage points for angel-backed firms, respectively, after a state introduces angel tax credits. The estimates for *Tax credit percentage* are similar, though it is statistically insignificant for employment growth.

We then construct a measure of labor productivity by calculating the natural logarithm of sales divided by employment. This measure captures the amount of sales generated per employee. We continue to find evidence of lower investment quality when tax subsidies are available. Column 9 reports that pre-investment startup productivity is 33.8% lower when there is an angel tax credit program. A 10-percentage-point increase in the tax credit percentage reduces pre-investment productivity by 10.5%, as shown in column 10.

In terms of economic magnitude, the decrease in average investment quality is large relative to the increase in investment. This indicates that the quality effects are not exclusively driven by the increase in angel-backed firms.[27] Instead, angel tax credits appear to impact the angel

[27] A back-of-the-envelope calculation indicates that the quality of the additional investments would have to decrease by more than 100% for the quality of the remaining investments to be unchanged.

investors' portfolios, with a deterioration in the quality of those investments that would have been made even without angel tax credits. Figure A1 in the appendix provides additional evidence of this by comparing the distributions of angel-backed firms' ex-ante quality in state-years with an angel tax credit program to state-years without a program. Consistent with our regression estimates, we find that the quality distribution of angel-backed firms shifts to the left during angel tax credit programs relative to state-years without an angel tax credit program. Importantly, this shift occurs across the entire distribution, which suggests that both marginal and average quality is impacted. Furthermore, since there are no substantial differences in the dispersion of these distributions, we do not find evidence that investors are risk-shifting or simply increasing their tolerance for risk.

In addition to firm financials, one important predictor of startup quality is founders' prior entrepreneurship experience. Hsu (2007) and Lafontaine and Shaw (2016) show that serial entrepreneurs are associated with better startup performance. We use detailed biographic information from CVV on firms' founders to measure their prior entrepreneurship experience. Specifically, we measure the fraction of serial entrepreneurs on a startup's founding team. Panel B of Table 7 presents these results. The sample is based on angel investments with data on a startup's founding team in CVV between 1985 and 2016. In column 1, we find that, after a state implements angel tax credits, the firms receiving angel investments have 1.3 percentage points lower fraction of serial entrepreneurs on their founding teams, which is a 26.0% decline relative to the sample mean. Column 2 reports that a 10-percentage-point increase in *Tax credit percentage* leads to a 0.4 percentage point decline in founder's prior entrepreneurship experience. Overall, these results provide evidence that subsidizing angel investors through tax credits reduces the average quality of angel investments.

6.2. Volume by ex-ante quality

The preceding results show that angel tax credits increase the volume of angel investments, while decreasing their average quality. This implies that more capital flows to lower-quality firms. However, the amount of capital flowing to higher-quality startups is unclear. From the perspective of policymakers, capital allocation to high-quality startups is important because these firms are the main drivers of economic growth. The expected return for angel investments is also skewed due to the high failure rates among startups (DeGennaro and Dwyer (2014)). For example, the founder of Y Combinator, Paul Graham, argues that in each investment portfolio, "there is at most one company that will have a significant effect on our returns, and the rest are just a cost of doing business" (Graham (2012)). In fact, although Y Combinator has invested in thousands of companies with a combined market value around $10 billion, just two companies, Dropbox and Airbnb, account for three quarters of the total. In this subsection, we study how angel tax credits affect capital flows to startups of different quality.

We employ the same specification used in Panel A of Table 4, but split angel investment volume into investments in lower-quality startups and investments in higher-quality startups. This allows us to uncover where the marginal investments flow. Panel A of Table 8 splits angel investment volume based on the median values of firm financials in the year before investment. Columns 1 to 6 focus on high-quality startups, and columns 7 to 12 focus on low-quality startups. In columns 1, 2, 7, and 8, we define high-quality startups as those with above-median sales *and* above-median sales growth before investment, and low-quality startups as those with below-median sales *or* below-median sales growth before investment. Columns 3, 4, 9, and 10 define quality similarly using employment and employment growth. Alternatively, we split angel volume based on median pre-investment productivity (columns 5, 6, 11, and 12). Across all columns, we find that angel tax credit programs have almost no effect on the amount of capital allocated to high-quality firms, but the programs significantly increase the amount of capital allocated to lower-quality firms.

Panel B of Table 8 repeats the analysis by splitting angel investment volume based on median entrepreneurial experience. The sample is based on CVV data from 1985 to 2016. We find that the effect of angel tax credits on investments into firms with more experienced entrepreneurs is statistically insignificant and economically small. Instead, angel tax credits significantly increase investments flowing to firms with a lower fraction of serial entrepreneurs. Comparing these results with Table 4, we find that the magnitudes estimated on low-quality startups are similar to those estimated on overall angel volumes, suggesting that almost all of the additional investments induced by tax credits flow to lower-quality startups, while higher-quality startups do not receive additional investments. Government subsidies for angel investors through tax credits therefore appear to be ineffective in boosting high-quality entrepreneurship and may direct capital to low-quality startups.

7. Robustness and additional identification tests

7.1. Robustness

We examine the robustness of our main results to several different sample restrictions. First, we limit our sample to the period when there is better coverage of angel investments in our data set, which is from 2001 to 2016. In Panel A of Table A2, we find that the results are quite similar for the impact of angel tax credits on both the quantity and ex-ante quality of angel investments. Second, we drop sales and employment estimated by NETS. Panel B of Table A2 reports that the estimates are quantitatively similar, though the significance is slightly attenuated.

Third, there might be a concern that the Form D data capture investments by angels and other investors. We address this potential issue by separately estimating our specifications on the CVV sample and the Form D sample. Panel C of Table A2 provides the estimates for the CVV sample, while Panel D of Table A2 details the results for the Form D sample. We find strikingly similar results across estimates for the effect of angel tax credits on the quantity and ex-ante quality of angel investments. Fourth, to address the concern that VentureXpert and VentureSource tend to capture higher-quality angel-backed firms that eventually received institutional capital, Panel E of Table A2 shows that our main findings are robust to dropping angel investments from these two data sources. Fifth, since California and Massachusetts have the highest concentration of entrepreneurial activities in the country and neither state has an angel tax credit program during our sample period, a concern might be whether they represent appropriate control states. Panel F of Table A2 shows that our results remain highly similar if we drop these two states from our sample. Lastly, we show in Panel G of Table A2 that our results are robust to restricting to angel tax credit programs that exclude insider investors. Taken together, these findings provide extensive robustness of our main results and address potential concerns about the sample.

7.2. Additional identification tests

Our main results rely on a difference-in-differences strategy to identify the causal effect of angel investor tax credits on the quantity and quality of angel investments. Section 2 highlights that state economic, political, fiscal, and entrepreneurial conditions do not predict the implementation of these programs. The dynamic difference-in-differences results in Table 5 lend further support to the parallel trends assumption. In this section, we address additional identification concerns.

To address the potential issue about confounding local economic shocks, we augment our baseline specification in equation (1) with Census region fixed effects interacted with year fixed effects.[28] These time-varying geographic fixed effects absorb unobserved local economic shocks occurring within a Census region. Panel A of Table A3 in the appendix reports the estimates for the main results in Sections 5 and 6. Column 1 reproduces the estimates on quantity and columns 2 to 7 reestimate the quality effects. We continue to find that the number of angel investments increase, while the average quality of angel investments declines across all of our measures.

We further address concerns about local unobserved economic shocks by using neighboring states as a placebo group. Specifically, we expand our baseline specification by including *ATC Neighbor*, which is an indicator variable equaling one if a state has at least one neighboring state with an angel tax credit program. Panel B of Table A3 provides these estimates for the effects on the quantity and quality of angel investments. Our findings are similar to the baseline estimates reported in Tables 4 and 7. Additionally, the coefficients on *ATC Neighbor* are statistically indistinguishable from zero. This suggests that it is unlikely that local economic conditions drive our results since neighboring states tend to share similar economic conditions. Further, these results suggest that angel tax credit programs have limited spillover effects across state borders.

Next, since angel tax credit programs primarily target the high-tech sector, we use the non-high-tech sector as a placebo group. We estimate a triple-difference (DDD) model for a state-year-sector panel:

$$Volume_{sti} \text{ } or \text{ } Quality_{sti} = \alpha_{si} + \alpha_{ti} + \beta_1 \cdot ATC_{st} + \beta_2 \cdot ATC_{st} \cdot High\text{-}tech_i + \gamma' \cdot X_{st} + \varepsilon_{sti}, \quad (2)$$

[28] There are four Census regions in the United States. Additional details are available at: https://www.census.gov/programs-surveys/geography.html.

where *High-tech*$_i$ is an indicator variable equaling one if sector *i* is the high-tech sector, which we define as information technology, biotech, and renewable energies based on program requirements. We include state-sector fixed effects to absorb time-invariant state-sector heterogeneity. To capture temporal variation by sector, we also include year-sector fixed effects. The remaining variables are defined as in Section 4. Standard errors are clustered by state.

There are two benefits of using a DDD model. First, the non-high-tech sector serves as a counterfactual as to what would have happened in the high-tech sector in the absence of angel tax credits and accounts for unobserved local economic shocks. Second, this DDD specification allows us to additionally include state-year fixed effects to *eliminate* any remaining time-varying state-level confounders and compares the impact of angel tax credits across sectors *within the same state-year*. Specifically, we estimate an augmented version of equation (2):

$$Volume_{sti} \text{ or } Quality_{sti} = \alpha_{si} + \alpha_{ti} + \alpha_{st} + \beta \cdot ATC_{st} \cdot High\text{-}tech_i + \varepsilon_{sti}, \quad (3)$$

where α_{st} is state-year fixed effects, which absorb ATC_{st} and the state-year controls X_{st}.

Table A4 in the appendix presents the estimates for equations (2) and (3). Panel A examines the effect of angel investor tax credit programs on the quantity of angel investments, while Panels B and C study the effect of these programs on the quality of angel investments. We find that angel tax credits significantly increase the number of angel investments and decrease the quality of these investments in the high-tech sector relative to the non-high-tech sector. The magnitudes are similar to those estimated in Sections 5 and 6 using the difference-in-differences specification in equation (1). There is no impact of angel tax credits on the quantity and quality of angel investments in the non-high-tech sector, which is consistent with the eligibility criteria of most programs. Further, the null results for the non-high-tech sector suggest that our findings are not driven by unobserved state economic shocks or by unobserved trends in local entrepreneurship. Additionally, these findings suggest that angel tax credits induce the supply of new capital to the high-tech sector, rather than reallocating capital from the non-high-tech sector.

8. Angel tax credits and the post-investment performance of angel-backed firms

This section examines the effect of angel tax credits on startup performance following angel investments. While the findings in Section 6 indicate that angel tax credits flow to firms of worse quality, it could be that these firms benefit from the additional capital injection.

As detailed in Section 3.3, we construct three measures of post-investment performance based on startups' exit outcomes: (1) an indicator equal to one if a startup eventually achieves an IPO or a high-price M&A; (2) a generalized categorical measure of success that ranks exit outcomes in the following order: IPO or high-price M&A (value of 1), low-price M&A (value of 0.5), ongoing (value of 0), M&A with undisclosed price (value of −0.5), and shutdown or living dead (value of −1); and (3) an indicator equal to one if a startup raises capital in another round of funding after the angel round. We supplement these measures with data from NETS on post-investment sales, employment, sales and employment growths, and sales-to-employment ratio.

