Angels, Entrepreneurship, and Employment Dynamics: Evidence from Investor Accreditation Rules

Laura Lindsey
W. P. Carey School of Business
Arizona State University

Luke C.D. Stein*
W. P. Carey School of Business
Arizona State University

September 2018

Abstract

This paper examines the effects of a shock to angel finance on entrepreneurial activity and employment. Using public micro data from the U.S. Census, we construct a state-level estimate of the fraction of accredited investors likely affected by Dodd-Frank's elimination of housing wealth in the determination of accreditation status. We demonstrate that a larger reduction in the pool of potential accredited investors negatively affects firm entry and reduces employment levels at small entrants. Employment increases at small and young incumbents as workers are absorbed, and relative wages for the startup sector decline. Angel finance appears to be a complement to organized venture capital and of greater importance in less concentrated and lower startup-capital-intensive industries. Our paper quantifies the impact of angel finance at the margin and offers insight on the geographies and sectors where it matters most.

*Department of Finance, P.O. Box 873906, Tempe AZ 85287; laura.lindsey@asu.edu and luke.stein@asu.edu.
We are grateful for comments from Tania Babina, Allen Berger, Stefano Bonini, Jessica Jeffers, Shane Johnson, Ramana Nanda, Berk Sensoy, and participants in several conferences and seminars. We thank Andra Ghent for extensive advice and Hong Zhao for valuable research assistance.

1 Introduction

Access to capital has long been recognized as crucial to the entrepreneurial process of creative destruction (Schumpeter, 1911, 1942). While organized financial intermediaries such as banks and venture capital firms play an important role, much of the capital supplied to new firms takes place through the informal channel of direct investment from individuals, often termed angel finance. Puri and Zarutskie (2012), for example, estimate that fewer than 0.2% of new companies raise venture capital, and bank lending often requires collateral or personal credit that is infeasible for many types of businesses or entrepreneurs. Survey evidence indicates that the U.S. angel market totaled over $24 Billion in 2014, and angel markets around the world have been growing rapidly (Sohl, 2014).

Relatively little is known about angel investing empirically, however. Many transactions require no disclosure, and enforcement for those requiring disclosure has been lax. Of transactions reported to the SEC, 99% of investment takes place through Rule 506 of Regulation D, which allows a company to issue securities to an unlimited number of accredited investors and a limited number of other purchasers, with a similarly high percentage even when the amounts raised would allow for use of other provisions. Approximately 90% of reported offerings are limited to accredited investors, meaning investors meet designated wealth or income thresholds. (Bauguess, Gullapalli, and Ivanov, 2015).[1] In this paper, we exploit a rule change in 2010 that differentially impacts eligibility for accredited investors across geographies in order to assess the importance of angel capital for the entrepreneurial sector. We show that the availability of angel capital bears a causal relation to firm entry that is driven by

[1]Shane (2009) estimates that about half of funds deployed in the angel market come from investors meeting accreditation standards and that accreditation status likely gives investors access to better investment opportunities.

smaller firms. The availability of other forms of finance do not reduce effects, suggesting complementarity between angels and financial intermediation geographically. Further, we provide evidence on how competitors and workers are affected by the resulting decline in business entry, demonstrating the importance of angels in the economy beyond the companies they directly fund.

Our measure of differential treatment derives from the public use 2008 Survey of Income and Program Participation (SIPP), with geographic information available at the state level. The survey contains detailed information on net worth and income.[2] From these data, we calculate the fraction of the sampled accredited investor population that lost accreditation status when the value of a primary residence was no longer permitted in meeting the net worth standard for investor accreditation as a result of the passage of The Dodd-Frank Wall Street Reform and Consumer Protection Act (Dodd-Frank).

Using a continuous-treatment difference-in-differences framework, we first examine the impact of this shock to angel finance on new business creation using information from the Business Dynamics Statistics (BDS) database. We find a negative and statistically significant reduction in new businesses of about 2% on average. These results obtain controlling for state fixed effects, as well as controls for local economic conditions that vary over time. Thus, we demonstrate that even relatively small angels play a vital role in the entrepreneurial sector of the economy.

To determine how the reduction in new businesses may be affected by other forms of available finance, we segment states at median levels of venture capital investment, home price appreciation, and small business lending at the time of the shock. We find that effects are more pronounced in areas with higher levels of alternative funding sources, suggesting

[2]We are unaware of any alternative source that contains these micro data on a finer geographic level.

that they are imperfect substitutes for angel finance. We also examine differences in entry based on the size of the new business, as measured by the number of employees. As one might expect, effects are driven by smaller businesses.

We next study the effect on employment. Survey estimates indicate that four jobs are created for each angel investment (Sohl, 2014). Fewer new businesses should result in a reduction in employment for smaller entrants. Incumbents, therefore, may benefit given less competition in labor or product markets, and funding sources that may have served as complements to angel-funded firms may redeploy capital to existing firms.

While we find no aggregate effects on employment for entrants and incumbents, employment falls more for firms with no more than 10 employees by the end of their entering year in states that lost a greater percentage of potential angel investors. For incumbent firms, we identify larger increases in employment at smaller and younger incumbents. This effect on net job creation comes both from an increase in new job creation and a decrease in job destruction. These results offer reassurance that our measured effects on entry plausibly stem from a shock to informal capital markets.

Informal financing networks may be more important for paricular industries, and industry composition may vary over time within state boundaries. We therefore turn to Quarterly Workforce Indicators (QWI) data that allow us to examine employment changes by state, quarter, firm age, and industry. We partition our sample according to industry characteristics related to ease of entry, where angel finance is likely to have larger impact. First, we segment industry sectors at the median level of venture capital funding. The decline in employment for entrants is driven by industries that attract a larger amount of venture capital, demonstrating again that formal venture capital does not easily substitute for angel finance. Next, we segment industries by the level of concentration. The decline in employment for entrants is

driven by sectors below the median in employment share for the top 50 firms, suggesting that effects are more pronounced in more competitive industries. We also segment industries by the typical amount of startup capital needed to enter. We find that employment effects are driven by industries with lower startup capital requirements, suggesting that angels fund firms with relatively modest capital requirements at the margin and again providing evidence consistent with forgone entry due to a reduction in angel finance.[3]

We also explore the role of labor competition. If fewer new businesses enter and compete for workers, labor demand shifts downward, putting downward pressure on wages, provided the labor supply curve is not flat. Indeed, we find evidence of lower wage levels at infant firms for states that are more affected by the investor accreditation rule changes. The effect is driven by industries that have a larger portion of higher skilled workers and for workers with higher skill. For lower-skilled industries, there is no effect, perhaps reflecting higher substitutability of workers across industries.

Our investigation sheds light on the impact of informal capital networks. To our knowledge, ours is the first paper to study the impact of investor accreditation rules on entrepreneurial activity. As such, we are the first to identify causal economic effects from changes in capital availability in the informal angel financing market. Our results obtain based on what might be considered minor changes to the rules affecting primarily smaller participants. Isolating the impact of these rule changes is particularly important in light of the policy directive of Dodd-Frank that the Securities and Exchange Commission (SEC) review the definition of accredited investor every four years. New recommendations suggest that the net worth and income standards be raised from current levels, with limitations on investment amounts

[3]When we examine younger incumbent firms, there is no measurable effect when segmenting industries by high or low venture capital, concentration, or startup capital requirements. These results offer little support for the notion that additional financing for young incumbents becomes available, though we cannot segment these data by age and size simultaneously.

below the new thresholds.

Numerous studies examine the impact of organized venture capital on the firms they finance and their role in the economy.[4] Largely due to data constratints, prior work on the consequences of angel finance is scarce. Notable exceptions include Kerr, Lerner, and Schoar (2011) and Lerner, Schoar, Sokolinski, and Wilson (2016), who examine the impact of angel funding on firm outcomes using data from angel groups, and Bernstein, Korteweg, and Laws (2015), who conduct an experiment on an investment platform to determine which factors are important in attracting early stage funding. Additional treatments seek to determine the relation of angel finance to formal VC (Hellmann and Thiele, 2008; Goldfarb, Hoberg, Kirsch, and Triantis, 2013). Our work contributes to the scant knowledge about financial angels, providing a first causal glimpse into their effect on entrepreneurial activity and employment.

Our work also relates to studies addressing alternative forms of finance for new firms. Both theoretical and empirical treatments suggest that banks are an imperfect substitute for venture or angel capital, particularly at the early stages (Ueda, 2004; Hellmann, Lindsey, and Puri, 2008). Corporations also participate in new firm finance, but typically invest in companies that will complement their core businesses (Hellmann, 2002; Gompers and Lerner, 2000; Ma, 2015). Additional papers have explored the role and success of government programs (Lerner, 1996; Brander, Du, and Hellmann, 2014) and newer market participants such as accelerators (Fehder and Hochberg, 2014). We show that angel finance also plays an important role and offer new evidence on its areas of impact.

A large literature has sought to understand the role of financial constraints on entry,

[4]Samila and Sorenson (2010); Bernstein, Giroud, and Townsend (2015); Gonzalez-Uribe (2014); Mollica and Zingales (2008); Sorensen (2007); Puri and Zarutskie (2012); Hellmann and Puri (2000, 2002); Lindsey (2008); Bottazzi, Da Rin, and Hellmann (2008). See also Da Rin, Hellmann, and Puri (2012) for an extensive review.

employment, and productivity.[5] Several of these studies employ changes in banking regulations to determine causal effects. For example, Kerr and Nanda (2009) and Krishnan, Nandy, and Puri (2015) focus on firm size at entry and firm total factor productivity, respectively. Additional work focuses on the role of bank financing through the most recent financial or other crises (Goetz and Gozzi, 2010; Greenstone, Mas, and Nguyen, 2014; Cortes, 2013; Chodorow-Reich, 2014). Our work is similar in spirit in that we utilize a shock to to the pool of potential suppliers of capital to measure differential effects across geographies and provide estimates for an additional constraint on the supply of capital in the aftermath of the financial crisis.

