# Venture Capital Investment Strategies under Financing Constraints: Evidence from the 2008 Financial Crisis

Annamaria Conti*

Nishant Dass†

Stuart J.H. Graham‡

**ABSTRACT**

This paper employs the 2008 financial crisis as an empirical setting to show that, while predictably venture capitalists (VCs) reduce investment, they lean towards startups operating in the VCs' core sectors. These effects are driven by more-experienced VCs, and are strongest for early-stage startups. These findings are robust to controlling for VC-times-startup fixed effects, and time-variant VC and startup characteristics. Complementing these results, we find superior *ex post* performance among crisis-funded startups operating in more-experienced VCs' core sectors.

**Keywords**: Financial Crises, Investment Decisions, Venture Capital, Value of Firms, Startups

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* Corresponding author. Annamaria.Conti@scheller.gatech.edu. Scheller College of Business, Georgia Institute of Technology, 800 W. Peachtree St. NW, Atlanta, GA 30308 USA.

† Scheller College of Business, Georgia Institute of Technology. Nishant.Dass@scheller.gatech.edu.

‡ Scheller College of Business, Georgia Institute of Technology. Stuart.Graham@scheller.gatech.edu.

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## ABSTRACT

This paper employs the 2008 financial crisis as an empirical setting to show that, while predictably venture capitalists (VCs) reduce investment, they lean towards startups operating in the VCs' core sectors. These effects are driven by more-experienced VCs, and are strongest for early-stage startups. These findings are robust to controlling for VC-times-startup fixed effects, and time-variant VC and startup characteristics. Complementing these results, we find superior *ex post* performance among crisis-funded startups operating in more-experienced VCs' core sectors.



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# 1. Introduction

Financial crises are seminal events, introducing shocks that ripple through the economy (Bernanke, 1983). The venture capital industry is not immune and venture capitalists (VCs) must periodically respond to these market-wide disruptions. This paper examines the investment strategies that VCs employ in response to financial crises, and their impact on the subsequent performance of the VCs' portfolio startups. Although financial crises tighten VCs' budget constraints, the effects such shocks have on VCs' investment strategies have not been widely studied. While VCs will predictably reduce their aggregate investments (Townsend, 2015), little is known about the way VCs allocate their diminished budgets among portfolio startups, and whether their investment strategies vary with their own and startup characteristics.

In general, financial crises can affect investors by imposing constraints from the supply side (capital liquidity) or demand side (investment opportunities). For example, the financial crisis following the collapse of the technology bubble in early 2000 imposed a demand side effect triggered by changing firm characteristics (Townsend, 2015). The 2008 financial crisis – and its influence on the venture capital (VC) industry into 2009 – was different in that capital commitments to US venture funds from major contributors collapsed, falling from 28.6 billion USD in 2008 to 15.2 billion USD in 2009 – a 47% reduction.[1] The effect this collapse had on the VC industry bears all the hallmarks of a supply-side liquidity shock on VCs. As such, it provides us with a unique empirical setting in which to explore the influence of supply shocks on VC investment behavior and portfolio dynamics.

A liquidity supply shock influences VCs' aggregate portfolio investment due to unexpected difficulties in raising new funds, finding suitable syndication partners willing to infuse capital, and successfully exiting from prior investments when IPO and acquisition markets weaken (Townsend, 2015; Nanda and Rhodes-Kropf, 2015). But how does a liquidity supply shock affect the *composition* of VCs' portfolio?

In answering this question, we build on research showing that a distinguishing feature of VCs is the amount of screening and monitoring capital they allocate to their portfolio startups (Bernstein *et al.*, 2015)

[1] U. Gupta, "Back to the future for venture capital," *Institutional Investor* (Feb. 5, 2010).

and that a significant fraction of this capital is sector-specific (Gompers and Lerner, 2004). VCs face a tradeoff between investing in sectors where they have developed an expertise and taking advantage of investment opportunities that may occur outside of these sectors (Stein, 1997). During normal times, it is possible that the tradeoff is resolved in favor of greater sector diversification to the extent that the abundance of capital offsets the risk of experimenting in sectors where VCs have developed little screening and monitoring skills. However, liquidity supply shocks may shift the balance towards investing in core sectors, given that the lack of capital increases the costs of failing.

In Figure 1, we plot aggregate VC investments in US startups over the 40 quarters from 2005 to 2014. These data show not only that the 2008 financial crisis dramatically impacted the VC industry, with funding levels falling by about half, but also that this industry was affected with a lag relative to the rest of the financial market. This result is consistent with a contraction in the supply of capital from foundations and endowments following their deep financial losses in 2008.[2]

Because we are interested in studying how VCs respond to supply-side shocks, in our empirical analysis we must rule out possible demand-side explanations for the sharp reduction in aggregate venture capital investments in 2009. One concern is that any modifications in VCs' investment behavior may be the result of changes in the aggregate demand for funding, prompted by the economic recession that started at the end of 2007[3]. However, we note that prior research by Haltiwanger *et al.* (2012) and Fairlie *et al.* (2015) employing data from both the US Census Bureau and the Kauffman Foundation shows that there is no decline in startup activity coinciding with the 2009 VC funding contraction.

Another concern may be that startups active during the financial crisis may have been intrinsically different from startups operating in "normal" times. For instance, one may be concerned that the proportion of startups founded by unemployed individuals may be higher during the financial crisis period than normal times. We address this concern in several ways. First, we exclude from our main analyses startups founded in 2009, based on evidence that their founders were most sensitive to employment conditions in 2008.

[2] See http://www.nacubo.org/Business_Officer_Magazine/Magazine_Archives/March_2016/Cool_Down.html.
[3] According to the NBER, the recession ran from December 2007 to June 2009 (http://www.nber.org/cycles.html).

However, because existing startups – depending on their characteristics – may have suffered from deteriorating employment conditions differently, we include fine-grained controls for these startups' characteristics in our regressions. Further, in estimating the amount allocated to a startup per round, we exploit the fact that startups can have multiple rounds with their VCs. This allows us to include VC-times-startup fixed effects to control for any remaining unobservable characteristics of the VC-startup pair; this is analogous to the firm-times-loan type fixed effects in Khwaja and Mian (2008). Finally, we show that – consistent with a supply-side effect – the reduction in VCs' portfolio sizes following the financial crisis is more accentuated among VCs near the end of their fund-raising cycle. Such VCs tend to be more financially-constrained (Townsend, 2015).

To assess whether VCs react to liquidity supply shocks by concentrating investments where they possess expertise, we allow the VCs' prior investment patterns to reveal their "core sector(s)". We define core sector(s)[4] as those in which VCs have invested the greatest number of their prior funding rounds. Our results show that, during the liquidity crisis, the *total* number of funding rounds invested by the VCs declined by 12%. However, the number of funding rounds invested by the VCs in *core sectors* increased by 6% relative to the mean. This "going to the core" effect is primarily driven by investments in early-stage startups.

We next consider the per-round *amount* of investment made by the VCs. In our baseline empirical specification, we find a reduction of about 10% in the amounts allocated per round. However, VC funding per round is about 6% higher for startups in the VCs' core sectors. The VCs' strategy of "doubling down on core sectors" is again driven by early-stage startups. During the financial crisis, VC funding to early-stage startups operating *within* the VCs' core sectors is 19% *higher* compared to non-core sectors. Notably, we find that per-round VCs' allocations decline during the financial crisis for all later-stage startups, irrespective of whether they operate inside or outside the VCs' core sectors. In normal times, however, startups operating in their VCs' core sectors do not receive preferential funding; this suggests that VCs opt

[4] In our sample 67% of VCs have one core sector and 97% of the VCs have no more than two core sectors.

for greater sector diversification during normal times. Overall, these results are consistent with the conjecture that when financial resources become tight, the marginal benefit that VCs derive from investing in core-sector startups increases, and this is especially true for early-stage companies where information problems are higher (Gompers, 1995).

Building on these findings, the next question we ask is: are there any differences between experienced and less-experienced VCs with regard to their "go to the core" strategy during liquidity supply shocks? The existing literature has shown that experienced VCs possess larger endowments of screening and monitoring capital than less experienced VCs (Sørensen, 2007). As such, they should derive relatively larger benefits from investing in their core sectors, especially when they invest in early-stage startups, which suffer from more severe information problems. Consistent with this conjecture, we find that the baseline results are driven by more-experienced VCs and by their investments in early-stage startups. During the financial crisis, the *number* of funding rounds invested by more-experienced VCs in their core sectors increases by 5% relative to the mean, while the coefficient for less-experienced VCs is zero. The effect for more-experienced VCs is driven by investments in early-stage startups. Similarly, we find that while more-experienced VCs allocate 23% more per round during the financial crisis to their core-sector startups, less-experienced VCs do not exhibit any such preference for startups in their core sectors. The effects for more experienced VCs are twice as large when they invest in early-stage startups.

Finally, these results lead us to examine the performance of startups that raise at least one funding round during the financial crisis. Given the more-experienced VCs' advantages in overcoming information problems, we expect that startups in their core sectors will outperform other startups. This should be especially true in the case of early-stage startups for which the screening and monitoring skills of more-experienced VCs are more valuable. Consistent with these conjectures, among early-stage startups that received funding during the financial crisis, the likelihood of having a successful exit is 21 percentage points higher for core-sector startups relative to non-core startups funded by more-experienced VCs; it is also 11 percentage points higher relative to startups funded by less-experienced VCs. We find similar performance gains when examining startups' valuations at exit and their patent output.

This paper contributes to several different strands of the literature. First, we extend a growing body of theoretical and empirical work examining the VCs' optimal portfolio allocation (Kanniainen and Keuschnigg, 2003; Fulghieri and Sevilir, 2009; Kaplan and Schoar, 2005). This literature has analyzed the VCs' optimal portfolio size that results from solving a tradeoff between the number of startups to include in the portfolio and the amount of financial and non-financial resources to invest in each startup. In contrast, we focus on a different tradeoff VCs face: whether to allocate more resources to startups in their core sectors to resolve information problems or to capture the benefits of sector diversification that VCs forgo by focusing on the core. Importantly, we also show that VCs solve their tradeoff differently, depending on whether they are operating in normal times or facing a liquidity supply shock. Finally, we show that VCs' optimal strategies also vary by their levels of experience.

Second, we contribute to the empirical literature examining how the financing environment influences startup outcomes (Kerr and Nanda, 2009; Nanda and Rhodes-Kropf, 2013; Townsend, 2015). In particular, Nanda and Rhodes-Kropf (2013) show that the increased financing risk during cold markets induces VCs, especially more-experienced VCs, to invest in less innovative projects. In contrast, our focus is on how liquidity supply shocks affect VCs' choice of investing in their core sectors. We show that these shocks increase VCs' costs of experimenting in sectors outside of their core and enhance the marginal value of their sector-specific screening and monitoring skills. This is particularly true for experienced VCs, which tend to be better at screening and monitoring (Sørensen, 2007).

Finally, we advance the literature studying the effects of the 2008 financial crisis (Mian and Sufi, 2010; Campello *et al.*, 2010; Duchin *et al.*, 2010; Ivashina and Scharfstein, 2010). While research shows that VCs generate substantial economic impact by facilitating innovation, increasing employment and aggregate income (Kortum and Lerner, 2000; Samila and Sorenson, 2011), the effect of financial crises on VC investing is largely unknown. To the best of our knowledge, this paper is the first to analyze the impact of the 2008 financial crisis on the venture capital industry.

## 2. Motivation

It is well known that VCs' investment portfolios include a relatively large number of startups and that VCs face tradeoffs when allocating their limited resources to portfolio startups (Sahlman, 1990). An important tradeoff that VCs face in choosing their optimal portfolio is whether to invest in sectors where they have developed an expertise or take advantage of opportunities that may arise outside of these sectors. Stein (1997), for example, argues that diversification across industries leads to efficient capital allocation because, when investment opportunities are poor in one industry, firms can compensate by making good investments in other industries. This tradeoff is brought into sharper relief during liquidity supply shocks.