Panel A of Table 9 examines eventual exit outcomes for angel-backed firms. In column 1, we find that the likelihood of a right-tail exit outcome (an IPO or high-valued sale) declines by 4.4 percentage points during angel tax credit programs, which is a 27.5% drop relative to the sample mean. Column 2 reports that a 10-percentage-point increase in *Tax credit percentage* depresses the likelihood of a successful exit by 1.0 percentage points. Columns 3 and 4 broaden the definition of successful exit using the generalized categorical variable. We find that exit outcomes deteriorate by 17.0% relative to the sample mean and decline by 2.2% for a 10-percentage-point increase in *Tax credit percentage*. Columns 5 and 6 examine the probability of a next round of financing and, while the estimates are statistically insignificant, there is a positive relation between angel tax credits and follow-on financing. In sum, we find that exit outcomes deteriorate when angel investors are subsidized, especially in the right tail of the distribution.[29]

We then examine the post-investment performance of angel-backed firms using NETS. To address potential survivorship bias, we use a fixed window of five years after investment to measure performance, and set sales and employment to zero after a firm exits the sample. We separately examine performance in the short run (0 to 2 years after investment) and in the long run (3 to 5 years after investment). We average the performance measures within each of these two windows and construct a state-year panel. Panel B of Table 9 presents the results for performance in the two years after investment. We find that there is no significant change in any measure of performance. Since angel tax credits increase investment to ex-ante lower-quality firms, this suggests that these programs prop up startups in the short-run through additional capital injections. Panel C of Table 9 presents the results for performance in the three to five years following investment. We find that angel tax credits lead to lower long-run performance after angel investments. Therefore, despite a short-run propping-up from capital injections, these angel-backed firms eventually underperform.

Figure 3 provides further firm-level evidence on the dynamics of startup performance after angel investments. We use a firm-fixed effects model to estimate the effect of angel investor tax credits on firm performance from two years before to six years after investment:

[29] Figure A2 in the appendix compares the distributions of angel-backed firms' exit outcomes in state-years with an angel tax credit program to state-years without a program. Consistent with our regression estimates, we find that firms receiving angel financing during angel tax credit programs have worse exit outcomes than those receiving angel financing outside of these programs.

$$Performance_{ist} = \alpha_{st} + \alpha_i + \beta \cdot ATC_{st} \cdot \sum_{n=-2}^{6} Year\ relative\ to\ investment_{i,t+n}$$

$$+\delta \cdot \sum_{n=-2}^{6} Year\ relative\ to\ investment_{i,t+n} + \gamma' \cdot X_{st} + \varepsilon_{st}. \qquad (4)$$

This specification includes state-year fixed effects and firm fixed effects. We omit the year prior to investment as the base year. The sample includes only the first round of angel investments for each firm. We continue to set sales and employment to zero after a firm exits the sample to mitigate survivorship bias. Figure 3 plots the coefficients on $ATC_{st} \cdot \sum_{n=-2}^{6} Year\ relative\ to\ investment_{i,t+n}$ for the following three performance measures: sales, employment, and sales-to-employment ratio (productivity). We find that tax subsidies for early-stage investors lead to an increase in sales, employment, and productivity in the first three years after angel investments. However, performance quickly deteriorates and, by the fourth year, average firm performance reverts back to or is sometimes below pre-investment levels.

Taken together, these findings indicate that, while tax credits for angel investors lead to a short-run propping up of angel-backed firms, it does not improve startup performance in the long run.[30] While we cannot separate the post-investment treatment effect from initial deal selection, these results suggest that the additional angel capital does not alleviate the impact of lower ex-ante quality on ex-post performance.

9. Channels

In this section, we examine two non-mutually exclusive channels through which angel investor tax credits decrease the quality of angel investments. First, a limited supply of high-quality startups might drive additional angel capital to lower-quality startups (*supply channel*). Second, a

[30] In Appendix C, we also examine aggregate outcomes and find that angel tax credit programs have no effect on state-level entry, exit, or job creation of nascent firms.

fixed tax subsidy reduces investors' cost of capital, thereby reducing screening effort (*screening channel*). If tax credits induce entry by new investors with less experience, then average deal quality will decline.

If the results are exclusively driven by the supply channel, newly invested deals should be of higher quality than the pool of available, uninvested deals. To test this, we compare the performance of firms receiving angel tax credits (in-program firms) with the performance of firms that meet eligibility requirements but did not participate in angel tax credit programs (out-of-program firms). We collect the sample of in-program firms by submitting FOIA requests to state program offices. We are able to obtain the lists of participating firms for 18 out of the 31 states with angel tax credit programs. The data is at the firm level, which allows us to control for a startup's industry, age at angel investment, investment amount, and the year of angel investment. We include state-year fixed effects to compare in-program and out-of-program firms within the same state-year that angel tax credits are available.

Table 10 presents the results. In column 1, we find that firms receiving capital from subsidized investors are 7.3 percentage points more likely to fail than a firm receiving capital from non-subsidized investors. This estimate is economically large, corresponding to a 37.2% increase relative to the sample mean of 19.6%. Column 2 examines successful exit, which is defined as an IPO or high-price M&A. We find that the likelihood of a successful exit is 2.1 percentage points lower for in-program firms than for out-of-program firms. This suggests that our results are not solely driven by angel investors efficiently allocating capital to the next best deal. Instead, there are better investment opportunities available, yet subsidized angels are not financing these deals.

Next, we study the impact of angel tax credits on the composition of investors using AngelList data from 2000-2016.[31] This data set allows us to track individual angel investors and angel groups across startups and their financing rounds. It also provides information on the timing of investors' investments. Table 11 presents the effect of angel tax credits on the entry of first-time investors and the average investor experience. We estimate the difference-in-differences specification in equation (1) at the state-year level for the high-tech sector. In columns 1 and 2, the dependent variable is the natural logarithm of the number of first-time investors per deal. We find that the adoption of angel tax credits leads to a 10.0% increase in the number of first-time investors. Column 2 shows that a 10-percentage-point increase in *Tax credit percentage* increases the number of first-time investors by 3.5%. Column 3 reports that average investor experience, which is defined as the number of years between an investor's first investment and the current investment, declines during angel tax credit programs, though it is statistically insignificant. In column 4, we find that the average investor experience decreases by about five months for a 10-percentage-point increase in *Tax credit percentage*, which corresponds to a 6.2% decrease relative to the sample mean. To the extent that less experienced investors have worse deal access or are worse at screening startups, these results can explain our main findings.[32]

Lastly, the supply channel predicts that marginal new investments are of lower quality as investors allocate capital to the next best deals. However, the quality of investments that would happen even without subsidies should not change. In contrast, the screening channel predicts that both groups of investments might be of lower-quality due to lower investor effort. Section 6.1 shows that the sizable decline in average investment quality cannot be reconciled fully by the

[31] We find similar results if we restrict our sample to start in 2010 to mitigate a potential concern about backfilled data.

[32] In Table A5 of the appendix, we validate that startups whose investors are less experienced achieve worse exit outcomes.

additional increase in low-quality angel-backed firms. Instead, investment quality deteriorates across the entire distribution. Overall, while we cannot rule out the supply channel, we find evidence consistent with lower average screening by investors after the adoption of angel tax credit programs.

10. Conclusion

There has been considerable debate about how governments can support startups, particularly using investor incentives. States throughout the U.S. have implemented programs offering tax credits for angel investors. Yet there is currently no systematic evidence on the effectiveness of these policies. While some argue that tax credits are an effective tool for stimulating early-stage investments, others are skeptical about their impact on investor decisions and, subsequently, entrepreneurial outcomes. As governments around the world continue to adopt angel tax credits, understanding the effect of these interventions becomes increasingly important.

We find that angel tax credits significantly increase the number of angel investments and the average investment size. Though the quantity of angel investments increases, the average quality of these investments deteriorates. Additional angel capital flows to lower-quality startups, as measured by lower sales, employment, productivity, and less experienced entrepreneurs at the time of investment. Despite a short-run propping up from the additional capital injection, angel-backed firms have lower long-run performance when their investors are subsidized. These results are consistent with a lower cost of capital directing investors to lower-quality deals through reduced screening. We find that the adoption of tax credits leads to forgone better investment opportunities and the entry of new inexperienced investors. Our paper highlights the need for caution when designing governmental interventions.

Appendix A. Variable Definitions

Variable Name	Definition
ATC	Indicator variable equaling one if a state has am angel investor tax credit programs in that year.
Tax credit percentage	Continuous variable equal to the maximum tax credit available (percent) in a particular state-year when there is an angel investor tax program and set to zero if there is no program in place in a state-year.
Number of angel investments	Total number of financing rounds that include angel investors in a state-year. Source: CVV and Form D.
Average investment amount	Average amount raised in an angel-participated round in a state-year. Note that this is not specific to an investor. Source: CVV and Form D.
Age at investment	Firm age (in years) at the time of investment. Source: NETS.
Pre-investment sales	Firm sales in the year prior to receiving angel investment. Source: NETS.
Pre-investment employment	Number of employees in the year prior to receiving angel investment. Source: NETS.
Pre-investment sales growth	The percentage change in firm sales from year *t*-2 to *t*-1. Source: NETS.
Pre-investment employment growth	The percentage change in firm employment from year *t*-2 to *t*-1. Source: NETS.
Pre-investment sales/employment	Ratio of firm sales to employment in the year prior to receiving angel investment. Source: NETS.
Fraction of serial entrepreneurs	Fraction of founding team members that have prior entrepreneurship experience at the time of angel investment. Source: CVV.
Volume: high sales and sales growth	Number of angel investments in firms that have above-median sales and above-median sales growth in the year prior to receiving angel investment. Source: NETS.
Volume: low sales or sales growth	Number of angel investments in firms that have below-median sales or below-median sales growth in the year prior to receiving angel investment. Source: NETS.
Volume: high employment and employment growth	Number of angel investments in firms that have above-median employment and above-median employment growth in the year prior to receiving angel investment. Source: NETS.
Volume: low employment or employment growth	Number of angel investments in firms that have below-median employment or below-median employment growth in the year prior to receiving angel investment. Source: NETS.
Volume: high sales/employment	Number of angel investments in firms that have above-median sales-to-employment ratio in the year prior to receiving angel investment. Source: NETS.
Volume: low sales/employment	Number of angel investments in firms that have below-median sales-to-employment ratio in the year prior to receiving angel investment. Source: NETS.

Volume: high fraction of serial entrepreneurs	Number of angel investments in firms that have an above-median fraction of team members with prior entrepreneurship experience. Source: CVV.
Volume: low fraction of serial entrepreneurs	Number of angel investments in firms that have a below-median fraction of team members with prior entrepreneurship experience. Source: CVV.
Post-investment sales (year 0-5)	Average sales in the five years following angel investments. Sales is set to zero after a firm exits. Source: NETS.
Post-investment sales growth (year 0-5)	Average sales growth in the five years following angel investments. Source: NETS.
Post-investment employment (year 0-5)	Average employment in the five years following angel investments. Employment is set to zero after a firm exits. Source: NETS.
Post-investment employment growth (year 0-5)	Average employment growth in the five years following angel investments. Source: NETS.
Post-investment sales/employment (year 0-5)	Average sales/employment in the five years following angel investments. Source: NETS.
Successful exit	Indicator variable equaling one if a startup has an IPO or high-valued M&A, defined as the sale price being at least 1.25 times the total invested capital. Source: CVV.
Successful exit (generalized)	Categorical variable of success that ranks exit outcomes in the following order: IPO or high-price M&A (value of 1), low-price M&A (value of 0.5), ongoing (value of 0), M&A with undisclosed price (value of −0.5), and shutdown or living dead (value of −1). Source: CVV.
Has next round	Indicator variable equaling one if a startup raises a next round of financing, regardless of the type of financing. Source: CVV.
Number of first-time investors	The total number of first-time investors that invest in a state-year. Source: AngelList.
Average investment experience	The average number of years of investment experience for investors in a state-year. Investment experience is defined as the number of years between an investor’s first angel investment and the current investment. Source: AngelList.
GSP growth	Gross State Product (GSP) at the state-year level. Source: BEA.
Income per capita	Income per capita at the state-year level. Source: BEA.
Population	Population at the state-year level. Source: BEA.
Unemployment rate	State unemployment rate in a given year. Source: BEA.
Democratic control	Indicator variable for whether a state (both the legislative and executive branch) is controlled by Democrats. Source: NCSL.
Republication control	Indicator variable for whether a state (both the legislative and executive branch) is controlled by Republicans. Source: NCSL.
Revenue/GSP	Ratio of revenue to Gross State Product at the state-year level. Source: Annual Survey of State and Local Government Finances.