Last, our work relates to the literature that seeks to understand the relation between firm size, age, and employment growth in order to inform policy decisions. Haltiwanger, Jarmin, and Miranda (2012) document that the relation between firm size and growth is driven largely by firm age and emphasize the role of entrants in new job creation in particular. Adelino, Ma, and Robinson (2016) examine differences in how young and old firms take advantage of investment opportunities and find that startup firms react more strongly to opportunities, with even more pronounced results in areas with more local bank finance. Both papers suggest that promoting capital availability to entering firms may be more important than policies that focus on small firms and job creation per se. While our work shows that tightening investor accreditation requirements has adverse effects on entry and job creation at entrants, our study cannot speak to the overall welfare implications of the policy change. While what we document are potential costs, there may be offsetting benefits that motivated the rule change and drive SEC recommendations going forward.

[5]See Kerr and Nanda (2011) for a review.

2 Empirical approach

Our analysis relies on a difference-in-differences approach to isolate causal effects of angel finance on entrepreneurial activity. The refinement to the investor accreditation definition within Dodd-Frank had little to do with any prior activity in the entrepreneurial sector. Further, the differential impact across regions is based on housing wealth and incomes in the general population and can be taken as exogenous as long as the extent to which these characteristics may predict changes in local economic conditions can be controlled. A key assumption is that angel finance is sufficiently local such that state-level shocks to capital availability impact new and incumbent businesses within the state. The available data on angel investing indicate that it is, indeed, a local activity, with the vast majority of investments occurring within 50 miles of the angel investor (Shane, 2009). In this section, we provide background on the rules that govern accredited investors and describe the construction of our treatment measure.

2.1 Regulatory background

Angel finance usually involves the issuance of private (unregistered) securities. Until recently, the issuance of private securities was governed largely by rules set forth in the Securities Act of 1933 and modifications made in the 1980s under Regulation D.[6] Transactions commonly take place under various provisions of Regulation D, which sets limits on the amount of capital that can be raised, requires various disclosures to investors, and limits the number of shareholders in certain circumstances. Disclosure of extensive financial information

[6]The Jumpstart our Business Startups (JOBS) Act, enacted in 2012, provides for an update to the rules, including those pertaining to general solicitation and investment by non-accredited individuals. Rules to allow advertising to accredited investors were made effective after the SEC rule-making process in September of 2013, and the crowdfunding provisions were not effective until 2016.

is not required nor is the capital amount limited as long as investors are "accredited," a designation meant to proxy for financial sophistication sufficient to evaluate securities not covered by the Securities Act.

In particular, investors must meet minimum wealth or income thresholds to be considered accredited investors. Regulation D defined accredited investor status for an individual as having income in excess of $200,000 in the most recent two years (with an expectation of continued income at the same level in the current year), or a net worth over $1 million. In 1988, the income requirement was refined to include a $300,000 joint-income test with one's spouse (Regulation D Adopting Release).[7] There were no further changes prior to Dodd-Frank.

In the wake of the financial crisis, Section 413(a) of Dodd-Frank required that the value of a person's primary residence be excluded from the calculation of net worth used to determine investor accreditation status. The change to the net worth status was effective immediately upon passage when signed into law on July 21, 2010. The SEC rules were later updated to reflect that positive home equity should not be included in the calculation. Importantly, Section 413(n)(2)(A) of Dodd-Frank directs the SEC to review the definition of accredited investor every four years. In the 2015 review, for example, recommendations to raise the income and net worth thresholds (to $500,000 and $3 million, respectively) and to introduce limits on investing for those meeting the current threshold but not the proposed levels were introduced.

From the 2010 Survey of Consumer Finances (SCF), we can estimate the number of households that lost accredited investor status. Applying a $200,000 income threshold if the household responder is unmarried and a $300,000 threshold if married, we find that 3.6% of

[7]Other thresholds apply to entities that are not natural persons such as business trusts or retirement accounts, and banks and investment companies are governed under separate rules.

households qualify under the income test. For assets, 9.8% of households have a net worth of $1 million or more including the home equity of the primary residence, dropping to 7.5% with the value of the residence excluded. With the income or asset distinction, 10.4% of households qualify as accredited investors prior to Dodd-Frank, and 8.4% after, a reduction of almost 20%.[8] Of course, only a small subset of investors who meet the accreditation standards likely engage in angel activity, and it is likely that a larger proportion of angel capital comes from those households that remain accredited under Dodd-Frank's stricter standard. Nevertheless, a 20% change in the number of households that can provide private capital under Rule 506 of Regulation D is a sizable change.

What are the demographics of these treated households? The mean age of the responder in a treated household is 63, with an interquartile range of 54 to 71. Over 71% are college graduates, with an additional 16% reporting some college. Approximately 61% of treated households report Excellent financial literacy and about 94% place themselves in either the Excellent or Good categories. These figures compare to 68% and 96% for those households that remain accredited after Dodd-Frank. Perhaps surprisingly, wealth and income standards may be a reasonable proxy for investor sophistication, and the treated population appears to be from the lower end of the distribution among this relatively sophisticated group.

In Figure 1, we consider the probability that a household is treated across several characteristics related to the accreditation criteria. Treatment likelihood varies considerably with non-housing wealth (i.e., net worth excluding equity in the primary residence). Household income is less predictive of treatment except, of course, near the accreditation thresholds. Home equity and home value also appear uninformative of treatment likelihood for values

[8]There is also a question in the SCF about whether the prior year's income is "unusually high." Excluding positive responders from the income qualification, about 10% of households qualify before Dodd-Frank, and approximately 8% after.

between $300K and $1M. Interestingly, households with homes worth more than $1M appear very unlikely to be treated, presumably because they have sufficient levels of income or non-housing wealth.

2.2 Measuring treatment

While the Survey of Consumer Finances has rich microdata on the determinants of investor accreditation status, it includes only limited information about respondent geography. Since our empirical strategy relies on geographic variation in the intensity of the Dodd-Frank-induced accreditation standards, we instead rely on the Survey of Income and Program Participation (SIPP). In particular, Wave 10 of the 2008 SIPP panel included a special topical module with detailed questions about family assets and liabilities that we can use to assess accreditation status.

The 2008 SIPP is a household-level longitudinal survey, with the Wave 10 interviews conducted between September and December 2011. The survey included 79,321 individuals in 34,216 families; our assessment of accreditation status is at the family level. The key variables we rely on are monthly earnings (*tpearn_waveavg*), home value (*tpropval*), amount owed on home mortgages (*thhmortg*), and net worth (*thhtnw*). Top-coding of variables means we can observe only an imperfect measure of accreditation and treatment status. Given that the SIPP's design goals include assessment of Americans' participation in income transfer programs, it oversamples lower-income households; given this, we do not rely directly on the *level* of treatment, but only on cross-state variation. In addition, the Census suggests some caution about using the SIPP to generate state-level estimates.[9] To the degree that our state-level treatment measure is noisy, we would expect our analysis to be biased against

[9]Per the Census's SIPP Users' Guide, "2004 and 2008 SIPP Panels can be used to produce state estimates. The survey was designed to produce reliable low-income estimates for the 33 largest states." Therefore, states with larger samples in the supplemental survey are more likely to be representative.

finding results.

Accreditation under the income standard requires annual income of at least $200,000, or $300,000 if married. Income in the SIPP is reported at the individual level, with top-coding at $12,500 (equivalent to $150,000 per year). For each family, we consider the "reference person" and spouse (if any): if neither has top-coded income we say the family *does not* meet the income standard (97.6% of families); if one is top-coded; it *may* meet the income standard (2.3%); if both are top-coded, it *does* meet the income standard (0.1%).

Accreditation under the asset standard requires net worth of at least $1 million. After Dodd-Frank, home equity was no longer included in this calculation. Net worth is reported in the SIPP at the family level, calculated from a number of separately top-coded asset and liability amounts including home value (top-coded at $750,000) and home mortgage debt (top-coded at $420,000). For each family we consider the reported net worth, a calculated net worth excluding home equity, and which variables are top-coded, dividing families into four types based on accreditation under the old (pre-Dodd-Frank) and new asset standards: Families which

1. *Do not* meet the old standard and *do not* meet the new standard (95.4% of families): Less than $1 million in net worth and a non-top-coded home value.

2. *May* meet the old standard and *may* meet the new standard (0.9%): Less than $1 million in net worth and a top-coded home value; or greater than $1 million in net worth, less than $1 million in net worth excluding home equity, and a top-coded mortgage debt.

3. *Do* meet the old standard and *do not* meet the new standard (1.6%): Greater than $1 million in net worth, less than $1 million in net worth excluding home equity, and a non-top-coded mortgage debt.

4. *Do* meet the old standard and *do* meet the new standard (2.1%): Greater than $1 million in net worth excluding home equity.

Combining the income standard with the old asset standard, we find that as many as 6.1% of families in the SIPP may have been accredited investors before Dodd-Frank. Potentially treated households—an upper bound on those who were actually treated—are those who do not necessarily meet the income standard, but may have met the old but not the new asset standard (i.e., categories 2 and 3, above). Such families represent 2.5% of all families in the SIPP, similar in magnitude to estimates from the SCF. We calculate the analogous fraction of potentially pre-Dodd-Frank-accredited investors who may have lost their accreditation at the state level, which represents the key source of cross-sectional variation in our analysis.

Our measure of treatment bears little correlation to economic characteristics that might relate to business entry and employment. In Figure 2, we show scatter plots of the estimate of the fraction treated by state with each of population, per capita income, and venture capital investment measures for 2010, along with house price appreciation leading up to our sample period. The highest correlation is with the house price change, with a value of 0.36, which is unsurprising given that large gains in housing wealth would push households with lower asset totals over the accreditation threshold.

3 Data

The primary data source for our analysis is the U.S. Census. In particular, we use the firm-level Business Dynamics Statistics (BDS) dataset that provides annual information on the number of businesses and jobs by state, year, firm size, and firm age.[10] The BDS data forms the core of our state-year and state-year-size samples. We also employ the

[10] Additional versions of the data are available.