To understand how VCs may solve this tradeoff differently depending on the availability of capital, it is important to recognize that a distinguishing characteristic of VCs is their screening and monitoring skills (Bernstein *et al.*, 2015) and these skills tend to be sector-specific (Gompers and Lerner, 2004). VCs can use their screening and monitoring skills in sectors where they have greater expertise to more efficiently select their investments and nurture their portfolio startups. As a part of their monitoring, VCs could adopt this strategy to also highlight their certification role in relation to less informed investors (Megginson and Weiss, 1991). However, extending the arguments of Stein (1997) to the VC market suggests that the downside of this focus on core sectors is that VCs may forgo attractive investment opportunities outside of their core sectors.

When there is abundance of capital, we would expect VCs to hold a more diversified portfolio by experimenting in sectors outside of their core, i.e., sectors in which they have limited screening and monitoring skills. This is because they can count on the expertise of syndicate partners and because the cost of failing is relatively low (Nanda and Rhodes-Kropf, 2015). If one of the VCs' investments fails, they can still replenish their capital pool by raising new funds and successfully exiting from their other investments (Townsend, 2015). Conversely, during liquidity supply shocks, VCs would concentrate their investments in their core sectors, given that failure imposes high costs due to VCs' budget constraints.

Research has shown that VCs differ in the amount of non-financial capital they can invest in their portfolio startups (Chemmanur *et al.*, 2011), with experienced VCs possessing larger endowments of such capital (Sørensen, 2007). When exploring VCs' optimal portfolio strategies following a supply shock, investing experience becomes a consequential factor as it enhances the benefits that VCs derive from concentrating on their core sectors. It does so by reducing the costs of screening and monitoring portfolio investments. Relatedly, experienced VCs also certify the quality of their startups more efficiently because of the reputation capital they have accumulated through past investments (Chemmanur and Loutskina, 2006).

Because experienced VCs derive higher marginal benefits from investing in their core sectors than less-experienced VCs, we expect that they will respond to liquidity supply shocks by making portfolio choices that favor startups operating in their core sectors. Conversely, because less-experienced VCs lack these advantages in screening and monitoring, they – akin to individual investors in stock markets – will be more likely to hold diversified portfolios.

# 3. Data

## 3.1. Sample construction

To examine VC investment strategies during capital supply shocks, we focus on the recent financial crisis and draw data on VCs, startups, and financing rounds from the Thomson Venture Economics (TVE) database.[5] To build the sample that we use in our main analyses, we employ two separate snapshots of TVE collected in October 2008 and April 2015. We do so because the accuracy of data on variables such as the startups' founding date, executive rosters, and geographical location is significantly better in 2008. Additionally, using the 2008 snapshot offers information on VCs and their investments just prior to the financial crisis hitting the industry.

[5] Data from TVE have been used in a number of venture capital studies (see, for instance, Kaplan and Schoar, 2005). Gompers and Lerner (2004) and Kaplan *et al.* (2002) report that this database includes a comprehensive set of venture capital investments.

We begin with a population of 30,781 US-based startups listed in the 2015 TVE database and raised at least one round of private equity funding by the end of 2014. We retain 6,891 startups that include founding dates and financing round records, and which had raised at least one funding round during 2005Q1-2010Q1 (inclusive). Choosing this sample period allows us to analyze investor strategies in the years before and after the 2009 VC-industry financial crisis, thus mitigating bias arising from time trends over longer sample periods. We truncate the sample in 2010 to provide sufficient time to evaluate startups' future performance.

These 6,891 startups received funds from 900 different "lead investors," which we define as VCs that invested in the largest number of funding rounds of a focal startup. In 76% of the sample, we record startups having a single lead investor. We exclude 402 startups having corporate venture capital (CVC) lead investors to focus exclusively on the strategies of independent VCs.[6] We retain 5,214 startups founded after 1989, both because TVE records on lead investors prior to 1990 are considerably noisy, and because "mature" companies are by definition not startups.

Finally, we merge these 2015 data with information retrieved in the TVE 2008 snapshot. After algorithmically matching and manually re-checking company names in each dataset, we find matches for approximately 71% of our 2015 sample. By overlapping these two samples, we limit ourselves to studying startups founded no later than 2008. Our final sample includes 3,676 startups that received funding from 632 lead VCs across 10,272 financing rounds. In Section 6, we present and discuss robustness tests using the entire sample of startups, including those founded in 2009 and those from our 2015 snapshot that are not identifiable in the 2008 TVE data. Our results remain unchanged.

One may worry that the startups listed in the 2008 TVE dataset but not recorded in the 2015 dataset are predominantly startups that went bankrupt by 2015. However, Conti and Graham (2016) randomly select 30 out-of-sample startups and find that bankrupt startups are as likely to appear in the out-of-sample as startups that either were acquired by October 2016 or are still active. These results are confirmed by an

[6] Independent VCs were likely more exposed to the 2009 liquidity shock compared to CVCs who can rely on internal capital markets. Prior literature also distinguishes between these two VC types; for example, Da Rin *et al.* (2011) argue that CVCs commonly invest in startups to gain complementary technology.

analogous experiment conducted by Shi *et al.* (2016), who also show that there is no systematic pattern of bankruptcies in any given year.

### 3.2. Descriptive statistics

As shown in Table 1, the startups in our sample are distributed across several sectors: communications (8%), computer hardware (4%), computer software (26%), internet (21%), energy (4%), semiconductors (8%), life science (22%), health services (1%), and the remainder (6%) in consumer-related sectors. These startups are on average aged 6 years as of 2008 (median 5 years), 56% were located in Massachusetts or California in 2008, and in their 2008 management rosters, 63% listed a technology executive and 40% listed a sales or marketing executive. Finally, 24% raised at least one funding round during the VC-industry financial crisis (2009Q1–2010Q1). We base the timing and duration of the VC-industry financial crisis on data provided by the National Venture Capital Association (NVCA), which is reported in Figure 1.

[Insert Figure 1 and Table 1 about here]

To assess how VCs respond to liquidity shocks, we compare both the number of funding rounds and the amount invested per round by lead VCs during the financial crisis as against normal times. We report descriptive statistics in Table 2, and definitions of all variables in Appendix A.

As shown in Panel A of Table 2, the average number funding rounds invested by lead VCs during the financial crisis (0.94) is lower than in normal times (1.21). As Panel B reports, the average amount of funding per round that startups receive during the crisis is $10.03 million compared to $9.48 million during normal times, although the median amount allocated during normal times is larger ($6.05 million) relative to crisis quarters ($6.00 million). VCs also tend to concentrate investment in relatively mature startups during a supply shock: startups funded during the financial crisis are older (approximately 6 years versus 4 years during normal times), and show greater cumulative funding across more funding rounds compared to VC investments made during normal times (cumulative funding: $33.72 million versus $20.18 million; number of funding rounds: 5 versus 4).

Panel C of Table 2 reports the outcome variables for startups, starting from the likelihood that a startup has a successful exit by September 2015 (either IPO or acquisition). Approximately 45% of startups in our

sample had a successful exit. This share decreases slightly to 43% among startups that raise funding during the financial crisis. For those startups showing a successful exit by September 2015, we gather information on the valuation at exit from Dow Jones Venture Source; we find valuation information only for 53% of our sample startups that had a successful exit. As shown, the average valuation at exit is higher among startups receiving funding during the financial crisis ($380.59 million) as against those receiving funding only during normal times ($201.14 million); sample medians also reflect this pattern.

Finally, we complement our main dataset with information on US patents granted to our sample startups. We match company names in our sample with "assignee" names listed in the US Patent & Trademark Office (USPTO) database. During the financial crisis, VCs tend to invest in startups with a larger innovation output (as proxied by the number of applications for patents that are eventually granted). However, funded startups produce fewer patents in the two years following a round awarded in the financial crisis compared to normal times.

[Insert Table 2 about here]

Histograms reported in Figures 2, 3, and 4 show the main data patterns for selected outcomes. In these figures, we restrict attention to early-stage startups because, as we report later, they drive our main results. We distinguish between funding from more- versus less-experienced lead VCs, as well as between startups operating in their lead VCs' core sectors versus others. Within each category, we distinguish between rounds that occur during the financial crisis as against those in normal times.

Figure 2 represents the natural logarithm of the investment amount received by startups in a given round. During the financial crisis, more-experienced lead VCs allocate 23% more funding per round to startups in their core sectors, but decrease per-round funding amounts by 4% to startups operating outside these sectors. Among less-experienced lead VCs, per-round funding for startups decreases in both categories: by 14% in core sectors and by 15% in other sectors.

Figure 3 depicts the percentage of startups that have a successful exit by September 2015 (IPO or acquisition). As before, we distinguish between startups that receive funding from more- versus less-experienced lead VCs, as well as between startups operating in VCs' core sectors versus others. Within

each category, we distinguish between startups that raise at least one round during the financial crisis from those that do not. Among startups raising funds in the financial crisis, those operating in the core sectors of more-experienced VCs outperform these same VCs' non-core investments by 8 percentage points, and also outperform all startups funded by less-experienced VCs by 5 percentage points, on average.

Finally, Figure 4 reports the natural logarithm of the number of patent applications (eventually granted) by startups in the two years following a given round. Among the startups raising funding during the financial crisis, we find a similar pattern to our other performance results: patenting activity is highest among startups operating in the core sectors of more-experienced VCs.

[Insert Figures 2, 3, and 4 about here]

# 4. VC investment strategies

## 4.1. The effect of liquidity supply shocks on VC portfolio size

In this section, we investigate the baseline effect of VCs investing during the financial crisis. In separate equations, we examine changes in both the VCs' number of investments (in terms of funding rounds) and the amount invested in each startup-round. The first equation we estimate is:

$$\#\ VC\ investments_{i,t} = \alpha + \beta_1 Financial\_Crisis_t + \beta_2 Controls_{i,t} + \gamma_i + \tau + \varepsilon_{j,t}. \quad (1)$$

In this model, each observation corresponds to a lead venture capitalist ("lead VC" henceforth) *i* in quarter *t*. The dependent variable, $\#\ VC\ investments_{i,t}$, is the natural logarithm of the number of funding rounds invested by the lead VC *i* during quarter *t*. The independent variable of interest, $Financial\_Crisis_t$, is an indicator variable that denotes the liquidity supply shock which affected the VC industry; it equals one for VC investments made during the five quarters comprising the VC-market contraction (2009Q1 to 2010Q1), and zero otherwise. The timing and duration of the financial crisis in the VC industry is based on information available from the NVCA (see Figure 1). $Controls_{i,t}$ includes the lead VC's overall experience and sector-specific experience, as proxied by the aggregate and sector-specific number of funding rounds (in natural logarithm), respectively, invested by lead VC *i* (as lead VC) in the 10 years preceding quarter *t*. Lead VC fixed effects are denoted by $\gamma_i$ and, finally, $\tau$ is a logarithmic time trend to control for (non-linear)

time-series variations. Results change neither when we add a linear trend, nor when we apply higher-order polynomial trends.

Panel A of Table 3 reports the results from estimating equation (1) for the number of funding rounds invested by the lead VCs in a quarter. Standard errors are clustered by lead VC. As reported, the coefficient $\beta_1$ on $Financial\_Crisis_t$ is negative and statistically significant at the 1% level. The estimate indicates that the number of funding rounds that VCs complete decreases by 12% during the crisis. Next, we disaggregate the influence on relatively early-stage startups (where we expect information problems to be exaggerated) from the influence on later-stage startups. "Early-stage" startups are defined as startups receiving their first financing round in 2005 or later, although our findings are robust to several different definitions of early-stage. As shown in columns II and III, the decline in VC investment during the crisis is more concentrated among early-stage startups. In fact, during the financial crisis, the number of VC funding rounds declines by 13% for early-stage startups and by only 5% for later-stage startups; this difference between early- and late-stage startups is statistically significant. This analysis suggests that during a liquidity shock, VCs favor investing in longer-established startups where information problems are less severe.