Expenditure/GSP	Ratio of expenditure to Gross State Product at the state-year level. Source: Annual Survey of State and Local Government Finances.
Debt/GSP	Ratio of debt to Gross State Product at the state-year level. Source: Annual Survey of State and Local Government Finances.
Has income tax	Indicator variable equal to one if a state has personal income tax in a given year. Source: NBER.
Max income tax rate	Maximum state personal income tax rate. Source: NBER.
Capital gains tax rate	State long-term capital gains tax rate. Source: NBER.
Neighbor ATC	Indicator variable equaling one if a state has a least one neighboring state with an active angel tax credit program.
Establishment entry rate	The number of new establishments relative to existing establishments in a given state-year. Establishments are defined as a single physical location where business is conducted. Source: BDS.
Establishment exit rate (age 0-5)	Rate of exit for firms younger than five years old. Firm exit identifies events where all of the establishments associated with a particular firm cease all operations. Note that M&A are not included as exits. Source: BDS.
Net job creation rate (age 0-5)	Job creation rate (age 0-5) minus job destruction rate (age 0-5). Source: BDS.
Venture capital volume	Natural logarithm of aggregate VC investment amount (in millions) in a state-year. Source: VentureXpert
Average investment experience (in years)	The average number of years of investment experience by angel investors in a state-year. Investment experience is the number of years between an investor's first investment and his/her current investment. Source: AngelList.
Number of first-time investors	The number of first-time angel investors investing in a state-year. Source: AngelList.
Program flexibility	An index ranging from 0 to 16 and is constructed based on the restrictions in Table 1. For each non-binary restriction, we rank programs from least to most strict and assign the highest rank to programs without this restriction. These rank values are then normalized to the unit interval by dividing all values by the maximum value. We also construct indicator variables for programs that do not exclude insider investors and for each of the non-refundable, non-transferable, and no carry forward restrictions. To form the Program flexibility index, we sum these 16 variables and then standardize the index by subtracting its mean and dividing by its standard deviation prior to interacting it with our treatment variables.
VC supply	State-year level aggregate venture capital investment amount (excluding angel and seed rounds identified in our main sample) scaled by the total number of young firms (of age 0-5) in that state-year. This variable is standardized by subtracting its mean and dividing by its standard deviation. Source: VentureXpert, BDS.

Appendix B. Identifying Angel Investments in CVV

In Crunchbase, we include round types identified as “pre-seed,” “seed,” “convertible note,” “angel,” or “equity crowdfunding,” in addition to rounds when the investor type is identified as “angel,” “micro,” “accelerator,” or “incubator.” In VentureXpert, we keep first rounds and rounds when the investment firm or fund type is identified as “individual,” “angel,” or “angel group.” In VentureSource, we incorporate round types identified as “seed,” “pre-seed,” “crowd,” “angel,” or “accelerator.”

For robustness, we also use a stricter definition of angel investments defined as follows:

1. All rounds in VentureXpert where the investment firm or fund type is identified as “individual,” “angel,” or “angel group.”
2. All rounds in VentureSource where the round type is identified as “seed,” “pre-seed,” or “angel.”
3. All rounds in Crunchbase where the round type is identified as “pre-seed,” “seed,” or “angel.”

Appendix C. Aggregate Effects of Angel Tax Credit Programs

In this appendix, we study the aggregate effects of angel tax credit programs. While our main analysis focuses on angel-backed startups, it is an open question whether there are spillover effects on firms that are not backed by angel capital. Though we find that tax subsidies support lower-quality angel-backed firms, these firms could still have a positive spillover effect on non-angel backed firms. A potential channel for this effect might be local agglomeration (Samila and Sorenson (2011) and Fehder and Hochberg (2019)). Additionally, it is important to examine the aggregate effect because this might be a primary concern for policymakers and their evaluation of a program's impact.

Our analysis uses three sets of state-level outcomes. First, we construct the total number of successful exits for startups in our CVV sample from 1985 to 2016, which we supplement with data on mergers and acquisitions from SDC Platinum. A successful exit is defined as a startup that has an IPO or a high-price M&A, which occurs when the deal price is more than 1.25 times the total invested capital. Notably, the firms in this data set are no longer conditioned on receiving angel capital. Second, we measure the entry and exit rates of young firms, which we define as those companies that were founded in the last five years, using the Census Business Dynamics Statistics (BDS) from 1985 to 2014. Lastly, we examine the job creation and destruction rate for young firms in BDS from 1985 to 2014.

To study the effect of angel investor tax credits on aggregate state-level outcomes, we estimate a difference-in-differences specification using equation (1). Panel A of Table A6 examines the total number of successful exits. Columns 1 and 2 report the estimates for angel investor tax credits. We do not find that these tax subsidies significantly affect the number of successful exits. Columns 3 and 4 provide the estimates for *Tax credit percentage*. We continue to find no evidence that successful exits are impacted by the size of the tax subsidy. This suggests that angel investor tax credit programs might not be effective in spurring high-impact startups.

Panel B in Table A6 evaluates the effect of angel-targeted tax credits on the entry, exit, job creation and job destruction rates for young firms. Columns 1 and 2 provide the estimates for entry rates. We find that tax subsidies for angel investors do not significantly impact entry rates. Additionally, there is no significant effect for the size of the tax credit. Columns 3 and 4 report the findings for exit rates of nascent firms. There is no significant change in exit rates for the duration of angel investor tax credit programs or for the size of the tax credit available. We also examine the effect of these programs on job creation rates (columns 5 and 6), job destruction rates (columns 7 and 8), and net job creation rates (column 9 and 10). Similar to the prior estimates in this table, we do not find that tax subsidies for angel investors or the size of the subsidy impact any of these job measures. In addition to the lack of statistical significance, the estimated economic magnitude for the *ATC* coefficient in each specification of Panel B is quite small, representing less than a 10-basis-point absolute change relative to the respective sample means.

Taken together, the aggregate results suggest that angel tax credit programs do not play a role in boosting state economic activity or promoting high-impact entrepreneurship. Across several measures of exit, business dynamism and employment rates, we do not find any aggregate change for the duration of these programs. Although we do not evaluate the net benefits, our findings highlight the need for caution when governments offer substantial tax breaks to early-stage investors due to their direct fiscal costs.

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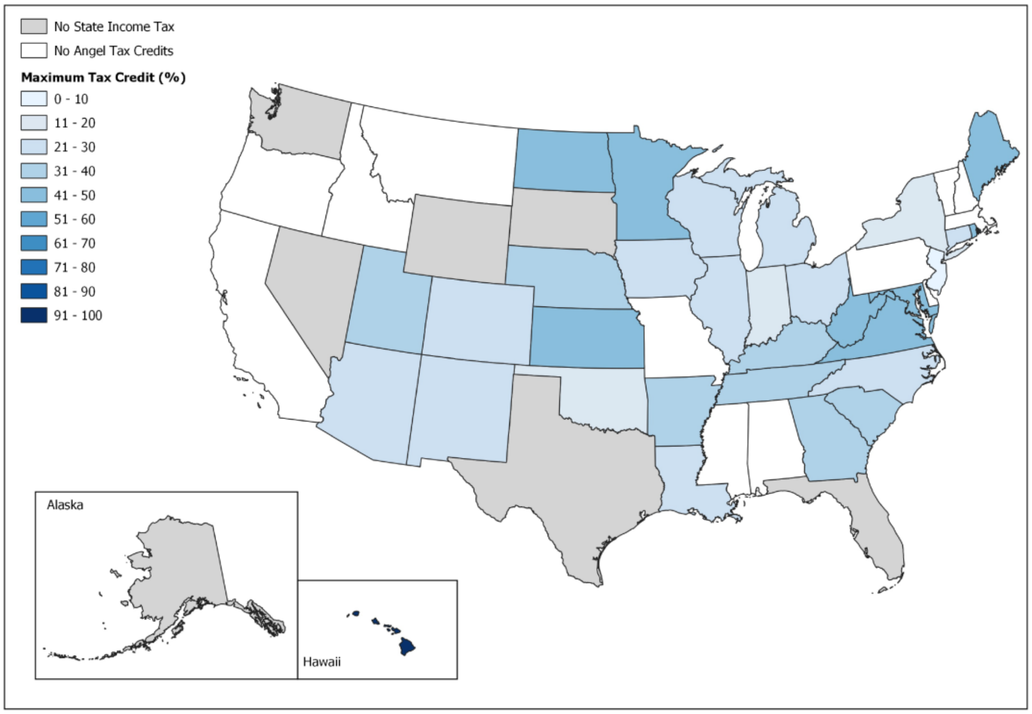
Figure 1. State Angel Tax Credit Programs

Panel A provides a map of states that have adopted angel tax credit programs from 1988 to 2018. The blue shading indicates the tax credit percentage, with darker shades representing larger tax credits. The grey shading denotes states with no state income tax. Panel B shows the introduction and termination of each program in our sample, starting with the earliest program and ending with the most recent one.

Panel A. States with Angel Tax Credit Programs



Panel B. Timing of State Angel Tax Credit Programs

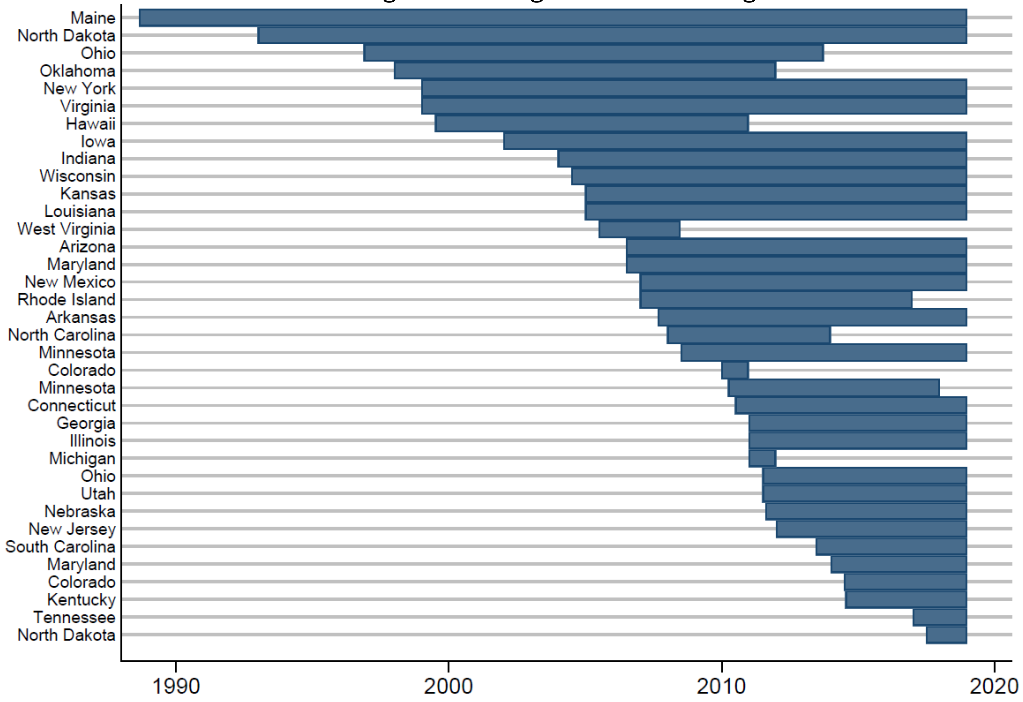


Figure 2. Effect of Angel Tax Credits on Angel Investment Volume

This figure plots the estimated effects of angel tax credits on state-level angel investment volumes in the high-tech sector for the years before and after the introduction of angel tax credit programs. Investment volumes are measured as the natural log of the number of angel investments. We estimate our baseline specification in equation (1) and replace the angel tax credit indicator with indicators identifying years <*t*−6, *t*−6 ..., *t*-2, *t*, *t*+1, ..., *t*+6, and >*t*+6 relative to the year a program is adopted. The year before program adoption is omitted as the base year. We plot the estimated coefficients in solid lines and the associated 95% confidence intervals in dashed lines. These estimates are also reported in column 2 of Table 5. Standard errors are clustered by state.