Census's Quarterly Workforce Indicators (QWI) data, which links the Longitudinal Employer-Household Dynamics data with the Quarterly Census of Employment and Wages. From the QWI, we obtain quarterly information on employment and earnings by state, industry, and firm age, which forms the core of our state-quarter-industry sample.

We supplement these sources with annual state- and industry-level data from a variety of sources. We obtain information by geography on state populations and incomes from the Bureau of Economic Analysis, housing prices from Federal Finance Housing Agency, venture capital investment amounts from SDC's Venture Xpert, and bank branch data from the FDIC's Summary of Deposits. Industry information includes VC investment amounts from SDC's Venture Xpert, startup capital requirements from the public use microdata sample of the 2007 Survey of Business Owners, concentration from the 2007 Economic Census, and employee educational status from the QWI.

The time period of our study is centered around the modification to the accreditation rules. The state-year and state-year-size samples (from the BDS) cover the years (ending March 12) 2008 to 2014. The state-quarter-industry sample (from the QWI) covers 2007q2 to 2013q1. We provide a detailed description of variable definitions in Table 1.

3.1 Variable construction: Outcomes

In the BDS data, firms are categorized by their employment size at the beginning of the period unless they are entrants, in which case the firm is categorized by its ending size. As such, we study entrants and incumbents separately. We identify entrants as the number of firms with an age recorded as zero, which indicates the first year a firm reports employment. For use in the regressions, we normalize the number of entrants in each cell (state×year) or (state×year×firm size) by the total number of firms in the state at the beginning of the year.

We construct the beginning total by subtracting the total number of age-zero firms from and adding the number of firm deaths to the total number of firms. We also examine net job creation (job creation less job destruction) at entrants. Similarly, this figure is normalized by the state-year total of the provided Davis-Haltiwanger-Schuh (DHS) denominator, which is the average of total employment in the current year and its lag.

We define young incumbents as non-entrants five years old or younger and old incumbents as firms older than 5 years. For each group of incumbents, we construct a measure of net job creation. For young incumbents, we also examine job creation and job destruction separately. Each of these measures is normalized by the (cell-level) DHS denominator. Thus, for incumbents, the normalization has the standard interpretation of a percent change in jobs for firms of a particular size, adjusted so that transitory shocks are smoothed. Note that for entrants, the average of lagged employment and ending employment would be half of ending employment, and so we choose a normalization that has the interpretation of the size of the entrepreneurial sector relative to the economy in the state as a whole.

The QWI contains information on employment and earnings at the state-quarter-age-industry level, as well as information on worker characteristics. As before, we separate analysis for entrants and (young) incumbents, with the caveat that the finest age category available for entrants also includes firms that are one year old. Our young incumbent category for any industry analysis, therefore, includes firms aged two through five years, inclusive.

From these data, we define quarterly changes in employment for entrants and young incumbents. Similar to before, entrant employment changes are calculated as the ending level of employment normalized by the total initial employment in the state-industry for the quarter. For incumbents, employment changes are the percentage change over the quarter

for the state-industry-age.[11] We compute the average quarterly wage for entrants in each industry and state by dividing the total quarterly payroll by the average of the number of employees at the beginning and end of the quarter; thus, we analyze entrants' average wages relative to the state-quarter-industry average wage. In addition, we segment the sample to examine differential wage effects by worker age and education.

A necessary condition for the validity of our approach is the absence of pre-treatment trends in the outcome variables of interest that are correlated with treatment intensity. Figure 3 plots annual firm entry rates within terciles of the state-level treated fraction of accredited investors after Dodd-Frank; pre-treatment trends appear parallel. Though we do not include graphs for each outcome variable, we do perform (unreported) formal tests for each outcome by regressing its first-difference on the treatment level (or the treatment level and its square). All coefficients are economically small and statistically insignificant.

3.2 Variable construction: Controls

We construct a number of variables to control for local economic conditions that may vary over time. We define population log as the natural log of population measured in the middle of the year, and income per capita log as the natural log of total personal income divided by the midyear population. We calculate the percentage change in the seasonally adjusted house price index for each state using index values from the first calendar quarter of the year. Not only might housing price changes serve as a barometer for economic fluctuations, but numerous studies have documented the importance of housing wealth and the collateral channel more generally for the growth of small businesses.

The availability of more organized startup capital may also affect entrepreneurial activity.

[11] Note that we cannot study new firm creation since the number of employers is available only at the establishment level.

We, therefore, construct controls for the amount of venture capital allocated in a state in each calendar year. We sum total venture capital disbursements in the Venture Xpert data for U.S. firms where the round date, the firm's location, and the amount of the round are available, i.e., we exclude stages coded as acquisitions, real estate, and other.[12] For use in the regressions, we take the natural log of (one plus) the total venture amount, in thousands.

In addition to using the log of the total amount of VC in a state-year as a control, we also define states as being high or low venture capital states at the time of treatment. Using 2010 measures, we categorize states as high VC if the VC volume was above the median level, and low VC otherwise. We also segment states into high and low home price appreciation using the same approach. In addition to segmenting based on the median across states for the single year increase from 2009 to 2010, we construct measures from 2002 to 2007 as in Adelino, Schoar, and Severino (2008), which is subsumed by state fixed effects in our models.

We also segment states according to the availability of small business lending. We proxy small business lending using a measure of the presence of small banks, under the assumption that smaller banks are more likely to lend to small business. We use the FDIC's Summary of Deposits data to calculate the 2010 fraction of bank branches in each state that are from banks with less than $1B in total assets. We define high lending states as those with above-median fraction of small bank branches, and low bank lending states otherwise.

We construct a number of additional categorical variables across industries at the 2-digit NAICS level, i.e., sectors. We divide sectors into high or low capital needs based on the amount of startup capital needed as in Adelino, Schoar, and Severino (2008). The source information comes from the public use microdata sample for the 2007 Survey of Business Owners in response to the question about the amount of startup capital needed to start the

[12]These data are compiled from legacy downloads.

business. Additionally, we recalculate the total amount of VC disbursements by sector (as of 2010). In order to assign company-level disbursements to a sector, we map 4-digit SIC codes to 6-digit NAICS and aggregate up to the 2-digit level. We also divide sectors according to high or low industry concentration based on the employment share of the largest firms in the sector. We define high industry concentration for sectors above the median share from the top 50 companies. Last, we use the QWI to extract education characteristics by industry at the national level. We define low-skilled industries as those with the highest percentage of workers with less than a high school education.

3.3 Summary statistics

Summary statistics for our various samples are reported in Table 2. In Table 2a, we show the mean, standard deviation, median, and interquartile range for variables by state-year. The mean firm entry rate is 7.42%, with an interquartile range of approximately 6.4% to 8.2%. Our measure of treatment, Frac, ranges from 26.7% to 47.1%, with an average of 36.6%.[13] Note that the measure is high relative to the actual population given the relatively lower number of pre-accredited investors that appear in SIPP.

Table 2b reports statistics for the state-year-size sample. We suppress reporting of the variables that do not change from the state-year level. Here, the entry rate is exactly one-third of the state-year sample, reflecting the division of the sample into three size groupings of 1–4, 5–9, and 10 or more employees. The job creation rate for entrants averages 0.64% for each state, year, and size grouping, or just under 2% in the aggregate. For both young and old incumbent firms, mean net job creation is negative. The magnitudes are percentage changes relative to the average of the initial year and lagged value of levels of employment, which

[13]These figures represent raw percentages. The correlation between the Frac measure with and without sampling weights is greater than 97%, and regression coefficients are almost identical across alternative measures.

can act to magnify negative changes. In Table 2c, we report quarterly net job creation rates for the QWI sample, which segments observations by 2-digit NAICS codes. Here, net job creation measures for entrants and young incumbents are slightly positive, and entrant wages are 84% of the average wage.

4 Results

In this section, we present results. Because the measure for the fraction of accredited investors treated is less reliable for smaller states, all reported regressions are weighted by the estimated number of potentially accredited households under the accreditation standards prior to Dodd-Frank in the SIPP. In unreported analysis, we weight by state population or employment with similar results. We first report analysis on entering and incumbent firms using BDS data, followed by analysis using industry information from the QWI.

4.1 Entrants by firm size

In Table 3, we present results for the difference-in-differences estimation of new business entry as a function the fraction of accredited investors affected by Dodd-Frank interacted with an indicator variable equal to one for BDS years 2011 and beyond. The unit of observation is a state-year, and the dependent variable is the number of entering firms normalized by the state total in the prior year. Control variables include population, per capita income, venture capital invested, and the percentage change in home prices, as well as state and year fixed effects. Standard errors are heteroskedasticity-consistent and clustered at the state level.

In Column 1, the coefficient on the interaction effect indicates a negative and statistically significant change in the number of new businesses for states more extensively affected by the change in investor accreditation standards. The coefficient of -0.0055 translates to about a 2%

reduction in entry at the mean (and median).[14] The estimate is in line with estimates from studies on capital availability in the banking literature, and is both economically meaningful and plausible. In particular, Shane (2009) estimates there are roughly 50 to 60 thousand angel-backed companies each year, though not all of these are new entrants. Therefore, it appears that close to 10% of employing startups are angel-backed. A 2% decline divided by the 10% in angel-backed starts implies (under) a 20% reduction in angel-backed entrants as a result of the decline in accredited households of similar magnitude.

Control variables have intuitive signs. States with higher per capita income and greater house price appreciation see an increase in new businesses. Given that the measure of entry is already normalized by the prior number of businesses in the state, population bears a negative relation.

In Columns 2 through 7, we present estimates from subsamples split at median values of alternative forms of finance for new business entry. Median values for the state are calculated in the year prior to treatment. Columns 2 and 3 report estimates for high and low VC states. For high VC states, the coefficient is negative and larger in absolute value than in the full sample regression; for low VC states, the sign on the coefficient is negative, but is not statistically different from zero. Thus, we can say that the overall effect on entry is driven by states with above-median levels of venture capital investment.