Next, we estimate the following regression model to examine the effect that a liquidity supply shock has on the amount invested by lead VCs in their startups:

$$Round\_Amount_{j,i,r} = \alpha + \beta_1 Financial\_Crisis_r + \beta_2 Controls_{j,i,r} + \phi_y + \delta_k + \lambda_r + \gamma_i + \tau + \varepsilon_{j,i,r}. \quad (2)$$

Each observation corresponds to a round $r$ raised by a startup $j$ funded by lead VC $i$. $Round\_Amount_{j,i,r}$ is the natural logarithm of the amount of funding that startup $j$ receives from lead VC $i$ in round $r$. As mentioned earlier, we assume the largest contributor to round $r$ is the lead VC $i$. The independent variable of interest is $Financial\_Crisis_r$, defined as an indicator that equals one if a given round $r$ occurred during 2009Q1–2010Q1; it is zero otherwise. $\phi_y$ denotes fixed effects for the year in which the startup is founded; $\delta_k$ denotes fixed effects for startup $j$'s sector $k$; $\lambda_r$ denotes fixed effects for the round type (i.e., seed, early stage, later stage, and expansion); $\gamma_i$ represents lead VC fixed effects; and $\tau$ denotes a logarithmic time trend. By including lead VC fixed effects, the indicator $Financial\_Crisis_r$ captures within lead VC variations in

the amounts allocated to portfolio startups, according to whether or not these startups received funding during the financial crisis.

$Controls_{j,i,r}$ is a vector of control variables for startup *j*, lead VC *i*, and round *r*. The vector captures aspects of startup *j*'s intrinsic quality and its investment-round characteristics by including: the natural logarithm of the cumulative funding amount a startup received prior to round *r;* the natural logarithm of the number of granted patents for which the startup applied prior to round *r*; an ordinal variable for the startup's round number; and the natural logarithm of the count of investing firms participating in round *r*. We also employ data from our 2008 TVE snapshot to control for additional relevant organizational characteristics of startup *j*. We measure a startup's proximity to having products or services on sale in the market with an indicator for whether a startup reported a marketing executive in its 2008 management roster. As an indicator of the startup's technology and science focus, we include an indicator variable for whether the startup listed a technology executive in 2008. For other organizational attributes, we include the startup's number of board members in 2008. In addition, we control for the geographic distance between a lead VC and the startup, thereby capturing the influence the lead VC's proximity may have on the startup's performance.[7] We also control for the experience of lead VCs by including the aggregate number of round investments made as lead VCs in the 10 years preceding the quarter in which round *r* occurs.

Finally, we include a measure – denoted as $Core_{j,i,r}$ – for whether a startup *j* operates in the core sector(s) of lead VC *i* at the time of round *r*. It is defined as an indicator variable that equals one if, during the 10 years prior to the quarter of round *r*, the number of funding rounds invested by the lead VC *i* in startup *j*'s sector is the largest among all sectors in which the lead VC invested. According to this measure, 44% of the sample financing rounds are led by VCs specializing in a startup's sector. This percentage increases to 51 for startups raising rounds during the financial crisis (Table 2). For robustness, we employ alternative

[7] To compute the geographic distance between a startup and its lead VC, we match the latitude and longitude coordinates for each individual zip code of the startup's headquarters and the closest branch office of the lead VC. We then use great circle distance formula to calculate mileage between two pairs of latitudes and longitudes.

definitions to define VCs' core sectors, such as using a continuous variable reflecting the percentage of investments made in the past by a given lead VC in startup *j*'s sector. Regardless of the definition used, our findings are qualitatively unchanged. The results are also robust to employing a five-year time window (instead of ten years) to measure a lead VC's experience in a given sector.

Panel B of Table 3 reports the results from estimating equation (2) for the funding amount that startup *j* receives in round *r* from lead VC *i*. Standard errors are clustered by lead VC. In column Ia, the estimated coefficient $\beta_1$ for $Financial\_Crisis_r$ is negative and significant at the 5% level, and the magnitude suggests that funding round amounts decline by about 7% during the financial crisis. Again, we disaggregate the effect on relatively early-stage startups from others. The results reported in columns IIa and IIIa indicate that the decline in per-round funding is 4% for early-stage startups and 10% for later-stage startups. The difference in effects is not statistically significant at conventional levels (*p*-value: 0.44).[8]

The estimated coefficients on the control variables are also illuminating. In describing them, we refer to column Ia, which presents the results for the full sample of funded startups. As expected, we find that the number of investors per round, cumulative startup funding, granted patents, and lead VC experience are each positively associated with the funding amount raised by startup *j* in round *r*. A startup's organizational development, as indicated by the presence of a marketing executive and a technology executive, as well as its board size (as measured in 2008), is also positively related with the funding amount in round *r*. Additionally, startups that are geographically distant from their lead VCs receive more funds, suggesting a selection effect whereby lead VCs – due to screening and monitoring costs increasing with distance – will invest in more-distant startups only when they guarantee higher expected payoffs.

[Insert Table 3 about here]

[8] We discuss the results reported in columns Ib, IIb, and IIIb in the next subsection.

### 4.2. Ruling out demand side explanations

One concern with estimating equations (1) and (2) is that even though VCs encountered a profound liquidity contraction in the most recent financial crisis, a simultaneous demand-side shock may be affecting our estimates. We deal with this concern in several ways. One possibility is that potential new entrepreneurs accurately forecasted the effects of the 2008 financial crisis on the VC industry in 2009, refrained from founding startups in 2009, thus driving down demand for VC funding. For this scenario to hold, would-be entrepreneurs would need to not only correctly forecast the start date but also the duration of the capital contraction in the VC industry, both of which are highly unlikely. Accordingly, economy-wide evidence reported in the 2015 Kauffman Foundation survey (Fairlie *et al*., 2015) shows that the US startup founding rate attributable to new entrepreneurs having at least a high school degree did not change substantially during 2008 or 2009. While new firm creation does increase among founders having less than a high school degree, such firms are an unlikely demand driver for VC funding (since high-technology startups represent 95% of our sample).

To corroborate the arguments we made above, we re-estimate equations (1) and (2) after limiting the sample to only high-technology startups, thus dropping observations identified by Thomson Reuters as "non-high-technology" (mostly in consumer-related sectors). As shown in Table 4, the results are similar to those reported earlier. In terms of the number of (only high-technology) funding rounds invested by lead VCs during the crisis (column I of Panel A), the coefficient on *Financial_Crisis* remains negative and significant at the 1% level; the magnitude is also unchanged, indicating a decline of 12%. When we consider the average funding amount per round, the coefficient on *Financial_Crisis* is negative and significant at the 5% level (column I of Panel B), with the magnitude being very similar to that reported in Table 3. In additional robustness tests unreported here, we again segment early-stage from late-stage startups, and re-run all the models: the results do not meaningfully change in comparison to those reported in Table 3.

Another possible source of demand-side bias would arise if a meaningful number of VC-funded startups ceased operations in response to the economic recession, thereby inducing the decline in VC-industry investments that we observe in 2009 (Figure 1). According to a US Census Bureau 2012 report (Haltiwanger

*et al*., 2012), while the US sustained a declining trend in job creation attributable to startups, that trend began at the end of 2006, before the economic recession started at the end of 2007. If this decline indicates possible demand-side bias in our results, we would expect to observe a contraction in cumulative VC investment beginning earlier than 2009, but in fact total investments were generally stable or growing quarter-on-quarter prior to 2009. The deep contraction in aggregate VC investments that began in the first quarter of 2009 is not otherwise explained by any observed structural break in the US Census data. As reported in Haltiwanger *et al*. (2012), the Census data show no particular change in the rate of decline in US job creation by startups in either 2008 or 2009.

Additionally, it is possible that the effects reported in Table 3 are the result of changes in high-technology startups' characteristics during the recent financial crisis. Such changes could be explained if those losing employment during the economic recession responded by becoming entrepreneurs and founding new ventures. Such individuals may be disproportionately responsible for altering startup characteristics during an economic downturn (Audretsch and Keilbach, 2008), and may differ in important respects from those who found startups in normal times. However, according to the 2015 Kauffman Foundation report (Fairlie *et al*., 2015), employment conditions in 2008 mostly affected the entrepreneurs who founded startups in 2009. As explained in subsection 3.1, our main sample consists of startups founded prior to 2009, which addresses the above concern. Moreover, our specifications control for a large set of startup attributes, including their financial characteristics, patent output, and organization structure, which capture important aspects of startups.

Fundamentally, in estimating equation (2), we exploit the fact that portfolio startups can have multiple rounds with their lead VC. This allows us to include lead VC-times-startup fixed effects to control for any remaining unobservable lead VC-startup characteristics. The results with these fixed effects are reported in columns Ib, IIb, and IIIb of Table 3, Panel B. Standard errors are double-clustered by lead VC as well as startup. With the addition of lead VC-times-startup fixed effects, the indicator *Financial_Crisis* captures the *within* lead VC-startup difference in per-round funding during the financial crisis relative to normal times. As shown in column Ib of Table 3, Panel B, the estimated coefficient $\beta_1$ for *Financial_Crisis* remains

negative and significant, and the magnitude increases from 7% to almost 19%. Again, we disaggregate the effect on relatively early-stage startups from others. The results reported in columns IIb and IIIb indicate that the decline in per-round funding is larger for later-stage startups than for early-stage startups, although the difference in effects is not statistically significant at conventional levels. These results do not qualitatively change when we employ a less restrictive set of fixed effects and include separate fixed effects for lead VCs and startups. With separate fixed effects for lead VCs and startups, the magnitude of $\beta_1$ for *Financial_Crisis* is 18% (standard error is 0.05), and we continue to observe no statistically significant differences in the amounts allocated to early- and later-stage startups. In the analyses that follow, we prefer to use lead VC-times-startup fixed effects because some unobservables are likely to be specific to the lead VC-startup dyad.

Startups may require more VC investment during a financial crisis because their internally-generated cash flows, whether from technology licensing or product-market sales, will likely be depressed. The resulting excess demand for VC capital is a source of positive correlation between the VC funds that startups receive during the financial crisis and the financial crisis itself. This implies that the negative effects of the financial crisis reported in Table 3 may, in fact, be biased downwards. Consequentially, even if the demand for funds by startups increased during the most recent crisis, we are confident that our estimates suggest a lower bound for the effect of receiving VC funds during a financial crisis.

We report a final robustness check in columns II and III of Table 4, Panels A and B. We re-estimate equations (1) and (2) to predict the portfolio choices of VCs, differentiating between investments made by lead VCs near the beginning of their fundraising cycle in the focal quarter versus those near the end of that cycle. In performing this analysis, we consider only those VC funds for which we are able to identify a start date, thus retaining 96% of our observations. The rationale for this test is that financial constraints are more pronounced for VCs later in their fundraising cycle due to the shrinking pool of uninvested capital (Townsend, 2015). While we do not find significant differences in the number of funding rounds invested by VCs in a crisis (Panel A, Table 4), we do find an interesting pattern in the amount of funding allocated (Panel B). Specifically, the $Financial\_Crisis_r$ coefficient is zero for lead VCs in their funds' early stages,

but negative and significant for lead VCs in their funds' late stages. This latter finding is consistent with the notion that liquidity supply shocks disproportionately influence the portfolio choices of financially-constrained VCs.