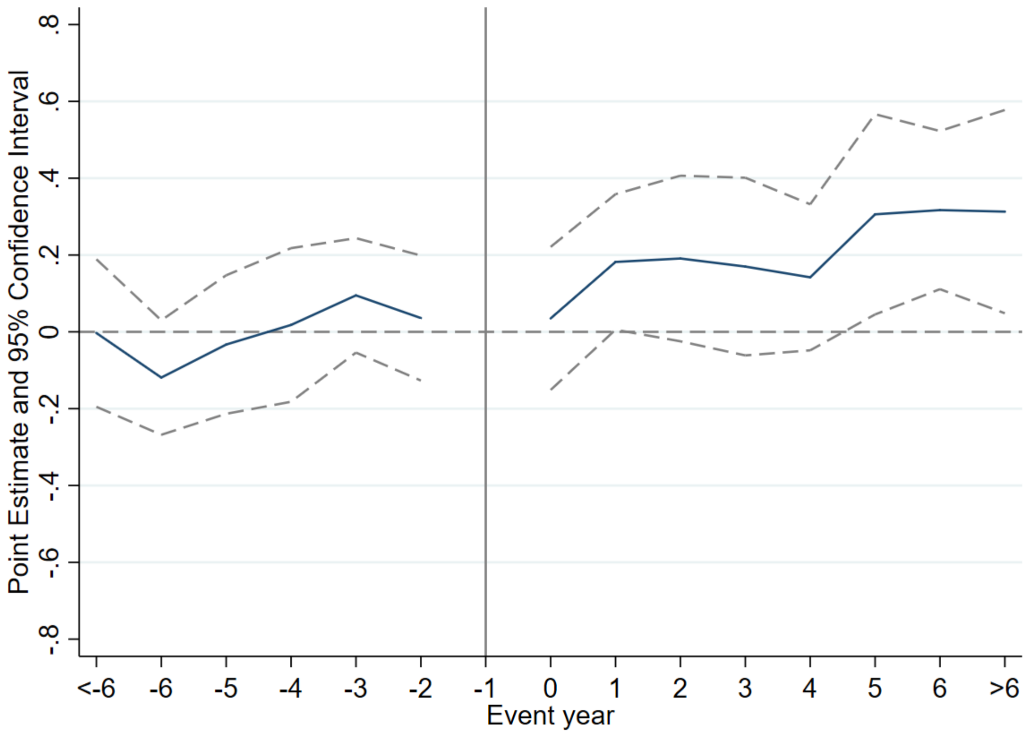


Figure 3. Angel Tax Credits and Within-Firm Changes in Performance around Investment

This figure shows the impact of angel tax credits on within-firm performance changes around angel investments. We estimate the firm fixed effects model in equation (4). The dependent variable is at the firm-year level and is one of three performance measures: natural logarithm of employment, natural logarithm of sales, and natural logarithm of sales-to-employment ratio (productivity). The independent variables are interactions of the ATC indicator with year indicators that identify years *t*−2, *t*, *t*+1, …, *t*+6 relative to the investment year *t*, with the year before investment (*t*-1) as the omitted base year. The lines show the estimated coefficients of these interaction terms associated with different performance measures.

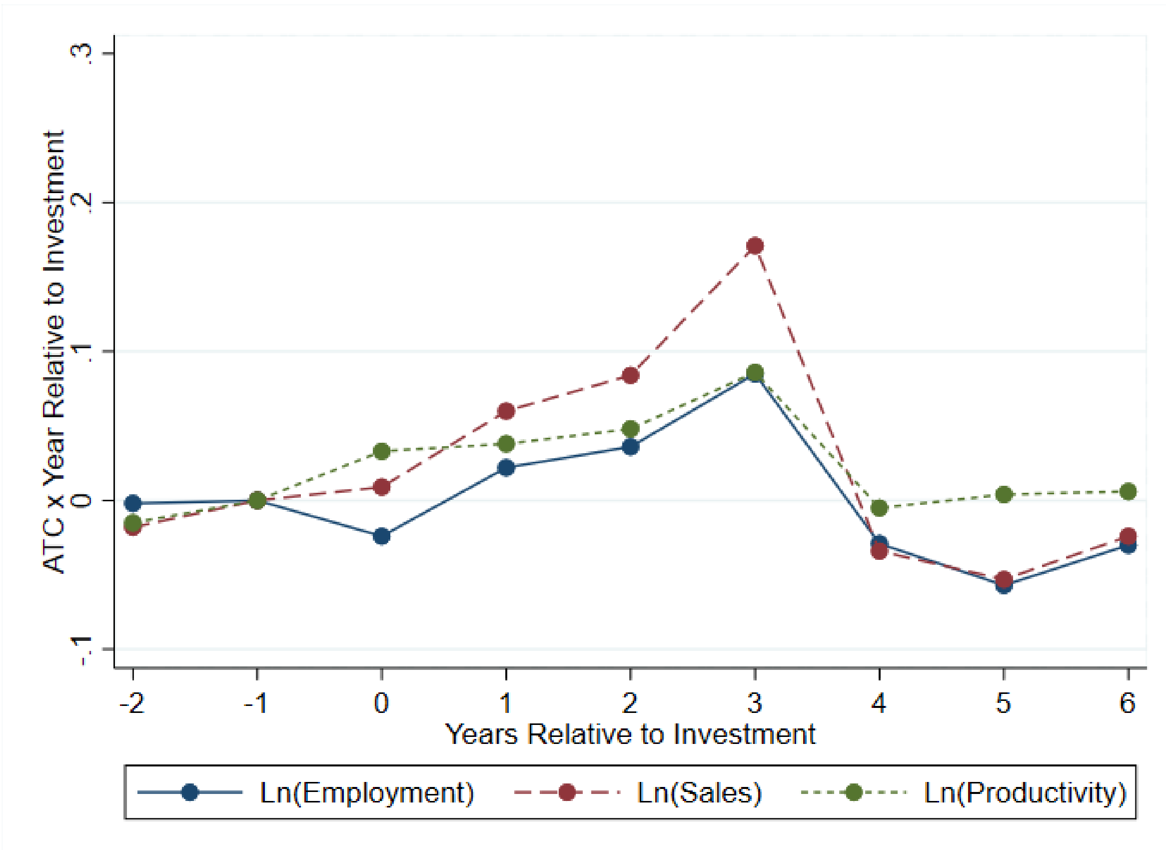


Table 1. Summary Statistics on Angel Tax Credit Programs

Table 1 presents the program parameters for the 36 angel tax credit programs in our sample. Column 1 reports the percentage of programs that have a particular restriction in place. Columns 2 and 3 report the mean and median values of the restriction.

	% with restriction	Mean	Median
Tax credit percentage		34%	33%
	Company restrictions		
Age cap	31%	7.1	6.0
Employment cap	39%	64.6	50.0
Revenue cap ($ million)	47%	5.4	5.0
Asset cap ($ million)	22%	11.5	7.5
Prior total external financing cap ($ million)	19%	5.7	4.0
	Investment and investor restrictions		
Minimum investment per investor ($)	36%	19,231	25,000
Minimum holding period	50%	3.2	3.0
Ownership cap before investment	64%	35%	30%
Exclude owners and their families	61%		
Exclude full-time employees	22%		
Exclude executives and officers	33%		
	Tax credit restrictions		
State tax credit allocation per year ($ million)	86%	9.0	5.0
Maximum tax credit per company per year ($ million)	42%	0.81	0.60
Maximum tax credit per investor per year ($ million)	78%	0.21	0.11
Non-refundable	72%		
No carry forward	11%		
Non-transferrable	72%		

Table 2. Predictive Regressions

This table examines whether a state's economic, political, fiscal, or entrepreneurial conditions predict the adoption of angel tax credit programs for the sample period 1985 to 2018. The dependent variable is an indicator equal to one (*ATC*) if a state has adopted an angel tax credit programs in that year (columns 1 to 4) or a continuous variable (*Tax credit percentage*) equal to the maximum tax credit percentage available in state-years with an angel tax credit program and zero otherwise (columns 5 to 8). State-years after a state adopts a program are excluded from the sample. All independent variables are lagged by one year relative to the dependent variable and are defined in detail in Appendix A. Each column includes year fixed effects, while the even-numbered columns also include state fixed effects. Standard errors are reported in parentheses and clustered by state. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

	ATC				Tax credit percentage			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
GSP growth	-0.051	0.056	-0.042	0.047	0.002	0.024	0.013	0.033
	(0.112)	(0.135)	(0.135)	(0.145)	(0.039)	(0.045)	(0.046)	(0.048)
Ln(Income per capita)	-0.003	0.013	-0.002	0.011	-0.000	-0.004	-0.002	-0.004
	(0.027)	(0.066)	(0.027)	(0.066)	(0.010)	(0.022)	(0.011)	(0.022)
Ln(Population)	0.000	-0.118	0.002	-0.126*	-0.001	-0.041	-0.001	-0.045
	(0.005)	(0.072)	(0.008)	(0.075)	(0.002)	(0.026)	(0.003)	(0.028)
Unemployment rate	-0.002	0.005	-0.001	0.006	-0.001	0.001	-0.001	0.001
	(0.003)	(0.005)	(0.003)	(0.005)	(0.001)	(0.002)	(0.001)	(0.002)
Democratic control	0.002	-0.008	0.001	-0.008	-0.001	-0.006	-0.001	-0.006
	(0.010)	(0.013)	(0.010)	(0.013)	(0.003)	(0.005)	(0.003)	(0.005)
Republican control	-0.009	-0.016	-0.009	-0.015	-0.003	-0.005	-0.003	-0.005
	(0.009)	(0.014)	(0.010)	(0.014)	(0.003)	(0.005)	(0.003)	(0.005)
Revenue/GSP	-0.133	-0.171	-0.129	-0.188	-0.049	-0.060	-0.040	-0.060
	(0.222)	(0.275)	(0.227)	(0.273)	(0.086)	(0.104)	(0.088)	(0.105)
Expenditure/GSP	0.131	-0.355	0.085	-0.273	0.064	-0.164	0.055	-0.140
	(0.276)	(0.440)	(0.281)	(0.461)	(0.098)	(0.151)	(0.099)	(0.158)
Debt/GSP	-0.023	0.480	-0.010	0.460	-0.028	0.132	-0.035	0.126
	(0.099)	(0.299)	(0.101)	(0.319)	(0.032)	(0.101)	(0.033)	(0.108)
Has income tax	0.032**	0.032	0.027	0.036	0.011**	0.006	0.009*	0.008
	(0.016)	(0.035)	(0.016)	(0.035)	(0.005)	(0.012)	(0.005)	(0.012)
Max income tax rate	-0.001	-0.016**	-0.001	-0.015**	-0.000	-0.005**	-0.000	-0.005*
	(0.003)	(0.007)	(0.003)	(0.007)	(0.001)	(0.002)	(0.001)	(0.003)
Capital gains tax	0.000	0.003	0.001	0.003	-0.000	0.001	-0.000	0.001
	(0.003)	(0.005)	(0.003)	(0.005)	(0.001)	(0.002)	(0.001)	(0.002)
Neighbor ATC	0.015	0.012	0.015	0.011	0.004	0.004	0.005	0.004
	(0.013)	(0.015)	(0.013)	(0.015)	(0.005)	(0.005)	(0.004)	(0.005)
Establishment entry rate			-0.016	0.329			0.019	0.112
			(0.227)	(0.345)			(0.079)	(0.112)
Establishment exit rate			-0.247	-0.292			-0.112	-0.083
			(0.224)	(0.385)			(0.083)	(0.144)
Net job creation rate			-0.034	-0.066			-0.062	-0.080
			(0.242)	(0.273)			(0.086)	(0.098)
Venture capital volume			-0.001	0.004			0.000	0.002
			(0.004)	(0.005)			(0.001)	(0.002)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	No	Yes	No	Yes	No	Yes	No	Yes
Observations	1343	1343	1343	1343	1343	1343	1343	1343
Adjusted R^2	0.022	0.038	0.02	0.036	0.017	0.04	0.015	0.039

Table 3. State-Year Level Summary Statistics

This table reports summary statistics for the samples used in our analyses. All angel investment-related variables are state-year averages based on angel investments in the high-tech sector (IT, biotech, and renewable energies). All variables are defined in detail in Appendix A.