Columns 4 and 5 report subsamples for high and low prior year home price appreciation. Insofar as home values translate into collateral that enables financing for business entry or expansion, we again see a negative and significant coefficient for areas with more alternative finance that is larger in absolute value than for the full sample. There is no measurable effect for areas with lower appreciation. The segmentation on small business lending availability is

[14]The coefficient estimate of -0.0055 times the mean Frac of 0.366 equals approximately -0.002, or 0.2 percentage points; a 0.2 percentage point decline divided by a 7% to 10% start rate equals approximately 2%.

similar. In Column 6, for the estimation of the subsample for above-median small business lending availability, the coefficient is negative and of larger magnitude to the full sample, with a statistically insignificant effect for the states with lower levels of small business lending availability.[15] Results are similar if we instead count the total amount of small business loans, the number of banks making small business loans, or the number of small business loans. Overall, it does not appear that these traditional channels to alleviate financial constraints act as substitutes for the decline in capital availability from angels. Nor do more specialized intermediaries like venture capital firms seem to serve the same population of potential entrants.

We next examine entry and employment changes by firm size. The unit of observation is now a state, year, and size grouping for age zero firms. The dependent variable is the number of entering firms in each size group for the state and year, again normalized by the state-year total. Recall that the size groupings for entering firms are the ending sizes. We expect effects to be most pronounced for smaller firms, so we group firms according to the number of employees in categories of 1 to 4 employees, 5 to 9 employees, and 10 or more employees as the base category. The regressions contain the same controls as Table 3 and are augmented with firm size fixed effects.

Table 4 reports the results. In Column 1, we report a baseline specification for this new unit of observation without any interactions with firm size. As before, the coefficient on (After×Frac) is negative and significant, with a value of -0.0018. In Column 2, we add the full set of interactions for firm size with the treatment variable Frac and the time indicator After.[16]

[15]Results throughout the paper are robust to including this measure as an independent variable in the regressions.

[16]With these data, we could include state-by-year fixed effects to test whether small firms experienced a reduction in entry and employment relative to larger firms controlling for any unobservable factors that vary

The coefficient on (After×Frac) is now insignificant, but the coefficient on the 1 to 4 employee size grouping interacted with (After×Frac) is -0.0048 and significant at 90% confidence. The coefficient for the grouping of 5 to 9 employees interacted with (After×Frac) is significant at 99% confidence, with an estimated value of -0.0017. These results indicate that the effects are, indeed, more pronounced at small firms, with a monotonic pattern moving from the smallest category.

We examine the employment effects for entering firms in Columns 3 and 4. We expect that forgone entry will result in decreased employment at entrants overall. The dependent variable is net job creation, normalized by the state-year denominator. As before, we report a baseline specification with firm size fixed effects but no interactions with firm size in Column 3. We note that there is no overall effect, meaning that the rate of job creation for entrants does not change when all firm sizes are grouped together. Any jobs created or lost by very small firms, i.e., those we expect to be more reliant on angels, are swamped by a much smaller relative change at larger firms. Column 4 demonstrates the effects across firm sizes as a result of differential treatment. Here, the coefficient on (After×Frac) is positive and significant, indicating the effect for all firms. The coefficient for the small firms interacted with After×Frac is negative and statistically significant. The coefficient estimates for both the 1 to 4 grouping and the 5 to 9 grouping are similar in magnitude to one another, and are similar in absolute value (but of opposite sign) to the overall treatment coefficient. These results indicate that employment at smaller firms, i.e., those likely more likely dependent on angel finance, experienced less job creation when compared to larger entrants.

within the state over time. Because none of our controls vary by firm size, however, the estimated coefficients of interest are identical to those reported. Inference remains qualitatively similar.

4.2 Incumbent firms by firm size

A decrease in entering firms may have positive repercussions for incumbents, particularly those that would compete with angel-backed firms in the product, labor, or financing markets. We, therefore, analyze employment changes at incumbent firms. Given the level of detail in our data, we might expect these effects to manifest at younger or smaller firms.

We segment incumbent firms by age, with young incumbents being firms ages one to five, and older firms over five years old. In Table 5, we report specifications for job creation at young and old incumbents. The unit of observation remains a state, year, and firm size grouping. The normalization for the job creation variables differ from before, however. Each unit of observation is normalized by the denominator for its state, year, and size. The variable of interest is (After×Frac) or , alternatively, (After×Frac) interacted with firm size groupings. The regressions have the same time-varying controls as reported in Table 3, and contain state, year, and size grouping fixed effects. Columns 1 and 2 report baseline specifications for net job creation in young and old firms. Consistent with prior literature, we see that younger and smaller firms create more jobs, though there is no statistically significant effect on (After×Frac). This makes sense given that we do not necessarily expect angel financed entrants to have a large competitive effect on the economy as a whole.

In Columns 3 and 4, we report estimations for net job creation at young and old incumbents with the full set of interactions for after, frac, and firm size. (After×Frac) remains statistically insignificant, but the interactions with smaller firm sizes are positive and significant in the specification for young incumbents (Column 3). There is no measurable effect for the firm size interactions for old incumbents (Column 4). These results show that younger, smaller incumbents expand more rapidly in areas disproportionately affected by the decline in angel financing, which affected the rate of entry. In Columns 5 and 6 of Table 5, we see that the

effect for young incumbents is driven equally by an increase in job creation and a decrease in job destruction for the smallest firms, and is driven by both creation and destruction for firms with 5 to 9 employees as well.

4.3 Entrants and incumbents by industry

Our analysis now turns to the state-quarter-industry sample, built from the Census's Quarterly Workforce Indicators (QWI) data. By considering within-industry effects, this sample allows us to more carefully control for differences in industry composition across states, as well as to consider heterogeneous effects across industries. For these regressions, we omit observations for NAICS code 92 (Public Administration) as well as state-industries with fewer than 250 employees. We also require that measures are not "significantly distorted" by the Census in their efforts to preserve confidentiality.

Table 6 presents estimates of the effect of angels' loss of accreditation status on net job creation at entering firms (defined in the QWI as those aged 0–1 years), by industry. The dependent variable is the employment at entering firms in a given state and industry divided by the total number of employees in the state-industry at the beginning of the quarter. In Column 1, we include only the main treatment effect (After×Frac), together with the usual annual state-level controls and fixed effects at the state-, quarter-, and industry-levels. The sign of the coefficient on After×Frac is negative, with a p-value of approximately 11%. Though we cannot segment entrant employment by size as in the BDS data (Table 4), this result suggests that states with a higher treated fraction of angels saw lower employment growth at entering firms after Dodd-Frank when controlling for industry composition.

The following three columns of Table 6 consider heterogeneous effects on employment across industries. In particular, each column allows the main treatment effect variable to

differ between industries that lie above or below the median on an industry characteristic plausibly related to the importance of angel-funded entrants to industry employment. In each case, the main coefficients of interest are on After×Frac (which shows the treatment effect in industries that lack the characteristic) and Characteristic×After×Frac (which shows the difference in treatment effects between industries with and without the characteristic).

Column 2 of Table 6 reports differential effects in industries not typically favored by VC firms. The coefficient on After×Frac is not measurably different from zero, whereas the coefficient on Low VC×After×Frac is positive and statistically significant at 90% confidence. Thus, we see a reduction in employment growth from entering firms for geographies more affected by changes in accredited investor status in industries favored by traditional VC. This result again suggests complementarity between angel and venture capital finance.

In Column 3, we examine effects by levels of industry concentration. The coefficient on After×Frac is negative and statistically significant, and the coefficient on Concentrated industry×After×Frac is positive and statistically significant. We thus observe negative effects on entrant employment in less concentrated industries, with no statistical effects for more highly concentrated industries where the threat of entry is presumably less severe.

Column 4 documents differential effects for industries with varying levels of startup capital requirements. The coefficient on After×Frac is negative and statistically significant, whereas the coefficient on High cap industry×After×Frac is positive, statistically significant at 90% confidence, and approximately equal in absolute value.Thus, the reduction in employment at entrants resulting from the change to accreditation standards is greater for industries with lower startup capital requirements, consistent with angels driving entrant employment growth in such industries. There is no overall effect for industries facing higher capital requirements.

In untabulated results, we replicate the analysis from Table 6, but consider employment

growth at incumbent firms aged 2–5 years rather than at entrants. To the degree that entrants compete with incumbents—particularly young ones—in product, financing, and labor markets, we expect that a reduction in angel finance availability will increase young incumbent employment, especially in industries where angel-funded entrants are likely to be important. While the signs on the coefficient estimates are consistent with this hypothesis, none of the coefficients of interest are statistically significant.

4.4 Wages

The QWI also includes payroll data, allowing us to assess the impact on wages. Entering firms compete for workers (with each other, and in the broader labor market), so we might expect that reduced angel funding—by reducing entry and employment at entrants—would lower relative wages for the entrepreneurial sector. Angel funding means there are more entrants (and potentially better capitalized ones) to bid wages up; we would expect these effects to be strongest for higher skilled workers who may be more difficult to attract to angel-funded startups. In addition, not all would-be entrants are identical. If a drop in capital availability disproportionately affects startups that would attract higher quality workers, changes in the composition of firms may similarly affect the change in relative wages. Notably, recent work by Babina, Ma, Ouimet, and Zarutskie (2018) shows that almost all of the difference in wages paid by young firms can be explained by time-invariant firm or worker characteristics.

Table 7 presents estimates of the effect of angels' loss of accreditation status on the wages at entering firms (defined in the QWI as those aged 0–1 years), by industry. We compute wages both overall and separately across workers with characteristics likely correlated with skill: education and age. The dependent variable is the average wage per employee in

the demographic category at entering firms in a given state and industry divided by the average wage per employee for firms in the same industry and state. In column 1 of Panel A, we include only our main treatment effect (After×Frac), together with our usual annual state-level controls and fixed effects at the state-, quarter-, and industry-levels. The negative coefficient on After×Frac, statistically significant at the 5% level, shows that states with a higher treated fraction of potential angels saw entrants pay their employees lower relative wages after Dodd-Frank. This is consistent with competition among angel-funded entrants bidding wages up as well as a decline in entrant quality as a result of a shock to funding availability.