[Insert Table 4 about here]

### 4.3. Responding to liquidity supply shocks: Investing in core sectors

We now explore the prediction that VCs react to liquidity supply shocks by concentrating their investments in their core sectors. This is driven by the VCs' higher costs during a financial crisis from experimenting in sectors where they have lesser screening and monitoring skills. As such, the VCs' opportunity costs of concentrating their investments in the core sectors should decline during a financial crisis. To test this prediction, we begin by estimating the following regression model:

$$\#\ Core\ Investments_{i,t} = \alpha + \beta_1 Financial\_Crisis_t + \beta_2\ \#\ Investments_{i,t} + \beta_3 Controls_{i,t} + \gamma_i + \tau + \varepsilon_{i,t}. \quad (3)$$

The dependent variable in (3) is the number of funding rounds invested by a lead VC *i* in its core sectors during quarter *t*. To mitigate the influence of outliers, we winsorize this variable at the 99 percent level. As before, we define "core sectors" according to the most common investment sector of lead VC *i* in the ten years prior to quarter *t*. Because we want to specifically assess the effect of the financial crisis on the decision of VCs to concentrate their investments in core sectors, we control for the total number of funding rounds invested by VCs in each quarter (denoted as $\#\ Investments_{i,t}$). In the $Controls_{i,t}$ vector, we include the percentage of the total number of funding rounds that a lead VC *i* invested in quarter *t* in the following broad sectors: life sciences and medical services, computer-related sectors, and non-high technology sectors. These controls as well as $\#\ Investments_{i,t}$ allow us to minimize the influence of unobserved factors that are possibly correlated with the demand for capital by startups. All the other regressors in the $Controls_{i,t}$ vector and fixed effects are identical to those defined in equation (1).

The results from estimating equation (3) are reported in Panel A of Table 5. In support of the idea that the VCs' opportunity costs of investing in their core sectors decrease during liquidity supply shocks, we find that the number of funding rounds in a lead VC's core sectors increases by 0.03 during the financial

crisis (column I). This estimate, which is significant at the 5% level, represents a 6% increase relative to the mean number of lead VC funding rounds in core sectors.

Because early-stage startups are characterized by relatively greater information problems (Gompers, 1995), we distinguish the investment strategies of VCs in early- versus later-stage startups. If VCs concentrate their investments in their core sectors to address information problems, then we should observe this behavior to be accentuated in early-stage startups where these problems are more prevalent. In columns II and III of Panel A, we modify the dependent variable in equation (3), and consider the number of funding rounds invested by lead VC *i* in its core sectors during quarter *t*, first only in early-stage startups (column II) and then only in later-stage startups (column III). As before, we define a startup as "early stage" if it raises its first financing round in 2005 or later, and as "later stage" if its first financing round was in 2004 or earlier. In support of our conjecture, we find that our baseline effects are in fact driven by investments in early-stage startups. The coefficient estimates reported in column II indicate that, during the financial crisis, the number of early-stage funding rounds in a lead VC's core sectors increases by 8% relative to the mean. Conversely, the effect of the financial crisis on the number of late-stage funding rounds in a lead VC's core sectors is zero.

Next, we modify equation (2) by introducing an interaction term between the $Financial\_Crisis_r$ indicator and a variable capturing whether startup *j* operates in its lead VC's core sectors at the time of round *r*. The model we estimate is:

$$Round\_Amount_{j,i,r} = \alpha + \beta_1 Financial\_Crisis_r + \beta_2 Core_{j,i,r} + \beta_3 Financial\_Crisis_r \text{ x } Core_{j,i,r} + \beta_4 Controls_{j,i,r} + \phi_y + \delta_k + \lambda_r + \gamma_i + \tau + \varepsilon_{j,i,r}. \quad (4)$$

The variable $Core_{j,i,r}$ is defined as an indicator that equals one if the number of funding rounds invested by the lead VC *i* in startup *j*'s sector during the 10 years prior to the quarter of round *r* is the largest of any sector that the lead VC invested in. All other regressors in equation (4) are identical to those listed in equation (2).

In Panel B of Table 5, we report the results from estimating equation (4). We begin by discussing the results obtained from including lead VC fixed effects in equation (4). Although the estimate of $\beta_3$ on the

interaction term is positive (as expected), it is not significantly different from zero (column Ia). However, when we re-estimate equation (4) for only early-stage startups (column IIa), we find that during the financial crisis, VC funding is about 19% higher for those early-stage startups operating within the VCs' core sectors and the effect is statistically significant. Column IIIa shows that later-stage startups receive no preference from their lead VCs, regardless of whether or not they operate in the VCs' core sectors. Notably, we find that the estimated coefficient on $Core_{j,i,r}$ is not significantly different from zero, regardless of the sample examined. This indicates that there is no significant difference in the VCs' investments across core and non-core sectors during normal times. This finding lends support to the notion that the VCs' optimization problem differs between crisis periods and normal times

In robustness checks available upon request, we show that the results from estimating equation (4) for early-stage startups do not qualitatively change when we replace the logarithmic trend with investment quarter fixed effects. Under this specification, the magnitude of $\beta_3$ decreases slightly to 18%, with a standard error of 0.090. Additionally, the results do not qualitatively change when we interact our trend variable with sector fixed effects. In this case, the magnitude of $\beta_3$ decreases to 17%, with a standard error of 0.095.

Next, to rule out the possibility that our findings are driven by unobserved characteristics of the lead VC and startup pair, we re-estimate equation (4) by including lead VC-times-startup fixed effects. The results are reported in columns Ib, IIb, and IIIb of Table 5, Panel B. Recall that the indicator variable *Core*, which captures whether a startup operates in its lead VC's core sectors, is time-variant and its value varies depending on the number of funding rounds invested by the lead VC in the startup's sector over time. With this premise, the findings in column IIb indicate that, during the crisis quarters, an early-stage startup operating in its lead VC's core sector at the time of round *r* receives almost 19% more funds than those raised in other quarters when the startup was classified as being outside of its lead VC's core. As before, we do not find any premium for operating in the lead VC's core sector during normal times, as indicated by the estimate for $\beta_2$. Additionally, we do not find any significant effect when we examine the subsample of later-stage startups in column IIIb. The results obtained from including lead VC-times-startup fixed effects also do not change when we interact our $Financial\_Crisis_r$ indicator with a time-*invariant* measure

of *Core*. With this alternative specification, the magnitude of $\beta_3$ for the subsample of early-stage startups remains 18%, with a standard error of 0.10.

[Insert Table 5 about here]

Taken together, the estimated coefficients for equations (3) and (4) in Table 5 indicate that during the financial crisis, VCs concentrated their investments in their core sectors, particularly when funding startups in their early stages. The results on early-stage startups are consistent with VCs relying on their expertise in managing uncertainty during a liquidity supply shock. Note that the difference in VC behavior that we observe during the financial crisis relative to normal times indicates that VCs' opportunity costs of investing resources to mitigate information problems are lower during a liquidity supply shock.

Finally, the results from estimating equations (3) and (4) continue to hold when we replace the *Financial_Crisis* indicator with a binary variable that equals one during 2008Q1–2010Q1, i.e., including the broader 2008 financial crisis. These results are reported in Table B1 of Appendix B. As shown, the number of funding rounds invested by a lead VC in its core sectors increases during the financial crisis, and the effect is driven by investments in early-stage startups. Additionally, during the financial crisis, VC funding is higher for early-stage startups operating in the VCs' core sectors.

### 4.4. Investing in core sectors: More- versus less-experienced VCs

Here, we re-estimate equations (3) and (4), but distinguish between more- and less-experienced lead VCs. As mentioned earlier, VCs differ in their ability to address information problems through their screening and monitoring skills, with more-experienced VCs being more skilled relative to less-experienced VCs. Accordingly, we expect the marginal benefits for more-experienced VCs from investing in their core sectors to be larger than those for less-experienced VCs during a financial crisis. Because of their limited exposure, less-experienced VCs may do relatively better by holding a more diversified portfolio across sectors during a supply shock. This is akin to less-informed individual investors holding a diversified portfolio of stocks.

In Panel A of Table 6, we present the results from estimating equation (3) in subsamples of more- and less-experienced VCs. We classify VCs as more- or less-experienced using as a cutoff the median number of funding rounds invested by lead VCs in the 10 years prior to quarter *t*. We find that during the financial

crisis, more-experienced lead VCs invest more in their core sectors (column I), although the coefficient is not statistically significant at conventional levels. However, it is significant when we consider funding rounds invested in early-stage startups (column II). The coefficient estimate indicates that, during the financial crisis, the number of funding rounds invested by a more-experienced lead VC in its core sectors increases by 8% relative to the mean of 0.26. On the other hand, less-experienced VCs do not change their level of concentration in their core sectors during the financial crisis (column IV), regardless of whether the startups are early- or later-stage (columns V and VI, respectively).

In Panel B of Table 6, we present the results from estimating equation (4), again in subsamples of more- and less-experienced VCs. We first discuss the results from including lead VC fixed effects. We find that, during the financial crisis, more-experienced VCs allocate 23% more funds to their core-sector startups relative to other portfolio startups, and this effect is significant at the 1% level (column Ia). In line with the results in Panel A, when we distinguish between early-stage and later-stage startups, we find that the baseline results for more-experienced lead VCs are in fact driven by allocations to early-stage startups. Within the subsample of early-stage startups backed by more-experienced lead VCs, core-sector startups receive 43% more funding than other startups during the financial crisis (column IIa). But within the subsample of later-stage startups (column IIIa), we observe no funding preference for investments in core-sector startups among more-experienced VCs in response to the financial crisis. Conversely, less-experienced VCs do not show any preference for their core-sector startups (column IVa), regardless of whether the startups are early- or later-stage (columns Va and VIa, respectively). All these results remain qualitatively unchanged when we replace the logarithmic trend with quarter fixed effects or when we interact the trend variable with sector fixed effects.

The results from including lead VC-times-startup fixed effects confirm the above findings: only the more-experienced lead VCs have a preference for their core-sector startups during the financial crisis (column Ib), while less-experienced VCs maintain a more diversified portfolio along the sector dimension (column IVb). Further, these findings for more-experienced VCs are again driven by the subsample of early-stage startups (column IIb). Finally, in tests left unreported (but available upon request), we find that

– in line with a supply-side effect – these results are driven by more-experienced VCs that are near the end of their fund-raising cycle, suggesting that these effects are accentuated when the VCs are financially constrained.

[Insert Table 6 about here]

# 5. Portfolio investment outcomes: Startup performance

In this section, we investigate startup outcomes in light of our findings that, during the financial crisis, more-experienced lead VCs concentrate their investments in their core sectors, while less-experienced VCs hold a more diversified portfolio. The implication of these findings is that startups operating in the core sectors of a more-experienced VC will tend to outperform other startups, *ceteris paribus*. We analyze the outcomes of startups on three different dimensions: whether they have a successful exit, their valuation at exit, and their innovation output.

## 5.1. Likelihood of a successful exit

We start by estimating the following linear regression model to analyze the likelihood that a startup has a successful exit (i.e., it either has an IPO or is acquired):

$$Exit_j = \alpha + \beta_1 Crisis\_Funding_j + \beta_2 Core_{j,i} + \beta_3 Crisis\_Funding_j \text{ x } Core_{j,i} + \beta_4 Controls_{j,i} + \phi_y + \delta_k + \lambda_{rmin} + \gamma_i + \tau + \varepsilon_{j,i}. \quad (5)$$

The dependent variable is an indicator that equals one if the startup has an IPO or an acquisition (as of September 2015), and zero otherwise. $Crisis\_Funding_j$ is defined as an indicator variable that equals one if a startup *j* receives at least one round of funding during the financial crisis. $Core_{j,i}$ in this equation is defined as an indicator variable that equals one if the number of funding rounds invested by the lead VC *i* in startup *j*'s sector during the 10 years prior to the quarter *rmin* is the largest of any sector in which the lead VC invested. The subscript *rmin* denotes the oldest funding round we observe in the sample. $Controls_{j,i}$ includes the natural logarithms of the cumulative amount of funds a startup received prior to round *rmin*, the number of patent applications (eventually granted) made prior to *rmin* by the startup, and the number of investors that participated in *rmin*. Our controls also include an ordinal variable for a startup's round number,

indicator variables for whether the startup reported a marketing executive and a technology executive in its 2008 management roster, the number of board members reported in the 2008 TVE dataset, and the geographical distance between a startup and its lead VC. We also control for the experience level of a lead VC with the total number of funding rounds invested by the lead VC in the 10 years preceding *rmin*'s quarter. Finally, we include fixed effects for the year in which a given startup is founded ($\phi_y$), startup *j*'s sector *k* ($\delta_k$), the earliest funding round type ($\lambda_{rmin}$), and the lead VCs ($\gamma_i$). We also include a logarithmic time trend ($\tau$).