Variable	N	Mean	Standard deviation	5th Pct.	50th Pct.	95th Pct.
			Treatment variables			
ATC	1,200	0.25	0.43	0.00	0.00	1.00
Tax credit percentage	1,200	0.09	0.18	0.00	0.00	0.50
			Volume			
Ln(Number of angel investments)	1,200	2.38	1.40	0.00	2.30	4.64
Ln(Average investment amount) in CVV	1,251	16.29	1.20	14.29	16.28	18.39
Ln(Average investment amount) in Form D	400	14.01	0.58	13.04	14.05	14.79
			Ex-ante quality			
Age at investment	1,200	5.40	2.67	1.78	5.00	10.25
Pre-investment ln(sales)	1,200	12.22	3.63	0.00	13.15	14.79
Pre-investment ln(employment)	1,200	2.06	0.87	0.00	2.09	3.30
Pre-investment sales growth	1,200	0.72	0.94	-1.00	0.67	2.12
Pre-investment employment growth	1,200	0.45	0.66	-1.00	0.45	1.35
Pre-investment ln(sales/employment)	1,200	10.20	2.97	0.00	11.09	11.70
Fraction of serial entrepreneurs on team	1,199	0.05	0.09	0.00	0.00	0.17
			Ex-post performance			
Post-investment sales growth (year 0-5)	881	0.23	0.34	-0.05	0.17	0.66
Post-investment employment growth (year 0-5)	881	0.16	0.20	-0.02	0.13	0.45
Post-investment ln(sales) (year 0-5)	881	13.60	1.02	12.01	13.60	15.13
Post-investment ln(employment) (year 0-5)	881	2.42	0.77	1.27	2.39	3.65
Post-investment ln(sales/employment) (year 0-5)	881	11.18	0.51	10.44	11.20	11.81
Successful exit	1,310	0.16	0.24	0.00	0.03	0.67
Successful exit (generalized)	1,310	-0.46	0.47	-1.00	-0.56	0.50
Has next round	1,310	0.18	0.21	0.00	0.14	0.50
			State-year level variables			
GSP growth	1,343	1.05	0.04	1.00	1.05	1.11
Ln(Income per capita)	1,343	10.12	0.41	9.46	10.12	10.78
Ln(Population)	1,343	15.03	1.04	13.33	15.16	16.73
Unemployment rate	1,343	5.75	1.90	3.14	5.41	9.38
Democratic control	1,343	0.24	0.43	0.00	0.00	1.00
Republican control	1,343	0.20	0.40	0.00	0.00	1.00
Revenue/GSP	1,343	0.13	0.04	0.09	0.12	0.19
Expenditure/GSP	1,343	0.12	0.03	0.08	0.11	0.18
Debt/GSP	1,343	0.07	0.04	0.02	0.06	0.15
Has income tax	1,343	0.77	0.42	0.00	1.00	1.00
Max income tax rate	1,343	4.90	3.30	0.00	5.51	9.86
Capital gains tax rate	1,343	4.40	3.07	0.00	4.77	9.00
Neighbor ATC	1,343	0.21	0.41	0.00	0.00	1.00
Establishment entry rate in %	1,343	0.12	0.02	0.09	0.12	0.16
Establishment exit rate in % (age 0-5)	1,343	0.10	0.02	0.08	0.10	0.13
Net job creation rate in % (age 0-5)	1,343	0.02	0.03	-0.03	0.02	0.06
Venture capital volume	1,343	3.95	2.41	0.00	4.10	7.72
			Investors			
Ln(Number of first-time investors)	850	1.29	1.24	0.00	1.10	3.66
Average investment experience (in years)	714	6.39	5.93	0.00	5.80	14.28

Table 4. Angel Tax Credits and Angel Investment Volume

Panel A reports the difference-in-differences estimates for the effect of angel tax credits on the quantity of angel investments in the high-tech sector. The sample period is 1993 to 2016. The dependent variable is the natural logarithm of the total number of angel investments in a state-year. *ATC* is an indicator equaling one if a state has an angel tax credit program in that year. *Tax credit percentage* is a continuous variable equal to the maximum tax credit parentage available in a state-year with an angel tax credit program. Panel B reports the effect of angel tax credit programs interacted with program flexibility. *Program flexibility* is an index ranging from 0 to 16 that measures the presence and strictness of the 16 program restrictions in Table 1. Higher values of the index represent more flexible programs. Panel C reports the effect of angel tax credit programs interacted with local supply of venture capital. *VC supply* is state-year-level aggregate VC investment amount (excluding angel and seed rounds identified in our main sample) scaled by the total number of young firms (of age 0 to 5) in that state-year from BDS. Both *Program flexibility* and *VC supply* are standardized by subtracting the sample mean and dividing by the standard deviation. Control variables are defined in equation (1). Each observation is a state-year. All specifications include state and year fixed effects. Standard errors are reported in parentheses and clustered by state. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Panel A. Baseline Results

	Ln(Number of angel investments)			
	(1)	(2)	(3)	(4)
ATC	0.161**	0.169**		
	(0.076)	(0.080)		
Tax credit percentage			0.546***	0.552***
			(0.178)	(0.179)
Controls	No	Yes	No	Yes
State FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	1,200	1,200	1,200	1,200
Adjusted R^2	0.925	0.925	0.926	0.926

Panel B. Interaction with Program Flexibility

	Ln(Number of angel investments)			
	(1)	(2)	(3)	(4)
ATC	0.147**	0.156**		
	(0.068)	(0.071)		
ATC × Program flexibility	0.120*	0.114*		
	(0.069)	(0.065)		
Tax credit percentage			0.401**	0.415***
			(0.150)	(0.147)
Tax credit percentage × Program flexibility			0.339***	0.329***
			(0.100)	(0.100)
Controls	No	Yes	No	Yes
State FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	1200	1200	1200	1200
Adjusted R^2	0.926	0.926	0.927	0.927

Panel C. Interaction with Venture Capital Supply

	Ln(Number of angel investments)			
	(1)	(2)	(3)	(4)
ATC	0.156**	0.161**		
	(0.067)	(0.070)		
ATC × VC supply	-0.154**	-0.148***		
	(0.061)	(0.054)		
Tax credit percentage			0.384**	0.393**
			(0.151)	(0.155)
Tax credit percentage × VC supply			-0.260***	-0.254***
			(0.068)	(0.068)
Controls	No	Yes	No	Yes
State FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	1,200	1,200	1,200	1,200
Adjusted R^2	0.926	0.926	0.927	0.927

Table 5. Angel Tax Credits and Angel Investment Volume: Dynamics

This table reports the dynamic effect of angel tax credit program adoption on the number of angel investments in the high-tech sector. The sample period is 1993 to 2016. We estimate our baseline regression (1) and replace the angel tax credit indicator with indicators that identify years <*t*-6, *t*–6, ..., *t*, *t*+1, ..., *t*+6, and >*t*+6 for states that adopt angel tax credit programs, where year *t* is the year of program adoption. State-years after an angel tax credit program expires are excluded from the sample. Control variables are defined in equation (1). Each observation is a state-year. All specifications include state and year fixed effects. Standard errors are reported in parentheses and clustered by state. ***, **, and * to denote significance at the 1%, 5%, and 10% level, respectively.

	Ln(Number of angel investments)	
	(1)	(2)
ATC(<*t*-6)	0.028	-0.003
	(0.099)	(0.098)
ATC(*t*-6)	-0.099	-0.119
	(0.076)	(0.076)
ATC(*t*-5)	-0.018	-0.033
	(0.093)	(0.092)
ATC(*t*-4)	0.034	0.018
	(0.103)	(0.102)
ATC(*t*-3)	0.100	0.095
	(0.076)	(0.076)
ATC(*t*-2)	0.039	0.036
	(0.081)	(0.083)
ATC(*t*)	0.037	0.035
	(0.092)	(0.095)
ATC(*t*+1)	0.184**	0.182**
	(0.088)	(0.090)
ATC(*t*+2)	0.196*	0.191*
	(0.106)	(0.110)
ATC(*t*+3)	0.169	0.170
	(0.112)	(0.118)
ATC(*t*+4)	0.135	0.142
	(0.097)	(0.097)
ATC(*t*+5)	0.297**	0.306**
	(0.127)	(0.133)
ATC(*t*+6)	0.301***	0.317***
	(0.101)	(0.105)
ATC(>*t*+6)	0.287**	0.313**
	(0.127)	(0.135)
Controls	No	Yes
State FE	Yes	Yes
Year FE	Yes	Yes
Observations	1,168	1,168
Adjusted R^2	0.925	0.926

Table 6. Angel Tax Credits and Angel Investment Size

This table reports the difference-in-differences estimates of the effect of angel tax credits on the average investment amount of angel investments in the high-tech sector. The dependent variable is the natural logarithm of the average size of angel rounds in a state-year. *ATC* is an indicator equaling one if a state has an angel tax credit program in that year. *Tax credit percentage* is a continuous variable equal to the maximum tax credit percentage available in a state-year with an angel tax credit program. Panel A reports the results estimated from the Form D sample. Since Form D filings only contain investment amounts starting in 2009, we begin our sample in this year. Panel B reports the results estimated from the full CVV sample from 1985 to 2016. Control variables are defined in equation (1). Each observation is a state-year. All specifications include state and year fixed effects. Standard errors are reported in parentheses and clustered by state. ***, **, and * to denote significance at the 1%, 5%, and 10% level, respectively.

Panel A: Form D

	Ln(Average investment amount)			
	(1)	(2)	(3)	(4)
ATC	0.157*	0.129*		
	(0.093)	(0.077)		
Tax credit percentage			0.427**	0.361**
			(0.182)	(0.150)
Controls	No	Yes	No	Yes
State FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	400	400	400	400
Adjusted R^2	0.187	0.215	0.187	0.215

Panel B. CVV

	Ln(Average investment amount)			
	(1)	(2)	(3)	(4)
ATC	0.242**	0.223**		
	(0.113)	(0.103)		
Tax credit percentage			0.472**	0.465**
			(0.232)	(0.217)
Controls	No	Yes	No	Yes
State FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	1,251	1,251	1,251	1,251
Adjusted R^2	0.207	0.217	0.205	0.216

Table 7. Ex-ante Quality of Angel Investments

This table reports the difference-in-differences estimates for the effect of angel tax credits on the ex-ante quality of angel investments in the high-tech sector. *ATC* is an indicator equaling one if a state has an angel tax credit program in that year. *Tax credit percentage* is a continuous variable equal to the maximum tax credit percentage available in a state-year with an angel tax credit program. Panel A reports the baseline specification (1) using the NETS-matched sample from 1993 to 2016. The dependent variables are the average natural logarithm of sales, sales growth, natural logarithm of employment, employment growth, and natural logarithm of sales-to-employment ratio (productivity) in the year before angel investment. Panel B reports the baseline specification (1) using the CVV sample from 1985 to 2016. The dependent variable is the state-year average fraction of serial entrepreneurs on the startup team. Each observation is a state-year. Control variables are defined in equation (1). All specifications include state and year fixed effects. Standard errors are reported in parentheses and clustered by state. ***, **, and * to denote significance at the 1%, 5%, and 10% level, respectively.

Panel A. Pre-investment Size, Growth, and Productivity

	Ln(Sales)		Sales growth		Ln(Employment)		Employment growth		Ln(Productivity)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
ATC	-0.538**		-0.187*		-0.133**		-0.126*		-0.413**	
	(0.238)		(0.103)		(0.066)		(0.064)		(0.188)	
Tax credit percentage		-1.389***		-0.186		-0.292**		-0.196		-1.114***
		(0.472)		(0.178)		(0.130)		(0.118)		(0.375)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200
Adjusted R^2	0.787	0.787	0.365	0.363	0.548	0.547	0.442	0.440	0.802	0.802

Panel B. Entrepreneur Experience

	Fraction of serial entrepreneurs on team	
	(1)	(2)
ATC	-0.013*	
	(0.008)	
Tax credit percentage		-0.038***
		(0.014)
Controls	Yes	Yes
State FE	Yes	Yes
Year FE	Yes	Yes
Observations	1,199	1,199
Adjusted R^2	0.152	0.152

Table 8. Angel Volume by Ex-ante Quality

This table reports the difference-in-differences estimates for the effect of angel tax credits on the quantity of angel investments in the high-tech sector split by pre-investment startup quality. *ATC* is an indicator equaling one if a state has an angel tax credit program in that year. *Tax credit percentage* is a continuous variable equal to the maximum tax credit percentage available in a state-year with an angel tax credit program. Panel A uses the NETS-matched sample from 1993 to 2016. The dependent variable in columns 1 and 2 (3 and 4) is the natural logarithm of the number of angel investments in firms that have above-median sales (employment) and above-median sales growth (employment) in the year before investment. The dependent variable in columns 7 and 8 (9 and 10) is the natural logarithm of the number of angel investments in firms that have below-median sales (employment) or below-median sales growth (employment) in the year before investment. Columns 5, 6, 11, and 12 split the number of angel investments by the median of sales-to-employment ratio in the year before investment. Panel B uses the CVV sample from 1985 to 2016. The columns split the number of angel investments by the median fraction of serial entrepreneurs on the founding team. Each observation is a state-year. Control variables are defined in equation (1). All specifications include state and year fixed effects. Standard errors are reported in parentheses and clustered by state. ***, **, and * to denote significance at the 1%, 5%, and 10% level, respectively.