In columns 2 through 4, we examine relative wages separately for workers with less than a high school education, high school graduates without college degrees, and those with college degrees. We observe no statistical effect for workers with less than a high school education, and a monitonically increasing negative effect for those with high school and college degrees. In columns 5 through 8, we segment the working population by age (18–34, 35–44, 45–54, and 55–64). We observe similar negative wage effects for both groups of workers below age 45, though the coefficient is not statistically significant for those age 35–44. For older workers, effects are more pronounced, with the largest measured effect for the oldest workers. Thus, insofar as human capital accumulates over time and education is an indication of skill, effects are stronger for workers where labor supply elasticity is presumably lower.

In Panel B of Table 7, we repeat the analysis of Panel A, but allow the treatment effects to differ between higher and lower skill industries (those with a below-median fraction of employees with less-than-high school education). The larger negative coefficients on After×Frac, and the positive coefficients on Lower skill industry×After×Frac mean that the treatment effects are stronger in higher skill industries both overall and across worker

demographics; the similar magnitude and opposite signs of these coefficients means that the wage effect is concentrated only in higher skill industries. Thus, effects are most pronounced for skilled workers in skilled industries, with no effects for industries that do not require skilled workers.

These results show that changing investor accreditation standards has an effect even on the firms that still enter, either through capital constraints or reduced competition for workers. The findings are also consistent with the notion that human capital is important in angel funded firms, such that these firms have a greater chance at being economically important entrants.

5 Conclusion

In this paper, we provide the first causal empirical estimates of the role of financial angels in the economy. We demonstrate that a larger reduction to the pool of potential angels negatively affects firm entry and reduces employment levels at smaller entrants. Effects are concentrated in states that are more developed in terms of other available financing, suggesting that financial angels serve a unique role.

Employment increases at small and young incumbents either as workers are absorbed or competitive pressures in the product markets are reduced. There is less evidence that additional financing becomes available for incumbent firms. Further, reduced entry relaxes wage pressure in the entrepreneurial sector. These effects demonstrate the importance of angels in the economy beyond the companies they directly fund.

References

Adelino, M., S. Ma, and D. T. Robinson, 2016, Firm Age, Investment Opportunities, and Job Creation, *Journal of Finance* forthcoming.

Adelino, M., A. Schoar, and F. Severino, 2008, House Prices, Collateral and Self-Employment, *Journal of Finance* 117, 288–306.

Babina, T., W. Ma, P. Ouimet, and R. Zarutskie, 2018, Entrepreneurial Wages, Working paper, UNC Chapel Hill.

Bauguess, S., R. Gullapalli, and V. Ivanov, 2015, Capital Raising in the U.S.: An Analysis of the Market for Unregistered Securities Offerings, 2009-2014, White paper, SEC Division of Economic and Risk Analysis.

Bernstein, S., X. Giroud, and R. Townsend, 2015, The impact of venture capital monitoring: Evidence from a natural experiment, *Journal of Finance* 71, 1591–1622.

Bernstein, S., A. Korteweg, and K. Laws, 2015, Attracting early stage investors: Evidence from a randomized field experiment, *Journal of Finance* forthcoming.

Bottazzi, L., M. Da Rin, and T. Hellmann, 2008, Who are the active investors?: Evidence from venture capital, *Journal of Financial Economics* 89, 488–512.

Brander, J. A., Q. Du, and T. Hellmann, 2014, The Effects of Government-Sponsored Venture Capital: International Evidence, *Review of Finance* 19, 571–618.

Chodorow-Reich, G., 2014, The Employment Effects of Credit Market Disruptions: Firm-level Evidence from the 2008-09 Financial Crisis, *Quarterly Journal of Economics* 129, 1–59.

Cortes, K. R., 2013, Rebuilding after disaster strikes: How local lenders aid in the recovery, Working paper, Federal Resere Bank of Cleveland.

Da Rin, M., T. Hellmann, and M. Puri, 2012, A survey of venture capital research, In *Handbook of the Economics of Finance*. George Constantinides, Milton Harris, and René Stulz (eds) , vol 2, Amsterdam, North Holland.

Fehder, D. C., and Y. Hochberg, 2014, Accelerators and the regional supply of venture capital investment, Working paper.

Goetz, M. R., and J. C. Gozzi, 2010, Liquidity shocks, local banks, and economic activity: Evidence from the 2007-2009 crisis, Working paper, Goethe University Frankfurt.

Goldfarb, B. D., G. Hoberg, D. Kirsch, and A. J. Triantis, 2013, Are angels different? An analysis of early venture financing, Robert H. Smith School Research Paper.

Gompers, P., and J. Lerner, 2000, Can Corporate Venture Capital Succeed? Organizational structure, Complementaries, and Success, In *Concentrated Ownership*. National Bureau of Economic Research Conference Reports, R. Morck, ed., University of Chicago Press.

Gonzalez-Uribe, J., 2014, Venture Capital and the Diffusion of Knowledge, Working paper, London School of Economics.

Greenstone, M., A. Mas, and H.-L. Nguyen, 2014, Do credit market shocks affect the real economy? Quasi-experimental evidence from the Great Recession and 'normal'economic times, Working paper 20704, National Bureau of Economic Research.

Haltiwanger, J., R. S. Jarmin, and J. Miranda, 2012, Who Creates Jobs? Small versus Large versus Young, *RES* 95, 347–361.

Hellmann, T., 2002, A theory of strategic venture investing, *Journal of Financial Economics* 64, 285–314.

Hellmann, T., L. Lindsey, and M. Puri, 2008, Building relationships early: Banks in venture capital, *Review of Financial Studies* 21, 513–541.

Hellmann, T., and M. Puri, 2000, The Interaction between Product Market and Financing Strategy: The Role of Venture Capital, *Review of Financial Studies* 13, 959–984.

Hellmann, T., and M. Puri, 2002, Venture Capital and the Professionalization of Start-up Firms: Empirical Evidence, *Journal of Finance* 57, 169–197.

Hellmann, T., and V. Thiele, 2008, Friends or foes? The interrelationship between angel and venture capital markets, *Journal of Financial Economics* 115, 639–653.

Kerr, W. R., J. Lerner, and A. Schoar, 2011, The Consequences of Entrepreneurial Finance: Evidence from Angel Financings, *Review of Financial Studies* 27, 20–55.

Kerr, W. R., and R. Nanda, 2009, Democratizing entry: Banking deregulations, financing constraints, and entrepreneurship, *Journal of Financial Economics* 94, 124–149.

Kerr, W. R., and R. Nanda, 2011, Financing constraints and entrepreneurship, in D. Audretsch, O. Falck, and S. Heblich, eds.: *Handbook on Research on Innovation and Entrepreneurship* (Edward Elgar, Cheltenham).

Krishnan, K., D. K. Nandy, and M. Puri, 2015, Does Financing Spur Small Business Productivity? Evidence from a Natural Experiment, *Review of Financial Studies* 28, 1768–1809.

Lerner, J., 1996, The Government as Venture Capitalist: The Long-Run Effects of the SBIR Program, Working paper 5753, National Bureau of Economic Research.

Lerner, J., A. Schoar, S. Sokolinski, and K. Wilson, 2016, The globalization of angel investments: Evidence across countries, Working paper, Harvard University.

Lindsey, L. A., 2008, Blurring Firm Boundaries: The Role of Venture Capital in Strategic Alliances, *Journal of Finance* 63, 1137–1168.

Ma, S., 2015, The life cycle of corporate venture capital, Working paper, Duke University.

Mollica, M., and L. Zingales, 2008, The impact of venture capital on innovation and the creation of new businesses, Working paper, University of Chicago.

Puri, M., and R. Zarutskie, 2012, On the lifecycle dynamics of venture capital and nonventure capital financed firms, *Journal of Finance* 67, 2247–2293.

Samila, S., and O. Sorenson, 2010, Venture Capital, Entrepreneurship, and Economic Growth, *Review of Economics and Statistics* 93, 338–349.

Schumpeter, J. A., 1911, *The theory of economic development*. Harvard University Press.

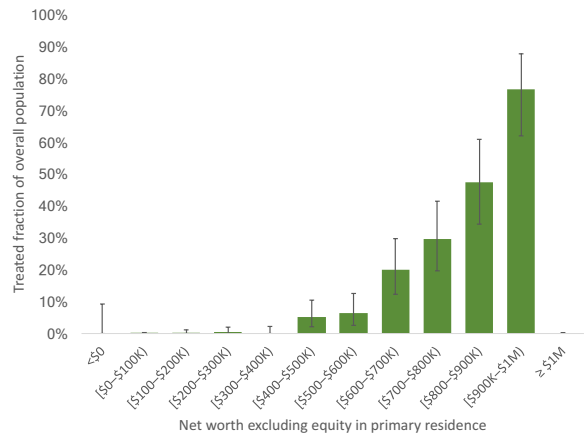
Schumpeter, J. A., 1942, *Socialism, capitalism and democracy*. Harper and Brothers.

Shane, S. A., 2009, *Fools Gold? The truth behind angel investing in America*. Oxford University Press New York.

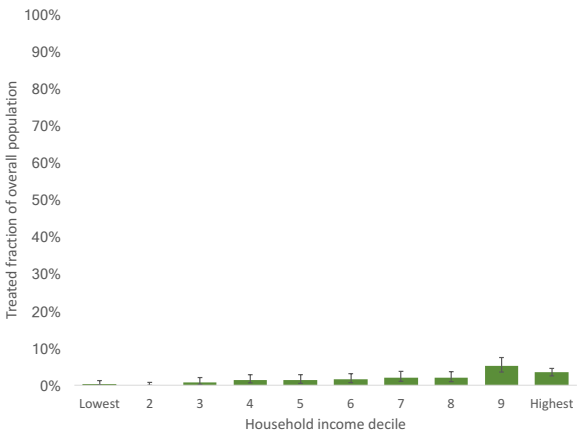
Sohl, J., 2014, The angel investor market in 2013: A return to seed investing, Center for Venture Research.

Sorensen, M., 2007, How Smart is Smart Money? An Empirical Two-Sided Matching Model of Venture Capital, *Journal of Finance* 62, 2725–2762.