The results from estimating equation (5) are reported in Table 7. In Panel A, we present the results for the entire sample of VCs, while in Panels B and C we distinguish between more- and less-experienced lead VCs, respectively. Results in all panels are presented as follows: in odd-numbered columns, we focus on the estimate of $\beta_1$, which is the effect of raising a funding round during the financial crisis on the outcome variable; in even-numbered columns, we focus on the estimates of $\beta_1$ as well as $\beta_3$. While in columns I-II we examine the entire sample of startups, in columns III-IV and V-VI, we report the coefficient estimates in subsamples of early- and later-stage startups, respectively.

Panel A shows that the effect of receiving a funding round during the financial crisis on the likelihood of having a successful exit is not significantly different from zero (column I). This effect becomes significant at the 5% level when we examine the sub-sample of early-stage startups (column III), while it continues to be insignificantly different from zero in the case of later stage startups (column VI). These results indicate that during liquidity supply shocks, lead VCs fund early-stage startups that yield higher quality outcomes on average.

Next, we specifically assess the effect ($\beta_3$) of raising a funding round during the financial crisis for startups operating in their lead VC's core sectors. In line with our prior results, we find that – contingent on receiving in-crisis funding – the likelihood of surviving is 5 percentage points higher for startups operating in their lead VC's core sectors, although the effect is not significantly different from zero (column II). As in our other findings, the effect becomes statistically significant when we examine VCs' investments in early-stage startups (column IV). Contingent on in-crisis funding, a startup operating in its lead VC's

core sectors is almost 11 percentage points more likely to have a successful exit. We do not find superior performance for later-stage core-sector startups that raise funding during the financial crisis (column VI).

To complete our analysis, we distinguish between more-experienced VCs (Panel B) and less-experienced VCs (Panel C), in order to evaluate their different advantages in mitigating information problems. As before, VCs are classified as more- or less-experienced according to the median number of funding rounds invested by the VC in the 10 years prior to each round observed in the sample. Based on this median cutoff, a startup is considered to be funded by a more-experienced lead VC if it received funds from a more-experienced lead VC in the first round that we observe (earlier denoted as *rmin*).

We find that, conditional on in-crisis financing, the likelihood of achieving a successful exit is greater among startups operating in the core sectors of more-experienced lead VCs than for startups in core and non-core sectors of less-experienced VCs (column II of Panel B versus column II of Panel C). Again, this improvement in the performance of core-sector startups is predominantly driven by early-stage startups. In particular, early-stage startups operating in the core sectors of their more-experienced lead VCs are 21 percentage points more likely to achieve a successful exit than non-core startups funded by the same VCs (as indicated by the $\beta_3$ estimate in column IV of Panel B). Additionally, these startups are approximately 11 percentage points more likely to have a successful exit than startups funded by less-experienced lead VCs (as indicated by a test of the difference between $\beta_1 + \beta_3$ in column IV of Panel B and $\beta_1$ in column III of Panel C). The estimated $\beta_3$ in column IV of Panel C indicates that the core/non-core distinction has no effect on the likelihood of achieving a successful exit for early-stage startups funded during the financial crisis by less-experienced lead VCs. Finally, $\beta_2$ estimates in column IV of both Panels B and C indicate that, for investments made during normal times, there is no significant difference in achieving either an IPO or an acquisition by early-stage startups operating in their lead VC's core sectors, regardless of whether they are funded by more- or less-experienced lead VCs. Collectively, these results support our conjecture that, during liquidity supply shocks, startups operating in the core sectors of a more-experienced lead VC tend to outperform other startups, *ceteris paribus*. We argue that this is indicative of more-experienced

VCs' superior screening and monitoring skills, which become especially relevant during a liquidity supply shock when the costs of failure are higher.

[Insert Table 7 about here]

### 5.2. Startups' valuation at exit

The above results imply that the valuation of startups at exit should be affected similarly by conditions under which financing is raised and the type of lead VC that funds the startup. Specifically, among startups raising at least one in-crisis funding round, those operating in the more-experienced VCs' core sectors should be more likely to achieve a higher valuation at exit. We test this prediction by estimating a model that is similar to equation (5), except that the dependent variable is the startup's valuation at exit (i.e., either in an IPO or an acquisition).

Following Nanda and Rhodes-Kropf (2013), we use the pre-money valuation of startups exiting in an IPO to avoid the effect of post-IPO price run-ups. Valuation in acquisition exits is estimated by the change in equity value of the acquirer. To address the problem of outliers and inaccurate reporting of startups' valuation, we follow the literature (Nanda and Rhodes-Kropf, 2013) and discretize startups' valuations into "high" and "low" categories. As such, we define the dependent variable as an indicator that equals one if the valuation is larger than the sector median, and zero otherwise. Results from using a continuous measure of a startup's valuation at exit remain similar.

The results are reported in Table 8. The sample size is smaller (1,219 observations as opposed to the initial 2,218 observations of those lead VC funded startups experiencing an exit by September 2015) because valuation information is available for only some records. The structure of the table is as follows: in columns I and II, we present the results for the entire sample of VCs, while in columns III–VI we distinguish between more- and less-experienced lead VCs. Columns I, III, and V report the estimate of $\beta_1$, representing the effect of raising a funding round during the financial crisis on the outcome variable. In columns II, IV, and VI, we focus on the estimates of $\beta_1$ and $\beta_3$. As before, VCs are categorized into more- and less-experienced by employing as a cutoff the median number of funding rounds invested by the lead VC in the 10 years prior to each round observed in the sample. Accordingly, startups are considered to be

funded by a more-experienced lead VC if the oldest round that we observe is funded by a more-experienced lead VC. We do not separately present the results for early-stage startups because the sample including data on valuation at exit for early-stage startups is too small to produce meaningful conclusions. The set of controls we employ is identical to those in equation (5), except that we add exit-quarter fixed effects to capture economy-wide conditions at exit.

The results in column I of Table 8 show that, in general, raising at least one round of funding during the financial crisis does not have a significant effect on the startup's valuation at exit. However, the sector in which a startup operates matters. Specifically, we find that – contingent on receiving in-crisis funding – the likelihood of receiving a high valuation at exit is approximately 15 percentage points higher for startups operating in their lead VCs' core sectors relative to non-core startups (column II).

In line with our earlier findings, once we distinguish the in-crisis funding choices made by more- and less-experienced lead VCs, we find that the results are driven by more-experienced VCs. Among startups raising in-crisis funding, those operating in more-experienced VCs' core sectors perform consistently better: these investments are approximately 25 percentage points more likely to achieve a high valuation at exit relative to non-core investments made by the same VCs (as indicated by the $\beta_3$ estimate in column IV), and about 9 percentage points more likely relative to startups funded by less-experienced VCs, regardless of whether they are core or non-core startups (as indicated by a test of the difference between $\beta_1 + \beta_3$ in column IV and $\beta_1$ in column V). Consistent with our previous findings, we find no superior performance among core-sector startups funded by less-experienced VCs compared to their non-core investments during the crisis (as indicated by the $\beta_3$ estimate in column VI).

[Insert Table 8 about here]

### 5.3. Startups' patenting

To assess the impact of investor strategies on innovation, we investigate the startups' patent output. As a measure for patent output, we use the natural logarithm of the number of granted patents applied for by a startup in the two years following round *r*. By using patent application dates, we measure as much as possible the timing of new technology produced by the startup; by counting only patents that were

ultimately granted from such applications, we condition on valuable technologies. We then relate patent output to whether the startup raises in-crisis funding and whether it operates in its lead VC's core sectors. Specifically, we estimate the following regression model:

$$Patents_{j,i,r} = \alpha + \beta_1 Financial\_Crisis_r + \beta_2 Core_{j,i,r} + \beta_3 Financial\_Crisis_r \times Core_{j,i,r} + \beta_4 Controls_{j,i,r} + \phi_y + \delta_k + \lambda_r + \gamma_i + \tau + \varepsilon_{j,i,r}. \quad (6)$$

We include the same independent variables as those listed in equation (4).

The estimated results are reported in Table 9. Panel A presents results for the entire sample of VCs, while in Panels B and C, we distinguish between more- and less-experienced lead VCs, respectively. While we examine the entire sample in the first two columns of all three panels, in columns III-IV and V-VI we report the coefficient estimates in subsamples of early- and later-stage startups, respectively. In odd-numbered columns, we focus on the estimate of $\beta_1$, which measures the effect of raising a funding round during the financial crisis on patent output; in even-numbered columns, we focus on the estimates of $\beta_1$ and $\beta_3$. To be consistent with prior studies, we exclude startups operating outside high technology sectors because startup patenting in these sectors often reflects strategic motivations other than innovation *per se* (Graham and Sichelman, 2008). In this context, we also re-classify early- and later-stage startups: a startup is considered early-stage if it has not applied for a patent prior to a given round *r*. Our rationale for this reclassification is that information problems should be larger for high-technology startups that are likely to patent by default (given the nature of their industry), but have not yet applied for a patent. The correlation between this measure and our previous measure of early stage, which was based on a startup's age, is 40%.

Results presented in column I of Table 9, Panel A, show that startups' patent output in the two years following an in-crisis funding round is 12% smaller, on average, than patent output following a funding round in normal times. This difference is entirely driven by the patenting of later-stage startups (column V), and is likely due to the fact that, during the financial crisis, VCs tend to invest in startups that have already applied for a relatively large number of patents (see Table 2). Such sorting by VCs is expected during a liquidity shock because patent application records are publicly observable (Graham and Hegde, 2015) and the VCs can thus target this characteristic in startups to mitigate information problems.

Corroborating this interpretation, the estimated $\beta_3$ reported in column II shows that, following an in-crisis funding round, startups operating in their lead VC's core sectors *do not* patent more than startups operating in other sectors. However, when we restrict the analysis to early-stage startups – those that have yet to apply for patents – we find that patent output of core-sector startups increases by 4% relative to non-core startups.

To mirror previous analyses, we distinguish between startups funded by more-experienced (Panel B) and less-experienced lead VCs (Panel C). This analysis yields results that are consistent with our earlier findings. Specifically, conditional on raising a funding round during the financial crisis, we find that patent output is highest for early-stage startups which operate in the core sectors of a more-experienced lead VC. These startups apply for 6% more patents than startups operating in non-core sectors of experienced VCs (as indicated by the $\beta_3$ estimate in column IV of Panel B), and 6% more relative to startups funded by less-experienced lead VCs (as indicated by a test of the difference between $\beta_1 + \beta_3$ in column IV of Panel B and $\beta_1$ in column III of Panel C). The estimated $\beta_3$ in column IV of Panel C indicates that the core/non-core distinction has no effect in the patent output of early-stage startups funded during the financial crisis by less-experienced lead VCs. Finally, $\beta_2$ estimates in column IV of both Panels B and C indicate that, for investments made during normal times, there is no significant difference in patenting by early-stage startups operating in their lead VC's core sectors, regardless of whether they are funded by more- or less-experienced lead VCs. Collectively, these results support our earlier claim that VC strategies change during crisis periods, when compared with normal times.

[Insert Table 9 about here]

## 6. Robustness checks

In this section, we report the outcomes from performing a number of robustness checks to ensure that our main results are not sensitive to the way we define "financial crisis" funding rounds or to the sample definition we adopt. The results from performing these tests are reported in the supplemental Appendix B.

We begin by reproducing the main analyses in Table 5 after redefining the *Financial_Crisis* indicator as a dummy variable that equals one during 2008Q1–2010Q1, i.e., including the broader financial crisis;

the indicator is zero otherwise. The results are reported in Table B1. In Panel A, we report the results from re-estimating equation (3) for the number of funding rounds invested by a lead VC in its core sectors. In Panel B, we present the results from re-estimating equation (4) for the per-round amount allocated to the startups. In line with our main findings, results in Panel A show an increase in the number of funding rounds invested by VCs in their core sectors during the financial crisis. As before, these results are driven by investments in early-stage startups (column II). Additionally, we find that during the financial crisis, funding is higher for early-stage startups operating in the VCs' core sectors (columns IIa and IIb of Panel B).