Pane A. Angel Investment Volume by Pre-investment Size, Growth, and Productivity

	Volume: high sales and sales growth		Volume: high employment and employment growth		Volume: high sales/employment		Volume: low sales or sales growth		Volume: low employment or employment growth		Volume: low sales/employment	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
ATC	0.021		0.054		0.080		0.227***		0.189**		0.209***	
	(0.086)		(0.089)		(0.077)		(0.079)		(0.078)		(0.076)	
Tax credit percentage		0.044		0.166		0.263		0.721***		0.609***		0.583***
		(0.174)		(0.187)		(0.158)		(0.176)		(0.166)		(0.132)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	1,200	1,200	1,200	1200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200
Adj. R^2	0.853	0.853	0.841	0.841	0.873	0.873	0.897	0.898	0.901	0.902	0.872	0.873

Panel B. Angel Investment Volume by Entrepreneur Experience

	Volume: high fraction of serial entrepreneurs		Volume: low fraction of serial entrepreneurs	
	(1)	(2)	(3)	(4)
ATC	0.084		0.176*	
	(0.115)		(0.093)	
Tax credit percentage		0.100		0.372**
		(0.216)		(0.178)
Controls	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	1,600	1,600	1,600	1,600
Adjusted R^2	0.741	0.740	0.879	0.878

Table 9. Ex-post Outcomes of Angel-backed Firms

This table reports the difference-in-differences estimates for the effect of tax credits on ex-post startup performance in treated states relative to control states. *ATC* is an indicator equaling one if a state has an angel tax credit program in that year. *Tax credit percentage* is a continuous variable equal to the maximum tax credit percentage available in a state-year with an angel tax credit program. Panel A uses the CVV sample from 1985 to 2016 and focuses on three measures of exit outcomes: an indicator equal to one for an IPO and a high-price M&A; a categorical variable that takes the value of 1 for an IPO or a high-price M&A, value of 0.5 for low-price M&A, value of 0 for ongoing, value of −0.5 for M&A with undisclosed price, and a value of −1 for shutdown or living dead; an indicator variable for raising a next round of financing. Panels B and C use the NETS-matched sample from 1993 to 2016. We evaluate startup performance using the natural logarithm of sales, sales growth, natural logarithm of employment, employment growth, and natural logarithm of sales-to-employment ratio (productivity) averaged from 0 to 2 years and 3 to 5 years following investment in Panels B and C, respectively. Control variables are defined in equation (1). All specifications include state and year fixed effects. Standard errors are reported in parentheses and clustered by state. ***, **, and * to denote significance at the 1%, 5%, and 10% level, respectively.

Panel A. Exit Outcomes

	Successful exit		Successful exit (generalized)		Has next round	
	(1)	(2)	(3)	(4)	(5)	(6)
ATC	-0.044***		-0.078**		0.027	
	(0.015)		(0.030)		(0.025)	
Tax credit percentage		-0.095**		-0.221***		0.014
		(0.046)		(0.073)		(0.052)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,310	1,310	1,310	1,310	1,310	1,310
Adjusted R^2	0.281	0.281	0.332	0.333	0.059	0.058

Panel B: Average Performance in Years 0-2 After Investment

	Ln(Sales)		Sales growth		Ln(Employment)		Employment growth		Ln(Productivity)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
ATC	-0.073		0.028		-0.035		-0.007		-0.038	
	(0.145)		(0.043)		(0.085)		(0.031)		(0.086)	
Tax credit percentage		-0.370		0.072		-0.155		-0.015		-0.215
		(0.355)		(0.092)		(0.233)		(0.056)		(0.179)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	881	881	881	881	881	881	881	881	881	881
Adjusted R^2	0.084	0.085	0.048	0.048	0.188	0.188	0.085	0.085	0.005	0.006

Panel C: Average Performance in Years 3-5 After Investment

	Ln(Sales)		Sales growth		Ln(Employment)		Employment growth		Ln(Productivity)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
ATC	-0.509		-0.112*		-0.165		-0.078**		-0.344	
	(0.490)		(0.058)		(0.136)		(0.036)		(0.385)	
Tax credit percentage		-1.922*		-0.271**		-0.576*		-0.169*		-1.346*
		(0.969)		(0.123)		(0.290)		(0.085)		(0.776)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	791	791	783	783	791	791	783	783	791	791
Adjusted R^2	0.056	0.058	0.045	0.045	0.039	0.041	0.049	0.048	0.098	0.100

Table 10. Comparing In-program vs. Out-of-program Firms

This table compares firm-level outcomes for firms that received angel tax credits relative to firms that did not receive angel tax credits, though are likely eligible. We collect a sample of qualified businesses from 18 states through FOIA requests during the period 1985 to 2015. *In program* is an indicator equaling one if a firm has received investment through the program. We compare these firms to out-of-program firms (the control group) that are in the same state-investment-years, in the high-tech sector, are less than seven years old at the time of investment, and received less than $10 million in angel investments. Each observation is a firm. Firm-level controls include age at angel investment, investment amount, and the year of the first investment. All specifications include state-year fixed effects. Standard errors are reported in parentheses and clustered by state. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

	Shutdown	Successful exit
	(1)	(2)
In program	0.073*	-0.021**
	(0.035)	(0.008)
State × Year FE	Yes	Yes
Firm-level controls	Yes	Yes
Observations	3,543	3,543
Adjusted R^2	0.101	0.228

Table 11. Investor Entry

This table reports the difference-in-differences estimates for the effects of angel tax credits on the entry of new investors and average investor experience based on AngelList data. *ATC* is an indicator equaling one if a state has an angel tax credit program in that year. *Tax credit percentage* is a continuous variable equal to the maximum tax credit percentage available in a state-year with an angel tax credit program. The table reports the baseline specification in equation (1). The dependent variable in columns 1 and 2 is the natural logarithm of the number of first-time investors that invested in a state-year. The dependent variable in columns 3 and 4 is the average investment experience (in years) of investors in a given state-year, where investment experience is the number of years between an investors' first angel investment and the current investment. Each observation is a state-year. Control variables are defined in equation (1). The sample period is 2000 to 2016. All specifications include state and year fixed effects. Standard errors are reported in parentheses and clustered by state. ***, **, and * to denote significance at the 1%, 5%, and 10% level, respectively.

	Ln(Number of first-time investors)		Average investment experience (in years)	
	(1)	(2)	(3)	(4)
ATC	0.100**		-0.482	
	(0.045)		(0.670)	
Tax credit percentage		0.345***		-3.350***
		(0.116)		(1.068)
Controls	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	850	850	714	714
Adjusted R^2	0.853	0.854	0.374	0.378

Appendix Figures and Tables

Figure A1. Distributions of Ex-Ante Quality: State-Years with vs. without ATC

This figure compares the distributions of ex-ante quality of angel-backed firms in state-years with an angel tax credit program to state-years without a program, restricting to states that eventually had an angel tax credit program. All quality measures are measured in the year before angel investment. The solid lines (dotted lines) represent the estimated kernel density for firms that received angel investments in state-years with (without) an angel tax credit program.

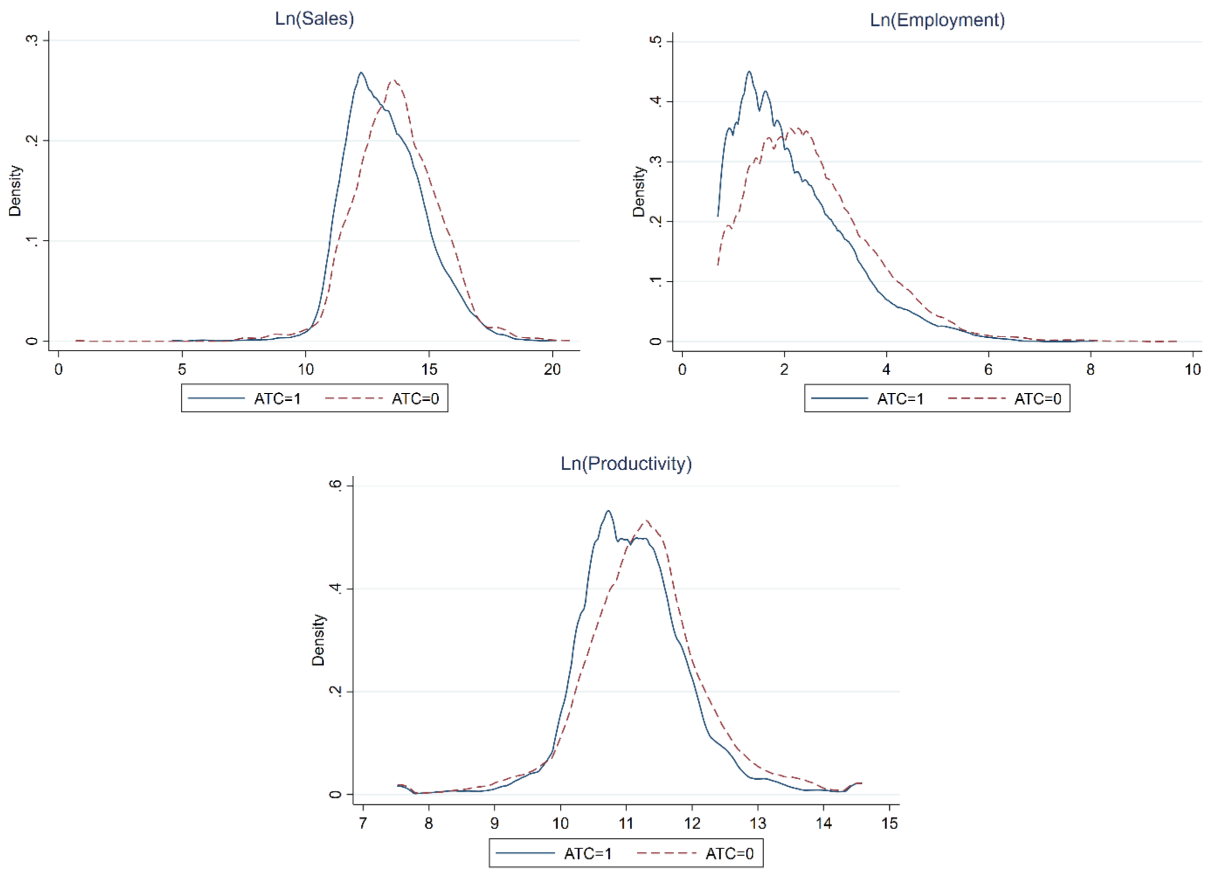
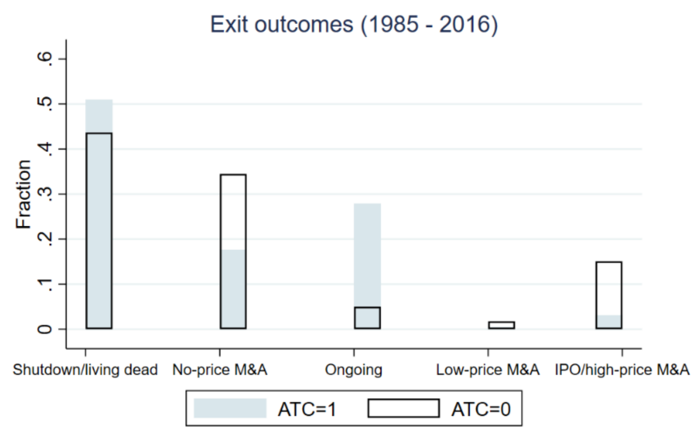


Figure A2. Distributions of Ex-Post Exit Outcome: State-Years with vs. without ATC

This figure compares the histograms of exit outcomes by angel-backed firms in state-years with an angel tax credit program to state-years without a program, restricting to states that eventually had an angel tax credit program. In both panels, the blue bars (empty bars) represent the fraction of angel-backed firms achieving each exit outcome by the end of 2018 and who received angel investments in state-years with (without) an angel tax credit program. The top panel focuses on angel-backed firms from 1985 to 2016, while the bottom panel focuses on angel-backed firms from 1985 to 2013.