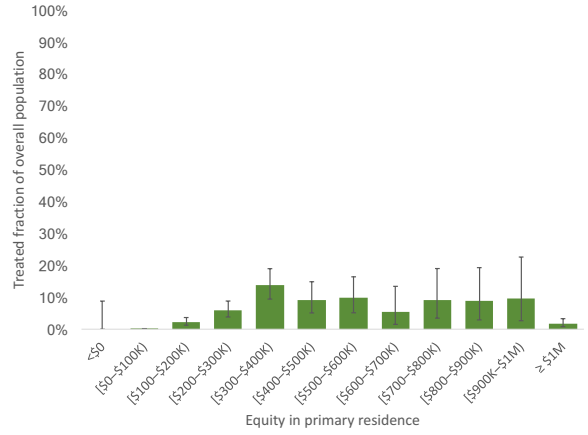
Ueda, M., 2004, Banks versus venture capital: Project evaluation, screening, and expropriation, *Journal of Finance* 59, 601–621.



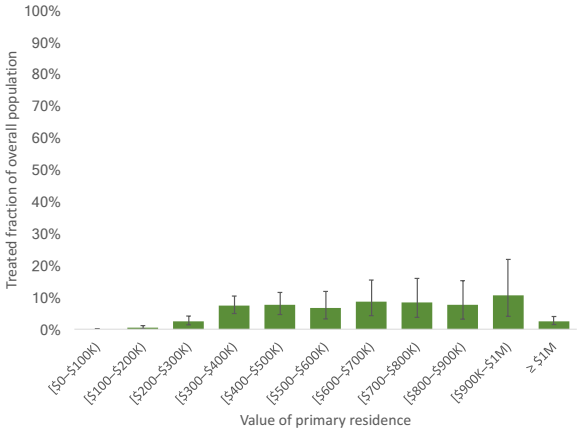
(a) Non-housing wealth



(b) Income



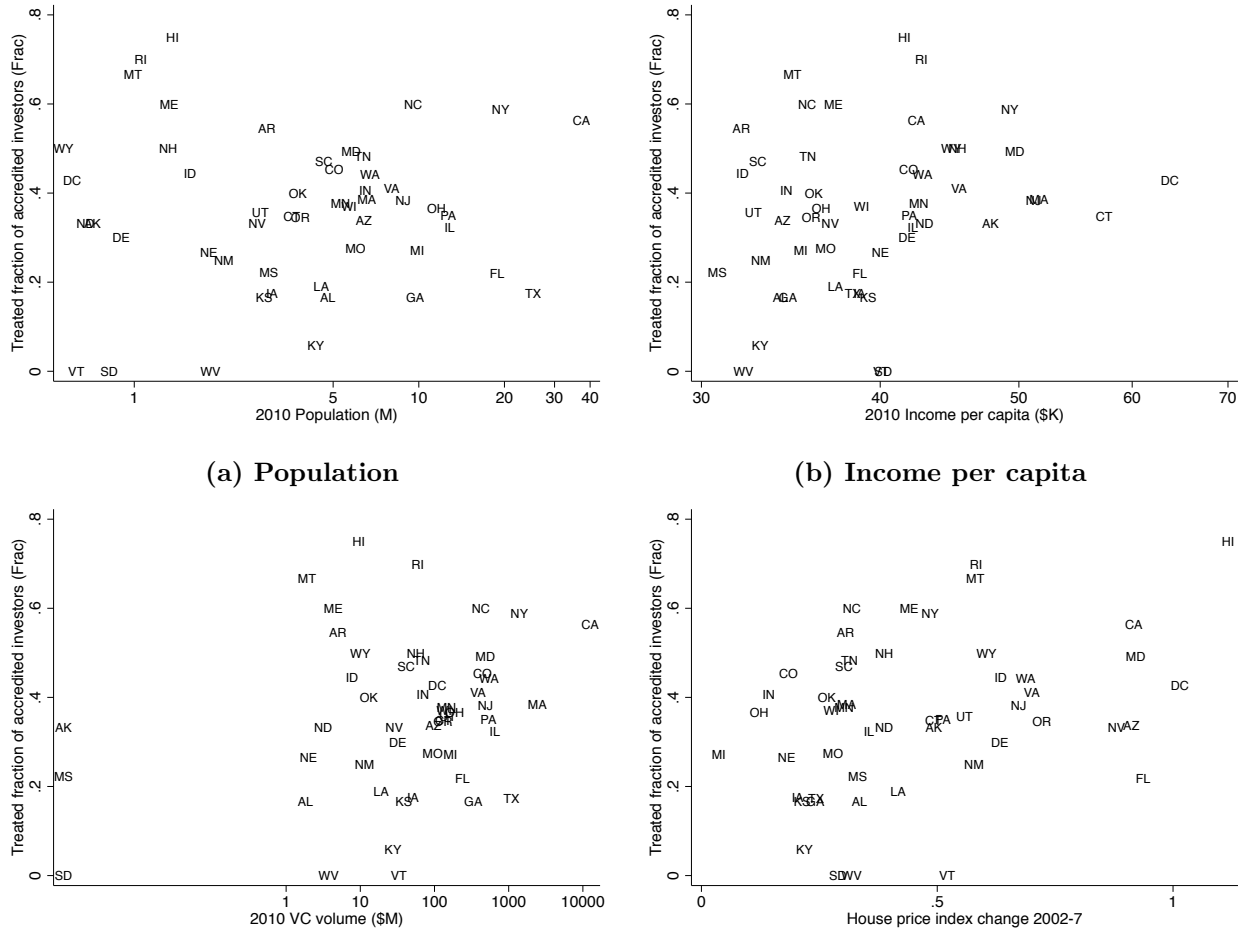
(c) Home equity



(d) Home value

Figure 1. Treated fraction of overall population by household attribute

Each graph plots the estimated fraction of the total population who are treated accredited investors across some household attribute: net worth excluding equity in primary residence, income, equity in primary residence, and value of primary residence. All estimates are calculated using the 2010 Survey of Consumer Finances, and reported with 95% Bernoulli confidence intervals.



(a) Population **(b) Income per capita**

(c) Venture capital **(d) House price index change**

Figure 2. Treated fraction of accredited investors and state attributes

Each graph plots the state-level treated fraction of accredited investors against a state attribute: 2010 log population (correlation = 0.01), 2010 log income per capita (0.23), 2010 log venture capital volume (0.26), and the 2002–7 change in house price index (0.36). Time-varying analogues of these measures are included as annual state-level controls in our main regressions.

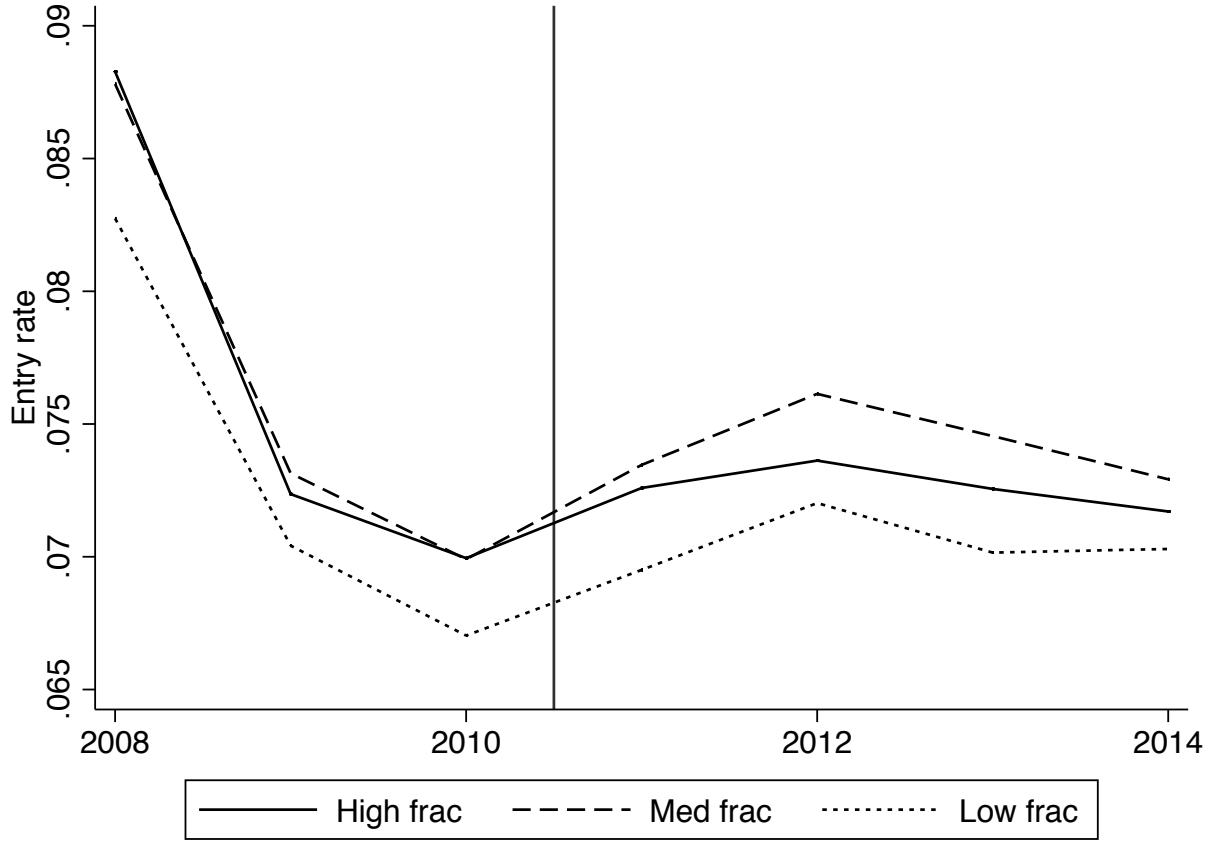


Figure 3. Parallel Trends (Entry)

This graph plots annual firm entry rates (Entry, as defined in Table 1) averaged within terciles of the state-level treated fraction of accredited investors after Dodd-Frank (Frac). In unreported tests, we regress first-differences of each dependent variable considered in our main analyses on Frac (or Frac and its square) for the pre-Dodd-Frank period; the coefficients on Frac (and its square) are both economically small and statistically insignificant in all cases.