In the next set of robustness checks, we include all startups that were not originally matched in the 2008 TVE dataset and also those with founding dates in 2009 or early 2010. The results are reported in Tables B2-B7.

In Panel A of Table B2, we re-estimate equation (1) relating the number of quarterly funding rounds invested by a lead VC *i* to the variable of interest, *Financial_Crisis*. In keeping with our main findings, the number of funding rounds invested by the lead VCs decreased by 8.5% during the financial crisis. In Panel B of Table B2, we re-estimate equation (2), predicting the financing amount a given startup *j* receives during round *r* from lead VC *i*. Since some data are missing in this larger sample, in this robustness check we are not able to control for whether a startup listed a marketing or a technology executive in its 2008 management roster, board size, or geographical distance from the startup's lead VC. All other controls are included. Again, the main explanatory variable is an indicator for whether the startup's funding round occurred during the financial crisis. Regardless of whether we include lead VC or lead VC-times-startup fixed effects in the regression, we continue to find that the estimated coefficient $\beta_1$ is negative and statistically significant (columns Ia and Ib, respectively). As in our main results, there is no statistically significant difference between investment amount raised by early and later-stage startups (columns IIa versus IIIa or IIb versus IIIb).

In Table B3, we assess whether lead VCs concentrate their investments during the financial crisis in their core sectors. We re-estimate equations (3) and (4), where the dependent variables are the number of

funding rounds invested by a lead VC in its core sectors and the per-round amount allocated to startups, respectively. The results from estimating equation (3) are presented in Panel A, where we report estimates for: the total number of funding rounds invested by the VCs in their core-sector startups (column I), the number of *early-stage* funding rounds invested in their core sectors (column II), and the number of *later-stage* funding rounds invested in their core sectors (column III). In line with our main results, we find an increase in the number of funding rounds invested by the VCs in their core sectors during the financial crisis, and this result is driven by investments in early-stage startups.

The results from estimating equation (4) for the per-round amount allocated to each startup are included in Panel B of Table B3. We report results for the entire sample of startups in columns Ia and Ib, and then distinguish between early-stage (columns IIa and IIb) and later-stage startups (columns IIIa and IIIb). In line with our main findings, we find that VCs allocate significantly more funds during the crisis to early-stage startups operating in their core sectors relative to the other early-stage startups. When focusing on later-stage startups, we find that in-crisis investments made by VCs in their core sectors are allocated no more funds than non-core investments; this is also consistent with our earlier findings. Note that these results hold even when we include lead VC-times-startup fixed effects (in columns Ib, IIb, and IIIb).

In Table B4, we re-estimate equations (3) and (4) distinguishing between more- and less-experienced lead VCs. Results in Panel A are obtained from estimating equation (3), while results in Panel B are from estimating equation (4). When analyzing the number of funding rounds invested by a lead VC in its core sectors (Panel A), we continue to find that the effects observed during the financial crisis are driven by more-experienced lead VCs, and by their investments in early-stage startups. In line with our main results, Panel B reports that the effect of VCs allocating more in-crisis funding to startups operating in their core sectors is driven by the behavior of more-experienced lead VCs, and is concentrated in early-stage startups.

Finally, in Tables B5-B7, we examine startups' performance outcomes, to verify that those operating in the core sectors of a more-experienced lead VC do outperform other startups *ex post*. We continue to find superior performance in these startups: results on the likelihood of a successful exit, valuation at exit, and patent output are each in line with our earlier findings.

# 7. Conclusion

Liquidity supply shocks have profound effects on the economy and the VC market is no exception. While, predictably, VCs reduce the size of their portfolio during these shocks, the fundamental question is how they selectively allocate their limited resources within their portfolio.

This paper addresses this question by focusing on the tradeoff that VCs face between investing in their core sectors of expertise (where they have screening and monitoring advantages) and taking advantage of investment opportunities that may occur outside of their core sectors. In times of abundant capital, VCs may be moved to experiment more by investing outside their core, but liquidity supply shocks increase the cost of failing and reduce VCs' opportunity costs of concentrating on their core sectors.

Employing the 2008 financial crisis as an empirical setting, we confirm that during this crisis VCs reduced the size of their portfolio investments by making smaller as well as fewer investments. Our results show that, during the financial crisis, VCs selectively allocated their limited resources to startups operating in their core sectors and that this finding is driven by early-stage startups, for which information problems are more severe.

Remarkably, when we examine the amount of cumulative investing experience that VCs possess, we discover that more-experienced VCs concentrate investments in their core sectors during the financial crisis, while less-experienced VCs opt to maintain a diversified portfolio across sectors – similar to an individual investor with little private information holding a diversified portfolio of stocks. This result is consistent with the interpretation that VCs differ in their ability to address information problems, and that more-experienced VCs have an advantage relative to less-experienced VCs in screening and monitoring.

Finally, to bring our results full circle, we find that, among startups receiving at least one funding round during the financial crisis, those operating in the core sectors of a more-experienced lead VC outperform other startups across relevant financial and non-financial output measures. Specifically, such startups are more likely to have a successful exit, higher valuation at exit, and larger innovation output in the future.

Our findings open avenues for further research. Two directions for extension are immediately clear. First, while we show that, during liquidity supply shocks, there is a decline in the opportunity costs of VCs in addressing information problems regarding their portfolio startups, we do not distinguish between the VCs' screening and monitoring roles. Further extensions could include examining the specific mechanisms through which such screening and monitoring occur. Second, while we stress that many of our results are strongest for VC investments in early-stage startups, where information problems are more profound, future studies could be directed to usefully examining other proxies for the severity of information problems; one such example is the geographic distance between VCs and their portfolio startups.

## References


Audretsch, D. B., Keilbach, M., 2008. Resolving the knowledge paradox: Knowledge-spillover entrepreneurship and economic growth. *Research Policy* 37, 1697-1705.

Bernanke, B. S., 1983. Non-monetary effects of the financial crisis in the propagation of the Great Depression. *American Economic Review* 73, 257-276.

Bernstein, S., Giroud, X., Townsend, R.R., 2015. The impact of venture capital monitoring. *Journal of Finance* 71, 1591-1622.

Campello, M., Graham, J. R., Harvey, C. R., 2010. The real effects of financial constraints: Evidence from a financial crisis. *Journal of Financial Economics* 97, 470-487.

Chemmanur, T. J., Loutskina, E., 2006. The role of venture capital backing in initial public offerings: certification, screening, or market power? *EFA 2005 Moscow Meetings Paper*.

Chemmanur, T. J., Krishnan, K., Nandy, D. K., 2011. How does venture capital financing improve efficiency in private firms? A look beneath the surface. *Review of Financial Studies* 24, 4037-4090.

Conti, A., Graham, S., 2016. Prominent investor influence on startup CEO replacement and performance. SSRN Working Paper No. 2738835.

Da Rin, M., Hellmann, T. F., Puri, M., 2011. A survey of venture capital research. *NBER Working Paper No. 17523*.

Duchin, R., Ozbas, O., Sensoy, B.A., 2010. Costly external finance, corporate investment, and the subprime mortgage credit crisis. *Journal of Financial Economics* 97, 418-435.

Fairlie, R. W., Morelix, A., Reedy, E. J., Russell, J., 2015. The Kauffman index of startup activity: National trends. Kauffman Foundation.

Fulghieri, P., Sevilir, M., 2009. Size and focus of a venture capitalist's portfolio. *Review of Financial Studies* 22, 4643-4680.

Gompers, P. A., 1995. Optimal investment, monitoring, and the staging of venture capital. *Journal of Finance* 50, 1461–1489.

Gompers, P. A., Lerner, J., 2004. The venture capital cycle. MIT Press.

Graham, S., Hegde, D., 2015. Disclosing patents' secrets. *Science* 347, 236-237.

Graham, S., Sichelman, T., 2008. Why do start-ups patent? *Berkeley Technology Law Journal* 23, 1063-1097.

Haltiwanger, J., Jarmin, R., Miranda, J., 2012. Business dynamics statistics briefing: Where have all the young firms gone? *US Census Bureau Business Dynamics Statistics Report*.

Ivashina, V., Scharfstein, D., 2010. Bank lending during the financial crisis of 2008. *Journal of Financial Economics* 97, 319-338.

Kanniainen, V., Keuschnigg, C., 2003. The optimal portfolio of start-up firms in venture capital finance. *Journal of Corporate Finance* 9, 521-534.

Kaplan, S. N., Strömberg, P., Sensoy, B., 2002. How well do venture capital databases reflect actual investments? *SSRN Working Paper No. 939073.*

Kaplan, S. N., Schoar A., 2005. Private equity performance: returns, persistence, and capital flows. *Journal of Finance* 60, 1791-1823.

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

Khwaja, A.I. and Mian, A., 2008. Tracing the impact of bank liquidity shocks: Evidence from an emerging market. *American Economic Review* 98, 1413-1442.

Kortum, S., Lerner, J., 2000. Assessing the contribution of venture capital to innovation. *Rand Journal of Economics* 31, 674-692.

Megginson, W. L., Weiss, K. A., 1991. Venture capitalist certification in initial public offerings. *Journal of Finance* 46, 879-903.

Mian, A., Sufi, A., 2010. The Great Recession: Lessons from microeconomic data. *American Economic Review* 100, 51-56.

Nanda, R., Rhodes-Kropf, M., 2013. Investment cycles and startup innovation. *Journal of Financial Economics* 110, 403-418.

Nanda, R., Rhodes-Kropf, M., 2015. Financing risk and innovation. *Management Science, forthcoming*.

Sahlman, W. A., 1990. The structure and governance of venture-capital organizations. *Journal of Financial Economics* 27, 473-521.

Samila, S., Sorenson, O., 2011. Venture capital, entrepreneurship, and economic growth. *Review of Economics and Statistics* 93, 338-349.

Shi, Y., Sorenson, O., Waguespack, D. M.,2016. The stability of centrality-based competitive advantage. *Sociological Science*, DOI: 10.15195/vX.aY.

Sørensen, M., 2007. How smart is smart money? A two-sided matching model of venture capital. *Journal of Finance* 62, 2725-2762.

Stein, J. C., 1997. Internal capital markets and the competition for corporate resources. *Journal of Finance*, 52, 111-133.

Townsend, R. R., 2015. Propagation of financial shocks: The case of venture capital. *Management Science* 61, 2782-2802.