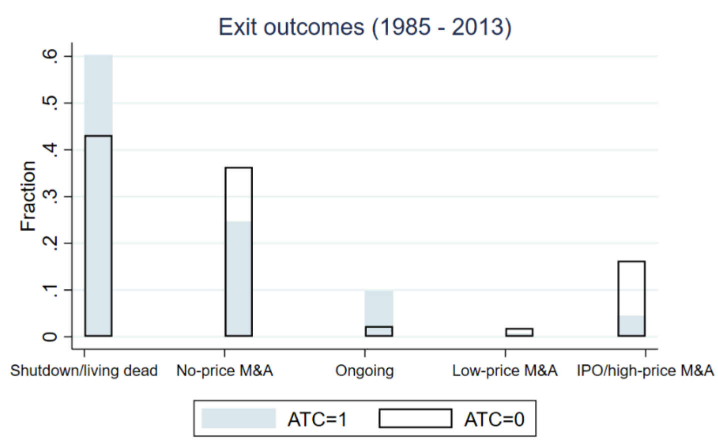


Table A1. Angel Tax Credit Programs

This table lists the angel tax credit programs in the U.S. from 1988 to 2018. For each program, it provides the state, program name, effective period and tax credit percentage. It also details program-level company, investment, investor and tax credit restrictions. We include the latest value for any restrictions that vary over a program's life. Additionally, we do not list state programs for direct investment or co-investment, in addition to support for investments in funds or universities.

				Company restrictions				
State	Program name	Effective period	Tax credit percentage	Age cap	Employment cap	Revenue cap ($ million)	Asset cap ($ million)	Prior external financing cap ($ million)
Arizona	Angel Investment Program	07/2006 - 06/2021	30% (35% for biotech or rural)				10	
Arkansas	Equity Investment Tax Credit Incentive Program	09/2007 - 12/2019	33.3%					
Colorado	Colorado Innovation Investment Tax Credit	01/2010 - 12/2010	15%	5		2	5	
Colorado	Advanced Industry Investment Tax Credit	07/2014 - 12/2022	25% (30% in rural area)	5		5		10
Connecticut	Angel Investor Tax Credit Program	07/2010 - 06/2019	25%	7	25	1		2
Delaware	Angel Investor Tax Credit	06/2018 - ongoing	25%	10	25			4
Georgia	Angel Investor Tax Credit	01/2011 - 12/2020	35%	3	20	0.5		1
Hawaii	Hawaii High Technology Business Investment Tax Credit	07/1999 - 12/2010	10% (1999-2001); 100% (2001- 04/2009); 80% (05/2009 - now)					
Illinois	Illinois Angel Investment Credit Program	01/2011 - 12/2021	25%	10	100			10
Indiana	Indiana Venture Capital Investment Tax Credit	12/2003 - 12/2020	20%					
Iowa	Angel Investor Tax Credit	01/2002 - ongoing	25%	6			10	
Kansas	Kansas Angel Investor Tax Credit	01/2005 - 12/2021	50%	5		5		
Kentucky	Angel Investment Tax Credit	07/2014 - ongoing	40% (50% in rural areas)		100		10	
Louisiana	Angel Investor Tax Credit	01/2005 - 06/2021	25%		50	10	2	
Maine	Seed Capital Tax Credit Program	09/1988 - ongoing	30% (before 2000); 40% (2000-2011); 60% (2012-2013); 50% (2014-now)			5		
Maryland	Cybersecurity Investment Tax Credit	01/2014 - 12/2018	33%		50			
Maryland	Maryland Biotechnology Investment Tax Credit	07/2006 - ongoing	50%	12	50			
Massachusetts	Angel Investor Tax Credit	01/2017 - ongoing	30% (20% for healthcare)		20	0.50		
Michigan	Angel Investment Incentive	01/2011 - 12/2011	25%					
Minnesota	Seed Capital investment Credit	07/2018 - ongoing	45%		10	0.15		
Minnesota	Angel Investment Tax Credit	04/2010 - 12/2017	25%	10	25			4
Nebraska	Angel Investment Tax Credit	08/2011 - 12/2022	35% (40% in rural areas)		25			
New Jersey	Angel Investor Tax Credit Program	01/2012 - ongoing	10%		225			
New Mexico	Angel Investment Tax Credit	01/2007 - 12/2024	25%		100	5		
New York	Qualified Emerging Technology Companies	01/1999 - ongoing	20% (if invest > 9 years); 10% (if invest 4 - 9 years)			10		
North Carolina	North Carolina Qualified Business Investment Tax Credit	01/2008 - 2013/12	25%					
North Dakota	Angel Investor Investment Credit	07/2017 - ongoing	35%			10		
North Dakota	North Dakota Seed Capital Investment Tax Credit	01/1993 - ongoing	45%					
Ohio	Invest Ohio	07/2011 - ongoing	10%			10	50	
Ohio	Ohio Technology Investment Tax Credit	11/1996 - 09/2013	25%			2.5	2.5	
Oklahoma	Oklahoma Small Business Capital Companies Tax Credit	01/1998 - 12/2011	20% (30% rural areas)					
Rhode Island	Rhode Island Innovation Tax Credit	01/2007 - 12/2016	50%			1		
South Carolina	Angel Investor Credit	06/2013 - 12/2019	35%	5	25	2		
Tennessee	Angel Tax Credit	01/2017 - ongoing	33% (50% in rural areas)					
Utah	Life Science and Technology Tax Credits	07/2011 - ongoing	35%				2.5	
Virginia	Virginia Qualified Equity and Subordinated Debt Investments Credit	01/1999 - ongoing	50%			3		3
West Virginia	High-Growth Business Investment Tax Credit	07/2005 - 06/2008	50%			20		
Wisconsin	Wisconsin Angel Investor Tax Credit	07/2004 - ongoing	25%	10	100			10

		Investment and investor restrictions						Tax credit restrictions					
State	Program name	Min. investment per investor ($)	Min. holding period (year)	Ownership cap before investment	Exclude owners and their families	Exclude full-time employees	Exclude executives or officers	State TC allocation ($ million)	Max tax credit per company ($)	Max tax credit per investor ($)	Refundable	Carry over	Transfer
Arizona	Angel Investment Program	25,000		30%	1			2.50	600,000		0	1	0
Arkansas	Equity Investment Tax Credit Incentive Program							6.25			0	1	1
Colorado	Colorado Innovation Investment Tax Credit	25,000		30%	1			0.75		20,000	0	1	0
Colorado	Advanced Industry Investment Tax Credit	10,000		30%	1			0.75		50,000	0	1	0
Connecticut	Angel Investor Tax Credit Program	25,000		50%	1			3.0		250,000	0	1	0
Delaware	Angel Investor Tax Credit	10,000	3	20%	1		1	5.0	500,000	125,000	1	1	0
Georgia	Angel Investor Tax Credit		2					5.0		50,000	0	1	0
Hawaii	Hawaii High Technology Business Investment Tax Credit		5							2,000,000	0	1	1
Illinois	Illinois Angel Investment Credit Program	10,000	3	50%				10.00	1,000,000	500,000	0	1	0
Indiana	Indiana Venture Capital Investment Tax Credit			50%	1			12.50	1,000,000		0	1	0
Iowa	Angel Investor Tax Credit			70%	1			2.00	500,000	100,000	1	1	0
Kansas	Kansas Angel Investor Tax Credit					1	1	6.0		250,000	0	1	1
Kentucky	Angel Investment Tax Credit	10,000		20%	1			3.0	1,000,000	200,000	0	1	1
Louisiana	Angel Investor Tax Credit		3	50%	1		1	3.6		180,000			1
Maine	Seed Capital Tax Credit Program		5	50%	1	1	1	5.0	1,500,000	150,000	1	1	0
Maryland	Cybersecurity Investment Tax Credit	25,000		25%				2.0		250,000	1	0	0
Maryland	Maryland Biotechnology Investment Tax Credit	25,000	2	25%				10.0		250,000	1	0	0
Massachusetts	Angel Investor Tax Credit			50%	1	1	1	25.0	37,500	50,000			
Michigan	Angel Investment Incentive	20,000					1	9.0	250,000	250,000			
Minnesota	Seed Capital investment Credit			50%	1	1	1			112,500	0	1	0
Minnesota	Angel Investment Tax Credit	10,000	3	20%	1		1	15.0	1,000,000	125,000	1	1	0
Nebraska	Angel Investment Tax Credit	25,000	3	50%	1	1	1	3.6	1,000,000	300,000	1	0	0
New Jersey	Angel Investor Tax Credit Program		2	80%	1			25.0			1	1	0
New Mexico	Angel Investment Tax Credit					1	1	2.0	25,000	62,500	0	1	0
New York	Qualified Emerging Technology Companies		6	10%	1					150,000	0	1	1
North Carolina	North Carolina Qualified Business Investment Tax Credit		3	10%	1	1	1	7.5		50,000		1	0
North Dakota	Angel Investor Investment Credit				1	1	1			45,000	0	1	0
North Dakota	North Dakota Seed Capital Investment Tax Credit		3	50%	1			3.5	225,000	112,500	0	1	0
Ohio	Invest Ohio		2					50.0			0	1	0
Ohio	Ohio Technology Investment Tax Credit		3	5%	1			45.0	375,000	62,500	0	1	0
Oklahoma	Oklahoma Small Business Capital Companies Tax Credit								100,000		0	1	0
Rhode Island	Rhode Island Innovation Tax Credit							0.5		100,000	0	1	0
South Carolina	Angel Investor Credit							5.0		100,000	0	1	1
Tennessee	Angel Tax Credit	15,000						4.0		50,000	0	1	0
Utah	Life Science and Technology Tax Credits	25,000	1	30%	1			1.3			0	0	1
Virginia	Virginia Qualified Equity and Subordinated Debt Investments Credit		3		1	1	1	5.0		50,000	0	1	0
West Virginia	High-Growth Business Investment Tax Credit		5	5%	1		1	1.0	500,000	50,000	0	1	0
Wisconsin	Wisconsin Angel Investor Tax Credit		3	20%	1			30.0	3,000,000		0	1	1

Table A2. Robustness Tests

Panel A repeats the main analysis in Panel A of Table 4 and Table 7, restricting to the sample period of 2001 to 2016. Panel B repeats our main analysis, dropping estimated sales and employment values in NETS. Panel C (Panel D) repeats our main analysis, restricting to angel investments from the CVV sample (Form D sample) only. Panel E repeats the main analysis, dropping angel investments from VentureXpert and VentureSource and keeping only those in Crunchbase and Form D. Panel F repeats our main analysis excluding California and Massachusetts. Panel G repeats our main analysis restricting to programs that exclude insider investors (owners, executive, or employees). *ATC* is an indicator equaling one if a state has an angel tax credit program in that year. *Tax credit percentage* is a continuous variable equal to the maximum tax credit percentage available in a state-year with an angel tax credit program. The dependent variables are the average natural logarithm of sales, sales growth, natural logarithm of employment, employment growth, and natural logarithm of sales-to-employment ratio (productivity) in the year before angel investment. Each observation is a state-year. Control variables are defined in equation (1). All specifications include state and year fixed effects. Standard errors are reported in parentheses and clustered by state. ***, **, and * to denote significance at the 1%, 5%, and 10% level, respectively.