Table 1.
Main Variable Descriptions

This table describes the variables used in our analysis and explains their construction.

Variable	Description	Calculation
Outcome variables: State-year sample and state-year-size sample		
Entry	Firm entry rate	The number of age-zero firms (perhaps of a given size) in a state, divided by the total number of firms in the state at the beginning of the year (calculated as firms minus firm entry plus firm deaths).
NJC	Net job creation rate	For entering firms (age zero): Net job creation by age-zero firms (perhaps of a given size) in a state, divided by the average of the total number of employees in the state at the beginning and end of the year. For incumbent firms (age $\geq$1): Net job creation by firms of a given age (and perhaps of a given size) in a state, divided by the average of the number of employees firms of the same age (and perhaps size) had in the state at the beginning and end of the year.
JC	Job creation rate	Job creation by firms of a given age (and perhaps of a given size) in a state, divided by the average of the number of employees firms of the same age (and perhaps size) had in the state at the beginning and end of the year.
JD	Job destruction rate	Job destruction by firms of a given age (and perhaps of a given size) in a state, divided by the average of the number of employees firms of the same age (and perhaps size) had in the state at the beginning and end of the year.
Outcome variables: State-quarter-industry sample		
NJC	Net job creation rate	For entering firms (age zero and one): Ending employment for infant firms in a state, divided by the number of employees in the state and industry at the beginning of the quarter. For incumbent firms (age $\geq$2): Net job creation by firms of a given age and industry in a state, divided by the number of employees firms of the same age and industry had in the state at the beginning of the quarter.

(continued)

Table 1.
Main Variable Descriptions (cont.)

Variable	Description	Calculation
Relative entrant wages	Relative wage per worker at entrants	Wage per employee at firms aged 0–1 year of a given industry and demographic category in a state (defined as payroll divided by the average of beginning and ending employment), divided by wage per employee for firms in the same industry in the state.
Main explanatory variables		
After	Post-Dodd Frank indicator	In the state-year sample and state-year-size sample: Years ending March 12, 2011 and later. In the state-quarter-industry sample: Quarter ending June 30, 2010 and later.
Frac	State-level treated fraction of accredited investors	The number of families in a state who may have been accredited investors under the pre-Dodd-Frank standard but not the post-Dodd-Frank standard, divided by the number who may have been accredited under the pre-Dodd-Frank standard. Calculated using Wave 10 of the 2008 SIPP panel as described in Section 2.2.
1–4/5–9/10+ employees	Number of employees	Categorized using end-of-year employment for entrants and beginning-of-year employment for incumbents.
Annual state-level variables		
Population log	Population	The natural log of population measured in the middle of the calendar year, from the Bureau of Economic Analysis.
Income per capita log	Income per capita	The natural log of total personal income divided by the midyear population, from the Bureau of Economic Analysis.
VC log	Venture capital volume	The natural log of (one plus) the total venture amount, in thousands, from SDC's Venture Xpert. The round date, the firm's location, and the amount of the round must be available, and we exclude stages coded as acquisitions, real estate, and other.
House price index change	House price change	The annual percentage change in the seasonally-adjusted house price index measured as of the first quarter of the year, from the Federal Finance Housing Agency.
State-level variables		

(continued)

Table 1.
Main Variable Descriptions (cont.)

Variable	Description	Calculation
High VC	Above-median 2010 venture capital volume	State has above-median levels of venture capital invested in 2010, calculated from SDC's Venture Xpert. (AZ, CA, CO, CT, DC, FL, GA, IL, IN, MA, MD, MI, MN, MO, NC, NJ, NY, OH, OR, PA, TX, UT, VA, WA, WI, WV.)
High ΔHPI	Above-median 2009–10 house price index change	State has above-median home price appreciation from 2009 to 2010 based on the percentage change in the Federal Finance Housing Agency home price index. (CA, CO, DC, IA, IN, KS, KY, LA, MA, ME, MO, MS, MT, ND, NE, NM, NY, OH, OK, PA, SD, TX, VA, VT, WY.)
High loan	Above-median 2010 fraction of small-bank branches	State has above-median fraction of bank branches at banks with less than \$1B in assets per FDIC Summary of Deposits data. (AL, AR, CO, IA, IL, KS, KY, LA, ME, MN, MO, MS, MT, ND, NE, NH, NM, OK, SC, SD, TN, TX, VT, WI, WY.)
Industry-level variables		
Low VC industry	Below-median venture capital	Two-digit NAICS industry has below-median venture capital volume, calculated from SDC's Venture Xpert. (NAICS 11, 21, 42, 53, 55, 56, 61, 71, 72.)
Concentrated industry	Above-median employment concentration	Two-digit NAICS industry has above-median fraction of total employment at 50 largest firms, from the 2007 Economic Census. (NAICS 22, 44–45, 48–49, 51, 52, 56, 72. Note: Data is not available for NAICS 11, 21, 23, 31–33, 55.)
High cap industry	Above-median start-up capital	Two-digit NAICS industry has above-median reported amount of start-up capital, from the 2007 Survey of Business Owners. (NAICS 21, 22, 31–33, 44–45, 51, 53, 55, 71, 72.)
Lower skill	Above-median fraction of low-skill workers	Two-digit NAICS industry has above-median fraction of 2010q2 total industry employees with a less-than-high school education, calculated from the QWI. (NAICS 11, 23, 31–33, 44–45, 48–49, 53, 56, 72, 81.)

Table 2. Summary Statistics

This table reports distributional summary statistics for our main variables of interest. Panel A reports summary statistics for the state-year sample (BDS); Panel B reports summary statistics for the state-year-size sample (BDS); Panel C reports summary statistics for the state-quarter-industry sample (QWI). For each variable in each dataset, we report the pooled mean, standard deviation (sd), median (p_{50}), first quartile (p_{25}), third quartile (p_{75}), skewness, and number of non-missing observations (count). The last row of each panel reports the total number of observations in the dataset.

(a) State-year sample

	mean	sd	p50	p25	p75
Firm entry rate (%)	7.42	1.36	7.22	6.40	8.19
Frac (%)	36.61	16.55	36.19	26.67	47.06
Population log	15.13	1.04	15.30	14.27	15.72
Income per capita log	10.62	0.16	10.60	10.49	10.71
VC log	10.75	3.14	11.23	9.59	12.72
House price index change (%)	-0.99	6.18	-1.04	-4.40	2.27
Observations	350				

(b) State-year-size sample

	mean	sd	p50	p25	p75
Firm entry rate (%)	2.47	2.26	1.05	0.86	4.68
Net job creation rate (%)					
Entrants	0.64	0.40	0.46	0.33	0.95
Younger incumbents	-3.54	7.11	-3.62	-8.20	1.47
Older incumbents	-1.42	3.65	-0.84	-3.97	1.00
JC (%): Younger incumbents	20.30	6.56	18.35	15.12	26.72
JD (%): Younger incumbents	23.84	3.58	23.51	21.52	25.70
Observations	1050				

(c) State-quarter-industry sample

	mean	sd	p50	p25	p75	Obs
Net job creation rate (%)						
Entrants	4.08	2.65	3.51	2.14	5.43	20869
Younger incumbents	0.79	8.98	0.49	-2.53	3.30	19124
Relative entrant wages (%)	84.20	15.39	83.93	75.59	91.85	17876

Table 3. Entry

This table reports coefficients, standard errors, and statistical significance from OLS regressions of the firm entry rate, estimated using the state-year sample described in Section 3. The key explanatory variable is the state-level treated fraction of accredited investors after Dodd-Frank (After×Frac); regressions also include annual state-level control variables (log population, log income per capita, log venture capital volume, and house price index change), state-fixed effects, and year-fixed effects. Variables are calculated as described in Section 3. Columns 2–7 are estimated separately on states with above- and below-median 2010 venture capital volume (columns 2–3), 2009–10 change in house prices (4–5), and 2010 fraction of branches at banks with less than $1B in assets (6–7). Standard errors clustered by state are reported in parentheses. Significance levels are indicated by *, **, *** for 10%, 5%, and 1% respectively.

	(1) Overall	(2) High VC	(3) Low VC	(4) High ΔHPI	(5) Low ΔHPI	(6) High loan	(7) Low loan
After×Frac	-0.00551**	-0.00736**	-0.00280	-0.00950*	0.000996	-0.0101**	-0.00448
	(0.00267)	(0.00328)	(0.00396)	(0.00467)	(0.00466)	(0.00453)	(0.00377)
Population log	-0.0604**	-0.0687**	0.00314	-0.0580	-0.110***	-0.0217	-0.0926**
	(0.0281)	(0.0311)	(0.0540)	(0.0404)	(0.0357)	(0.0335)	(0.0424)
Income per capita log	0.0429**	0.0532**	0.0450*	0.0426*	0.000109	0.0238	0.0424
	(0.0198)	(0.0257)	(0.0243)	(0.0221)	(0.0343)	(0.0288)	(0.0317)
VC log	0.000280	0.0000690	0.000261	0.000518**	0.0000288	0.000317	0.0000867
	(0.000234)	(0.000797)	(0.000189)	(0.000210)	(0.000264)	(0.000238)	(0.000678)
House price index change	0.0163***	0.0155***	0.0222***	0.0225***	0.0151**	0.00846	0.0162***
	(0.00361)	(0.00422)	(0.00651)	(0.00504)	(0.00591)	(0.0143)	(0.00467)
State FE	✓	✓	✓	✓	✓	✓	✓
Annual FE	✓	✓	✓	✓	✓	✓	✓
Observations	350	175	175	175	175	175	175

Table 4. Entry and employment at entrants by size

This table reports coefficients, standard errors, and statistical significance from WLS regressions of the firm entry rate by firm size (columns 1–2) and entering firms' net job creation rate by firm size (3–4), estimated using the state-year-size sample described in Section 3. The key explanatory variable is the state-level treated fraction of accredited investors after Dodd-Frank (After×Frac), and (in columns 2 and 4) its interaction with indicators for firm size categories. Regressions also include annual state-level control variables (log population, log income per capita, log venture capital volume, and house price index change), state-fixed effects, year-fixed effects, and firm size indicators (1–4 employees and 5–9 employees; 10+ employees is omitted). Columns 2 and 4 also include interactions of the firm size indicators with a post-Dodd Frank indicator and with the state-level treated fraction of accredited investors. Variables are calculated as described in Section 3. Standard errors clustered by state are reported in parentheses. Significance levels are indicated by *, **, *** for 10%, 5%, and 1% respectively.