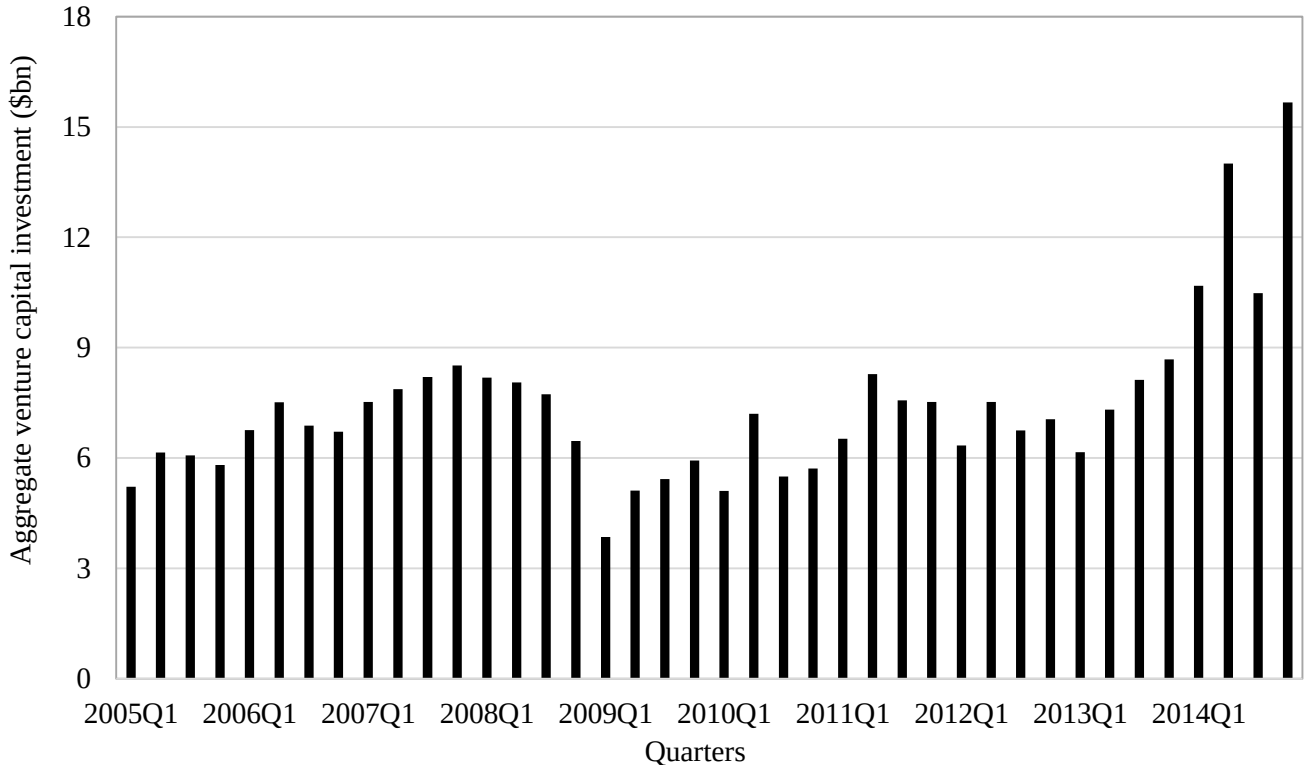


**Figure 1: Venture capital investments in portfolio companies, 2005-2014.** This figure reports aggregate VC funding invested in US startups, by quarter, collected from the National Venture Capital Association.

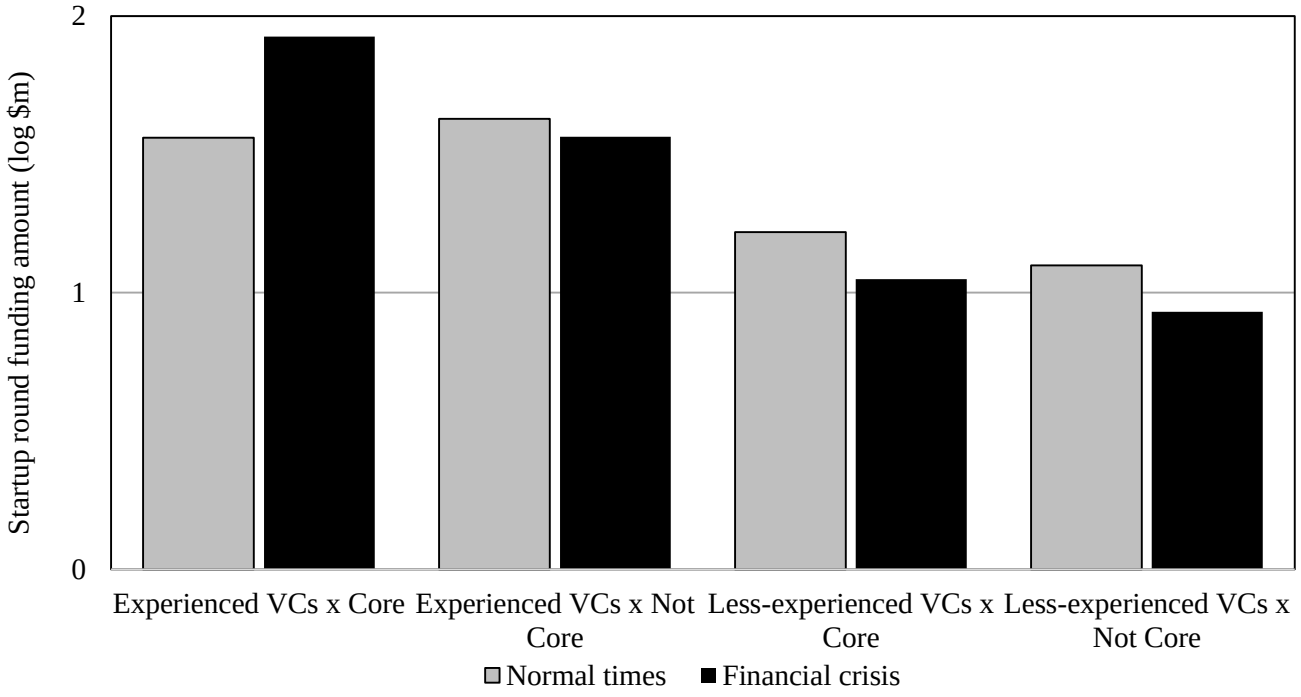


**Figure 2:** Lead VCs' investments made in startups operating in core sectors. This figure compares the average funding round investment (log $m) made by VCs in their portfolio startups during the 2008 financial crisis as against "normal time" quarters. The different subsamples are: (i) Experienced VCs x Core - Experienced VCs and startups that operate in the core sectors of the lead VC; (ii) Experienced VCs x Not Core - Experienced VCs and startups that operate outside the core sectors of the lead VC; (iii) Less-experienced VCs x Core - Less-experienced VCs and startups that operate in the core sectors of the lead VC; (iv) Less-experienced VCs x Not Core - Less-experienced VCs and startups that operate outside the core sectors of the lead VC.

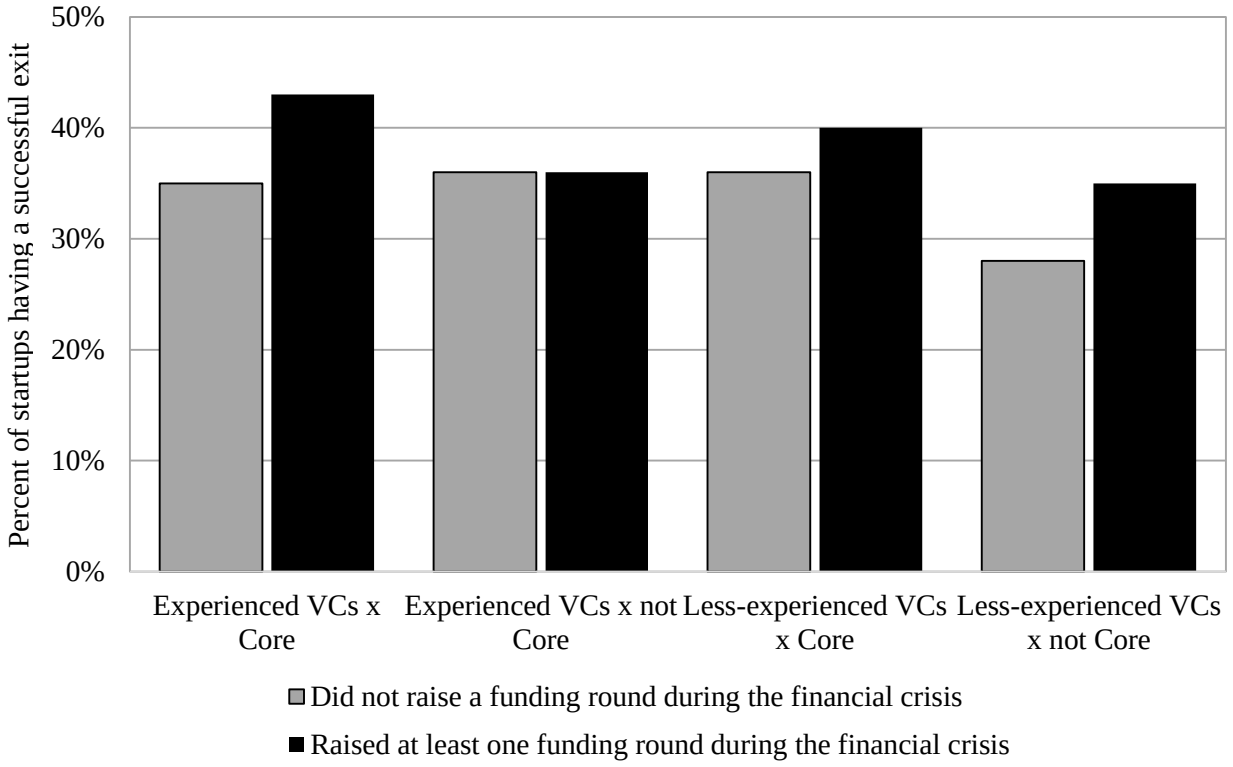


**Figure 3: Likelihood of a startup having a successful exit.** This figure compares the likelihood that a startup has a successful exit by September 2015, contingent on raising or not raising at least one round of funding during the 2008 financial crisis. The different subsamples are: (i) Experienced VCs x Core - Experienced VCs and startups that operate in the core sectors of the lead VC; (ii) Experienced VCs x Not Core - Experienced VCs and startups that operate outside the core sectors of the lead VC; (iii) Less-experienced VCs x Core - Less-experienced VCs and startups that operate in the core sectors of the lead VC; (iv) Less-experienced VCs x Not Core - Less-experienced VCs and startups that operate outside the core sectors of the lead VC.

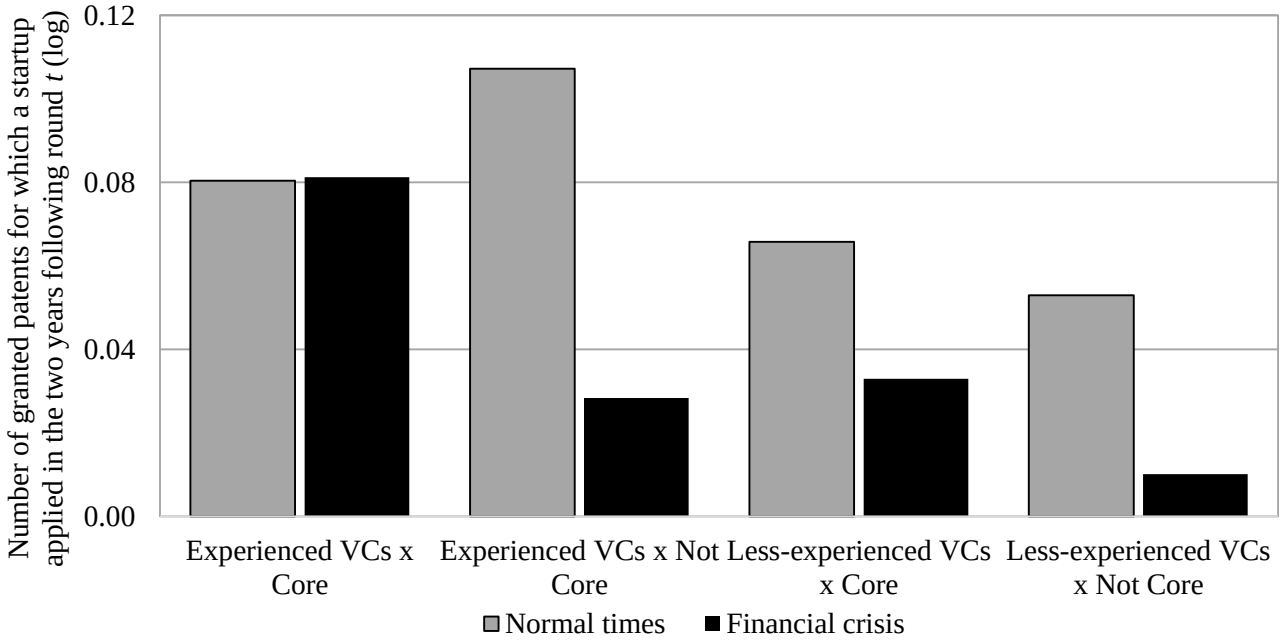


**Figure 4: Startups' patenting.** This figure compares startups' patenting output following an in-crisis round against patenting output during normal times. The different subsamples are: (i) Experienced VCs x Core (ii) Experienced VCs x Not Core; (iii) Less-experienced VCs x Core; (iv) Less-experienced VCs x Not Core.