Panel A. Post-2000 Sample

	Ln(Number of angel investments)	Ln(Sales)	Ln(Employment)	Sales growth	Employment growth	Ln(Productivity)	Fraction of serial entrepreneurs
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
ATC	0.158**	-0.634**	-0.149***	-0.267***	-0.213***	-0.487**	-0.016*
	(0.076)	(0.257)	(0.049)	(0.078)	(0.057)	(0.221)	(0.009)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	800	800	800	800	800	800	672
Adjusted R^2	0.927	0.814	0.645	0.523	0.561	0.822	0.148

Panel B: Dropping Estimated Values in NETS

	Ln(Sales)		Sales growth		Ln(Employment)		Employment growth		Ln(Productivity)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
ATC	-0.444		-0.259*		-0.202**		-0.125*		-0.353*	
	(0.467)		(0.134)		(0.094)		(0.075)		(0.193)	
Tax credit percentage		-0.330		-0.423		-0.517***		-0.225*		-1.072**
		(1.132)		(0.264)		(0.183)		(0.128)		(0.411)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200
Adjusted R^2	0.296	0.296	0.168	0.166	0.551	0.551	0.426	0.425	0.727	0.727

Panel C. CVV Sample

	Ln(Number of angel investments) (1)	Ln(Sales) (2)	Ln(Employment) (3)	Sales growth (4)	Employment growth (5)	Ln(Productivity) (6)
ATC	0.141**	-0.408*	-0.201**	-0.157*	-0.132**	-0.451**
	(0.070)	(0.245)	(0.079)	(0.094)	(0.066)	(0.205)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,200	1,200	1,200	1,200	1,200	1,200
Adjusted R^2	0.889	0.632	0.380	0.239	0.294	0.640

Panel D: Form D Sample

	Ln(Number of angel investments) (1)	Ln(Sales) (2)	Ln(Employment) (3)	Sales growth (4)	Employment growth (5)	Ln(Productivity) (6)
ATC	0.181**	-0.643**	-0.138**	-0.179*	-0.116*	-0.510**
	(0.072)	(0.296)	(0.069)	(0.103)	(0.065)	(0.249)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,200	1,200	1,200	1,200	1,200	1,200
Adjusted R^2	0.904	0.730	0.454	0.268	0.344	0.749

Panel E: Dropping VentureXpert and VentureSource Deals

	Ln(Number of angel investments) (1)	Ln(Sales) (2)	Ln(Employment) (3)	Sales growth (4)	Employment growth (5)	Ln(Productivity) (6)
ATC	0.170**	-0.562**	-0.131*	-0.186*	-0.127*	-0.441*
	(0.083)	(0.271)	(0.069)	(0.095)	(0.065)	(0.220)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,200	1,200	1,200	1,200	1,200	1,200
Adjusted R^2	0.908	0.744	0.479	0.285	0.350	0.762

Panel F. Dropping California and Massachusetts

	Ln(Number of angel investments) (1)	Ln(Sales) (2)	Ln(Employment) (3)	Sales growth (4)	Employment growth (5)	Ln(Productivity) (6)	Fraction of serial entrepreneurs (7)
ATC	0.169**	-0.556**	-0.140**	-0.190*	-0.133*	-0.426**	-0.014*
	(0.083)	(0.246)	(0.068)	(0.104)	(0.066)	(0.195)	(0.008)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,152	1,152	1,152	1,152	1,152	1,152	1,135
Adjusted R^2	0.905	0.778	0.534	0.353	0.429	0.794	0.145

Panel G. Restricting to Programs Excluding Insider Investors

	Ln(Number of angel investments) (1)	Ln(Sales) (2)	Ln(Employment) (3)	Sales growth (4)	Employment growth (5)	Ln(Productivity) (6)	Fraction of serial entrepreneurs (7)
ATC	0.190**	-0.539*	-0.154*	-0.277*	-0.183*	-0.388*	-0.015*
	(0.082)	(0.287)	(0.090)	(0.146)	(0.095)	(0.217)	(0.009)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	984	984	984	984	984	984	978
Adjusted R^2	0.934	0.768	0.551	0.355	0.421	0.781	0.162

Table A3. Controlling for Geographic Effects

This table reports the results for baseline specification (1) while controlling for geographic effects. The dependent variables are measures of the quantity and quality of angel investments at the state-year level: natural logarithm of the total number of angel investments, the average pre-investment natural logarithm of sales, sales growth, natural logarithm of employment, employment growth, and natural logarithm of sales-to-employment ratio, and the average fraction of serial entrepreneurs on the team. In Panel A, we augment the baseline specification (1) by replacing year fixed effects with year interacted with Census-region fixed effects. In Panel B, *ATC Neighbor* is an indicator equal to one if a state has not adopted angel tax credits in a year but at least one neighboring state has. Control variables are defined in equation (1). Standard errors are reported in parentheses and clustered by state. ***, **, and * denotes significance at the 1%, 5%, and 10% level, respectively.

Panel A. Controlling for Census Region × Year Fixed Effects

	Ln(Number of angel investments) (1)	Ln(Sales) (2)	Ln(Employment) (3)	Sales growth (4)	Employment growth (5)	Ln(Productivity) (6)	Fraction of serial entrepreneurs (7)
ATC	0.136*	-0.644**	-0.185**	-0.210**	-0.147**	-0.468**	-0.014*
	(0.072)	(0.254)	(0.079)	(0.104)	(0.065)	(0.197)	(0.008)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Census region × Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,200	1,200	1,200	1,200	1,200	1,200	1,199
Adjusted R^2	0.926	0.774	0.539	0.350	0.425	0.789	0.146

Panel B. Controlling for ATC in Neighboring States

	Ln(Number of angel investments) (1)	Ln(Sales) (2)	Ln(Employment) (3)	Sales growth (4)	Employment growth (5)	Ln(Productivity) (6)	Fraction of serial entrepreneurs (7)
ATC	0.169**	-0.534**	-0.132**	-0.187*	-0.126*	-0.410**	-0.013*
	(0.080)	(0.237)	(0.066)	(0.104)	(0.065)	(0.188)	(0.008)
ATC Neighbor	-0.040	-0.185	-0.021	0.004	-0.035	-0.178	-0.003
	(0.047)	(0.206)	(0.082)	(0.098)	(0.059)	(0.152)	(0.008)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,200	1,200	1,200	1,200	1,200	1,200	1,199
Adjusted R^2	0.925	0.787	0.547	0.365	0.442	0.802	0.151

Table A4. Triple-Difference

This table provides the estimates from a triple-difference (DDD) specification as described in equations (2) and (3). *ATC* is an indicator equaling one if a state has an angel investor tax credit program in that year. *High-tech* is an indicator variable equaling one if the startup is in the high-tech sector (IT, biotech, and renewable energies). The dependent variable in Panel A is the natural logarithm of the number of angel investments. In Panel B, we estimate the triple-difference model with the dependent variable being measures of startup quality at the time of investment. Lastly, in Panel C, we focus on eventual exit outcomes using the CVV sample from 1985 to 2016. The sample consists of state-year averages for the high-tech sector and state-year averages for the non-high-tech sector. Each observation is a state-sector-year. Control variables are defined in equation (1). Standard errors are reported in parentheses and clustered by state. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Panel A. Volume

	Ln(Number of angel investments)	
	(1)	(2)
ATC	-0.014	
	(0.049)	
ATC × High-tech	0.184***	0.184***
	(0.060)	(0.060)
Controls	Yes	No
State × High-tech FE	Yes	Yes
Year × High-tech FE	Yes	Yes
State × Year fixed effects	No	Yes
Observations	2,400	2,400
Adjusted R^2	0.926	0.937

Panel B. Ex-ante Quality

	Ln(Sales)		Ln(Employment)		Sales growth		Employment growth		Ln(Productivity)		Fraction of serial entrepreneurs	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
ATC	-0.006		0.022		0.016		-0.002		-0.039		0.004	
	(0.130)		(0.039)		(0.039)		(0.030)		(0.105)		(0.010)	
ATC × High-tech	-0.581**	-0.581**	-0.170**	-0.170**	-0.199*	-0.199*	-0.128*	-0.128*	-0.409**	-0.409**	-0.021*	-0.019*
	(0.236)	(0.235)	(0.076)	(0.076)	(0.113)	(0.113)	(0.074)	(0.073)	(0.180)	(0.180)	(0.011)	(0.010)
Controls	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
State × High-tech FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year × High-tech FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State × Year FE	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Observations	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,380	2,380
Adjusted R^2	0.831	0.828	0.574	0.587	0.4	0.375	0.484	0.465	0.848	0.841	0.179	0.132

Panel C. Eventual Exit Outcomes

	Successful exit		Successful exit (generalized)		Has next round	
	(1)	(2)	(3)	(4)	(5)	(6)
ATC	0.010		0.028		-0.005	
	(0.011)		(0.024)		(0.018)	
ATC × High-tech	-0.048**	-0.048**	-0.094**	-0.094**	0.027	0.027
	(0.020)	(0.020)	(0.044)	(0.044)	(0.024)	(0.024)
Controls	Yes	No	Yes	No	Yes	No
State × High-tech FE	Yes	Yes	Yes	Yes	Yes	Yes
Year × High-tech FE	Yes	Yes	Yes	Yes	Yes	Yes
State × Year FE	No	Yes	No	Yes	No	Yes
Observations	2432	2432	2432	2432	2432	2432
Adjusted R^2	0.277	0.260	0.329	0.332	0.162	0.132

Table A5. Investor Experience and Exit Outcome

This table presents the relationship between investor experience and startup exit outcome using AngelList data. The dependent variable *Exit* is a dummy equal to one if a startup eventually achieves exit though IPO or M&A. *Investor experience* is the average investment experience of a startup's angel investors, where investment experience is the number of years between an investor's first investment on AngelList and the current investment. *High-tech* is an indicator variable equaling one if the startup is in the high-tech sector (IT, biotech, and renewable energies).The sample is at the startup level. Column 1 includes all startups on AngelList. Column 2 (3) restricts to startups in the high-tech (non-high-tech) sector. Control variables are defined in equation (1). All columns include state fixed effects and year fixed effects. Standard errors are reported in parentheses and clustered by state. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

	Exit	Exit	Exit
	(1)	(2)	(3)
Investor experience	0.003***	0.004***	0.003***
	(0.001)	(0.001)	(0.001)
High-tech	0.044***		
	(0.009)		
Sample	All firms	High-tech	Non-high-tech
State FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Observations	27,576	16,492	10,904
Adjusted R^2	0.062	0.073	0.034

Table A6. Aggregate Effects of Angel Tax Credits

This table reports the difference-in-differences estimates of the aggregate effects of angel tax credits using baseline specification (1). In Panel A, the dependent variable is the total number of successful exits in a state-year based on angel-invested startups in the CVV sample from 1985 to 2016. A successful exit is defined as a startup that has an IPO or high-price M&A, which occurs when the deal price is more than 1.25 times the total invested capital. In Panel B, the dependent variables are the entry rate, exit rate, job creation rate, job destruction rate, and net job creation rate for young firms (age 0 to 5) from the Census Business Dynamics Statistics (BDS) from 1985 to 2014. Each observation is a state-year. Control variables are defined in equation (1). All specifications include state and year fixed effects. Standard errors are reported in parentheses and clustered by state. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Panel A. Number of Successful Exits

	Ln(Number of successful exits)	
	(1)	(2)
ATC	-0.068	
	(0.056)	
Tax credit percentage		-0.145
		(0.131)
Controls	Yes	Yes
State FE	Yes	Yes
Year FE	Yes	Yes
Observations	1,600	1,600
Adjusted R^2	0.746	0.746

Panel B. Entry, Exit, Job Creation, and Job Destruction Rates

	Entry rate		Exit rate among (age 0 to 5)		Job creation rate (age 0 to 5)		Job destruction rate (age 0 to 5)		Net job creation rate (age 0 to 5)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
ATC	0.000		-0.026		0.190		0.089		0.101	
	(0.109)		(0.139)		(0.301)		(0.277)		(0.432)	
Tax credit percentage		-0.144		0.045		1.203		0.321		0.882
		(0.265)		(0.282)		(0.956)		(0.576)		(1.086)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500
Adjusted R^2	0.874	0.875	0.558	0.558	0.572	0.573	0.417	0.417	0.455	0.455