	(1) Entry	(2) Entry	(3) Net job creation	(4) Net job creation
After×Frac	-0.00184**	0.000306	0.000496	0.00173*
	(0.000836)	(0.000585)	(0.000366)	(0.000967)
1-4	0.0502***	0.0459***	-0.00708***	-0.00893***
	(0.00185)	(0.00603)	(0.000379)	(0.00128)
5-9	0.00110***	-0.000409	-0.00886***	-0.0103***
	(0.000194)	(0.000330)	(0.000410)	(0.00138)
1-4×After		0.00148		0.00167***
		(0.00109)		(0.000304)
5-9×After		0.000867***		0.00158***
		(0.000243)		(0.000341)
1-4×Frac		0.0114		0.00329
		(0.0141)		(0.00296)
5-9×Frac		0.00349***		0.00234
		(0.000985)		(0.00319)
1-4×After×Frac		-0.00476*		-0.00185**
		(0.00264)		(0.000868)
5-9×After×Frac		-0.00167***		-0.00184*
		(0.000543)		(0.000999)
Annual state-level controls	✓	✓	✓	✓
State FE	✓	✓	✓	✓
Annual FE	✓	✓	✓	✓
Observations	1050	1050	1050	1050

Table 5. Employment at incumbents by size

This table reports coefficients, standard errors, and statistical significance from WLS regressions of the rates by firm size of net job creation at young incumbent firms aged 1–5 years (columns 1 and 3), net job creation at older incumbents aged ≥6 years (2 and 4), job creation at young incumbents (5), and job destruction at young incumbents (6). All are estimated using the state-year-size sample described in Section 3. The key explanatory variable is the state-level treated fraction of accredited investors after Dodd-Frank (After×Frac), and (in columns 3–6) its interaction with indicators for firm size categories. Regressions also include annual state-level control variables (log population, log income per capita, log venture capital volume, and house price index change), state-fixed effects, year-fixed effects, and firm size indicators (1–4 employees and 5–9 employees; 10+ employees is omitted). Columns 3–6 also include interactions of the firm size indicators with a post-Dodd Frank indicator and with the state-level treated fraction of accredited investors. Variables are calculated as described in Section 3. Standard errors clustered by state are reported in parentheses. Significance levels are indicated by *, **, *** for 10%, 5%, and 1% respectively.

	(1) NJC, Young	(2) NJC, Old	(3) NJC, Young	(4) NJC, Old	(5) JC, Young	(6) JD, Young
After×Frac	0.0131	0.00271	-0.0185	-0.00245	0.00435	0.0229
	(0.0148)	(0.0101)	(0.0142)	(0.00598)	(0.00869)	(0.0145)
1-4	0.109***	0.0240***	0.148***	0.0374***	0.154***	0.00636
	(0.00497)	(0.00214)	(0.0150)	(0.00724)	(0.00986)	(0.00916)
5-9	0.0214***	-0.0366***	0.0261***	-0.0365***	0.0347***	0.00862
	(0.00308)	(0.00118)	(0.00945)	(0.00529)	(0.00413)	(0.00767)
1-4×After			-0.0517***	-0.0259***	-0.0283***	0.0235***
			(0.00836)	(0.00755)	(0.00633)	(0.00758)
5-9×After			-0.0189*	-0.00146	-0.00851**	0.0104
			(0.00951)	(0.00588)	(0.00353)	(0.00878)
1-4×Frac			-0.0569	-0.00650	-0.0258	0.0310
			(0.0383)	(0.0175)	(0.0258)	(0.0243)
5-9×Frac			-0.00571	0.00310	0.00389	0.00960
			(0.0220)	(0.0108)	(0.00846)	(0.0181)
1-4×After×Frac			0.0586***	0.0174	0.0293**	-0.0293*
			(0.0182)	(0.0161)	(0.0145)	(0.0164)
5-9×After×Frac			0.0364*	-0.00189	0.0118	-0.0246
			(0.0190)	(0.0123)	(0.00845)	(0.0199)
Annual state-level controls	✓	✓	✓	✓	✓	✓
State FE	✓	✓	✓	✓	✓	✓
Annual FE	✓	✓	✓	✓	✓	✓
Observations	1050	1050	1050	1050	1050	1050

Table 6. Employment at entrants by industry

This table reports coefficients, standard errors, and statistical significance from WLS regressions of the net job creation rate at firms aged 0–1 years by industry, estimated using the state-quarter-industry sample described in Section 3. The key explanatory variable is the state-level treated fraction of accredited investors after Dodd-Frank (After×Frac), and (in columns 2–4) its interactions with indicators for various industry characteristics (highly funded by venture capital, requiring high startup capital, highly concentrated). Regressions also include annual state-level control variables (log population, log income per capita, log venture capital volume, and house price index change), state-fixed effects, quarter-fixed effects, and industry-fixed effects. Columns 2–4 also include interactions of indicators for various industry characteristics with a post-Dodd Frank indicator and with the state-level treated fraction of accredited investors. Variables are calculated as described in Section 3. Standard errors clustered by state are reported in parentheses. Significance levels are indicated by *, **, *** for 10%, 5%, and 1% respectively.

	(1)	(2)	(3)	(4)
After×Frac	-0.00671	-0.0106*	-0.0118**	-0.0116**
	(0.00416)	(0.00549)	(0.00563)	(0.00574)
Low VC industry×After		-0.00267		
		(0.00197)		
Low VC industry×Frac		-0.0263*		
		(0.0143)		
Low VC industry×After×Frac		0.00821*		
		(0.00459)		
Concentrated industry×After			-0.00329*	
			(0.00171)	
Concentrated industry×Frac			-0.00997	
			(0.0144)	
Concentrated industry×After×Frac			0.00726**	
			(0.00325)	
High cap industry×After				-0.00466*
				(0.00248)
High cap industry×Frac				-0.0229
				(0.0194)
High cap industry×After×Frac				0.0110*
				(0.00628)
Annual state-level controls	✓	✓	✓	✓
State FE	✓	✓	✓	✓
Quarterly FE	✓	✓	✓	✓
Industry FE	✓	✓	✓	✓
Observations	20869	20869	15768	20869
p-val: $\beta_{\text{Aft}\times\text{Frac}} + \beta_{\ldots\text{industry}\times\text{Aft}\times\text{Frac}} = 0$		0.522	0.355	0.887

Table 7. Wages at entrants

This table reports coefficients, standard errors, and statistical significance from WLS regressions of the ratio of the average wage per worker (of the worker type defining each column) at firms aged 0–1 years to the average wage per worker for workers of the same type at all firms in the same industry, state, and quarter, estimated using the state-quarter-industry sample described in Section 3. The key explanatory variables are the state-level treated fraction of accredited investors after Dodd-Frank (After×Frac), and (in Panel B) its interactions with an indicator for lower-skill industries (those with an above-median fraction of total employees with less than a high school diploma). All regressions also include annual state-level control variables (log population, log income per capita, log venture capital volume, and house price index change), state-fixed effects, quarter-fixed effects, and industry-fixed effects. Panel B also includes interactions of the lower-skill industry indicator with a post-Dodd Frank indicator and with the state-level treated fraction of accredited investors. Variables are calculated as described in Section 3. Standard errors clustered by state are reported in parentheses. Significance levels are indicated by *, **, *** for 10%, 5%, and 1% respectively.

(a) Worker demographics

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
		Education			Age			
	Overall	<HS	<College	College	18–34	35–44	45–54	55–64
After×Frac	-0.0641**	-0.0370	-0.0516*	-0.0742*	-0.0450**	-0.0437	-0.0972**	-0.138***
	(0.0253)	(0.0222)	(0.0257)	(0.0414)	(0.0193)	(0.0365)	(0.0434)	(0.0458)
Controls (incl. FE)	✓	✓	✓	✓	✓	✓	✓	✓
Observations	17876	8773	15965	11726	14345	12408	11769	8891

(b) Worker demographics and industry skill

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
		Education			Age			
	Overall	<HS	<College	College	18–34	35–44	45–54	55–64
After×Frac	-0.159**	-0.100*	-0.127*	-0.316**	-0.106**	-0.143	-0.312*	-0.415***
	(0.0661)	(0.0595)	(0.0662)	(0.148)	(0.0517)	(0.128)	(0.157)	(0.132)
Lower skill industry×After	-0.0513*	-0.0571**	-0.0632**	-0.171**	-0.0283	-0.0475	-0.115*	-0.157***
	(0.0266)	(0.0217)	(0.0248)	(0.0691)	(0.0190)	(0.0523)	(0.0639)	(0.0545)
Lower skill industry×Frac	-0.143**	-0.0594*	-0.0605	-0.200	-0.0770*	-0.259**	-0.292**	-0.327***
	(0.0576)	(0.0309)	(0.0440)	(0.138)	(0.0394)	(0.122)	(0.126)	(0.108)
Lower skill industry×After×Frac	0.176**	0.102	0.138*	0.449**	0.109*	0.177	0.380*	0.477**
	(0.0850)	(0.0705)	(0.0796)	(0.223)	(0.0621)	(0.170)	(0.210)	(0.183)
Controls (incl. FE)	✓	✓	✓	✓	✓	✓	✓	✓
Observations	17876	8773	15965	11726	14345	12408	11769	8891
p-val: $\beta_{\text{Aft}\times\text{Frac}} + \beta_{\text{Lower}\times\text{Aft}\times\text{Frac}} = 0$	0.525	0.924	0.610	0.132	0.868	0.479	0.249	0.355