**Table 1 – Characteristics of sample startups.** This table reports descriptive statistics of the 3,676 startups in our sample. Funding rounds during the financial crisis are those that took place in 2009Q1–2010Q1, which marks the period that affected the VC industry most adversely. Data on startups' location, age, their personnel composition, and the size of their board is available from the 2008 Thomson's Venture Economics (TVE) database. The source for the remaining data is the 2015 TVE database. Regarding the geographical distance between a startup and its lead VC, if a startup reports more than one lead VC, then the mean value of the geographical distance is weighted by the number of lead VCs. We only report the mean because the median for most variables is zero.

| | **Mean** |
|---|---|
| Startup experienced either an IPO or an acquisition, by September 2015 | 0.45 |
| Startup was financed at least once during the financial crisis | 0.24 |
| Startup age, as of 2008 | 5.78 |
| Listed a technology executive in 2008 | 0.63 |
| Listed a marketing executive in 2008 | 0.40 |
| Board size | 4.23 |
| Startup-VC geographical distance, as of 2008 (miles) | 704.89 |
| Located in Massachusetts, as of 2008 | 0.12 |
| Located in California, as of 2008 | 0.44 |
| *Industry sectors:* | |
| Life Sciences | 0.22 |
| Communications and Media | 0.08 |
| Computer Hardware | 0.04 |
| Computer Software and Services | 0.26 |
| Consumer Related | 0.06 |
| Industrial/Energy | 0.04 |
| Internet | 0.21 |
| Health Services | 0.01 |
| Semiconductors | 0.08 |

**Table 2 – Descriptive statistics.** Panel A of this table reports descriptive statistics at the lead VC-quarter level. Financial crisis quarters are: 2009Q1–2010Q1. Panel B reports descriptive statistics at the lead VC-startup-round level. Financial crisis rounds are the ones that took place during 2009Q1–2010Q1. Lead VCs are defined as those VCs that invested in the largest number of funding rounds of a given startup. If a startup reports more than one lead VC, then its financing rounds are counted as many times as the number of lead VCs. Panel C reports descriptive statistics at the lead VC-startup level, distinguishing between startups that did and did not raise at least one financing round during the financial crisis. Definitions of all variables are provided in Appendix A.

**Panel A**

| | **Financial crisis (N=1,560)** | | | **Normal times (N=7,267)** | | |
|---|---|---|---|---|---|---|
| | **Mean** | **Median** | **SD** | **Mean** | **Median** | **SD** |
| # VC investments (in terms of startup rounds) | 0.94 | 1.00 | 1.19 | 1.21 | 1.00 | 1.69 |
| # VC investments in early-stage startups | 0.39 | 0.00 | 0.69 | 0.46 | 0.00 | 0.83 |
| # VC investments in later-stage startups | 0.55 | 0.00 | 0.86 | 0.74 | 0.00 | 1.23 |
| # investments in a VC's core | 0.48 | 0.00 | 0.78 | 0.52 | 0.00 | 0.91 |
| # early-stage investments in a VC's core | 0.21 | 0.00 | 0.49 | 0.19 | 0.00 | 0.49 |
| # later-stage investments in a VC's core | 0.27 | 0.00 | 0.55 | 0.32 | 0.00 | 0.69 |

**Panel B**

| | **Rounds during the financial crisis (N=1,467)** | | | **Rounds in normal times (N=8,805)** | | |
|---|---|---|---|---|---|---|
| | **Mean** | **Median** | **SD** | **Mean** | **Median** | **SD** |
| Round amount ($m) | 10.03 | 6.00 | 13.79 | 9.48 | 6.05 | 11.24 |
| Number of investors per round | 2.46 | 2.00 | 1.48 | 2.50 | 2.00 | 1.55 |
| # investors per round | 2.46 | 2.00 | 1.48 | 2.50 | 2.00 | 1.55 |
| Round number | 5.19 | 5.00 | 2.64 | 3.56 | 3.00 | 2.42 |
| Lead VC's Expertise | 61.58 | 36.00 | 67.14 | 52.94 | 30.00 | 59.19 |
| VC's Experience | 248.04 | 177.00 | 242.90 | 225.92 | 154.00 | 231.28 |
| Core | 0.51 | 1.00 | 0.50 | 0.43 | 0.00 | 0.50 |
| Cumulative funding stock prior to round *r* ($m) | 33.72 | 20.58 | 38.90 | 20.18 | 8.80 | 30.05 |
| Cumulative # granted patents applied for prior to round *r* | 8.62 | 1.00 | 23.91 | 6.59 | 0.00 | 18.47 |
| # granted patents applied for in the two years following round *r* | 0.89 | 0.00 | 5.22 | 1.51 | 0.00 | 5.41 |
| Startup age at round *r* | 5.97 | 5.00 | 3.29 | 4.34 | 4.00 | 3.14 |

**Panel C**

| | **Startups that reported at least one financing round during the financial crisis (N=1,311)** | | | **Startups that did not report any financing round during the financial crisis (N=3,635)** | | |
|---|---|---|---|---|---|---|
| | **Mean** | **Median** | **SD** | **Mean** | **Median** | **SD** |
| Startups that had a successful exit (IPO or acquisition) | 0.43 | 0.00 | 0.49 | 0.45 | 0.00 | 0.50 |
| Startup Patents | 8.50 | 1.00 | 23.67 | 6.16 | 0.00 | 16.15 |
| Valuation at exit ($m)* | 380.59 | 151.60 | 1076.72 | 201.14 | 92.50 | 328.38 |

* for those 1,219 lead VC-startups for which we have this information.

**Table 3 – Financial crisis and lead VCs' investment strategies.** Panel A of this table reports OLS estimates of equation (1) coefficients. The dependent variable is the number of funding rounds invested by VCs (as lead VCs) in a given quarter. In column I, we count the total number of funding rounds, while in columns II and III, we count the number of funding rounds in early-stage and later-stage startups, respectively. Early-stage startups are those startups that raised their first funding round in 2005 or later. Later-stage startups are those that raised their first funding round in 2004 or before. Panel B reports OLS estimates of equation (2). The dependent variable is the amount of funding that a startup receives from its lead VC in a given round. In columns Ia-Ib, we consider the entire sample, while in columns IIa-IIb and IIIa-IIIb, we examine rounds raised by early-stage and later-stage startups, respectively. The independent variable of interest in both panels is *Financial Crisis*, which is an indicator that equals one for quarters during the financial crisis, and zero otherwise. In Panel A, standard errors (in parentheses) are clustered by lead VC. In Panel B, standard errors (in parentheses) are clustered by lead VCs in columns Ia, IIa, and IIIa while they are double-clustered by lead VC and startup in columns Ib, IIb, and IIIb. *, **, and *** denote significance at the 10%, 5%, and 1% level. Definitions of all variables are provided in Appendix A.

**Panel A**

| | **# VC investments (log)** | **# VC early-stage investments (log)** | **# VC later-stage investments (log)** |
|---|---|---|---|
| | (I) | (II) | (III) |
| Financial Crisis | -0.1234*** | -0.1336*** | -0.0545*** |
| | (0.0115) | (0.0113) | (0.0115) |
| VC's experience (log) | 0.0449** | -0.0048 | 0.0572*** |
| | (0.0192) | (0.0159) | (0.0158) |
| Trend (log) | -0.0503*** | 0.0523*** | -0.0914*** |
| | (0.0079) | (0.0078) | (0.0081) |
| Constant | 0.1949*** | 0.0422 | 0.1609*** |
| | (0.0464) | (0.0406) | (0.0397) |
| Controls for Lead VC's experience in each sector | YES | YES | YES |
| VC FE | YES | YES | YES |
| R-squared | 0.5518 | 0.1584 | 0.3264 |
| Observations | 8,827 | 8,827 | 8,827 |

**Panel B**

| | All startups | | Early-stage startups | | Later-stage startups | |
|---|---|---|---|---|---|---|
| | (Ia) | (Ib) | (IIa) | (IIb) | (IIIa) | (IIIb) |
| Financial Crisis | -0.0741** | -0.1860*** | -0.0421 | -0.1217* | -0.1001** | -0.2378*** |
| | (0.0364) | (0.0554) | (0.0647) | (0.0693) | (0.0440) | (0.0752) |
| # investors per round (log) | 0.6945*** | 0.7769*** | 0.7237*** | 0.7492*** | 0.6891*** | 0.7857*** |
| | (0.0280) | (0.0414) | (0.0445) | (0.0602) | (0.0349) | (0.0511) |
| Core | -0.0220 | 0.0419 | -0.0322 | -0.0126 | -0.0166 | 0.0628 |
| | (0.0273) | (0.0586) | (0.0436) | (0.0788) | (0.0350) | (0.0922) |
| VC's experience (log) | 0.0566* | 0.1538*** | 0.0650 | 0.0872 | 0.0731 | 0.1996*** |
| | (0.0337) | (0.0557) | (0.0530) | (0.0817) | (0.0600) | (0.0741) |
| Cumulative funding stock (log) | 0.0753*** | -0.2741*** | 0.0059 | -0.3033*** | 0.1371*** | -0.3915*** |
| | (0.0165) | (0.0268) | (0.0319) | (0.0382) | (0.0238) | (0.0472) |
| Round number | -0.0854*** | 0.0716*** | -0.0703** | 0.1431*** | -0.0837*** | 0.0635** |
| | (0.0103) | (0.0213) | (0.0303) | (0.0370) | (0.0118) | (0.0279) |
| Cumulative patents granted (log) | 0.1007*** | 0.3013*** | 0.0955*** | 0.2555*** | 0.0946*** | 0.3563*** |
| | (0.0106) | (0.0634) | (0.0278) | (0.0836) | (0.0122) | (0.0919) |
| Listed a technology executive | 0.1046*** | | 0.0918* | | 0.0630 | |
| | (0.0340) | | (0.0523) | | (0.0457) | |
| Listed a marketing executive | 0.0575* | | 0.1133** | | 0.0284 | |
| | (0.0310) | | (0.0463) | | (0.0412) | |
| Board size | 0.0297*** | | 0.0124 | | 0.0379*** | |
| | (0.0081) | | (0.0128) | | (0.0110) | |
| Startup-VC geographical distance | 0.0112* | | 0.0241** | | 0.0004 | |
| | (0.0062) | | (0.0105) | | (0.0082) | |
| Located in Massachusetts | 0.0232 | | -0.0072 | | 0.0385 | |
| | (0.0454) | | (0.0763) | | (0.0557) | |
| Located in California | 0.0840** | | 0.0797 | | 0.0818* | |
| | (0.0366) | | (0.0650) | | (0.0463) | |
| Trend (log) | -0.0025 | -0.0471 | -0.0606 | 0.0533 | 0.0087 | -0.0207 |
| | (0.0183) | (0.0381) | (0.0403) | (0.0782) | (0.0236) | (0.0450) |
| Constant | -0.3004 | | -0.0589 | | -0.3301 | |
| | (0.2711) | | (0.3875) | | (0.5014) | |
| VC FE | YES | | YES | | YES | |
| Sector FE | YES | | YES | | YES | |
| Round-stage FE | YES | YES | YES | YES | YES | YES |
| Startup start-year FE | YES | | YES | | YES | |
| VC x Startup FE | | YES | | YES | | YES |
| R-squared | 0.2193 | 0.6989 | 0.1807 | 0.6983 | 0.2271 | 0.6894 |
| Observations | 10,272 | 8,735 | 4,009 | 3,290 | 6,263 | 5.085 |

**Table 4 – Addressing demand-side explanations.** Panel A of this table reports OLS estimates of equation (1) coefficients. The dependent variable is the number of funding rounds invested by VCs (as lead VCs) in a given quarter. Panel B reports OLS estimates of equation (2). The dependent variable is the amount of funding that a startup receives from its lead VC in a given round. The independent variable of interest in both panels is an indicator that equals one for the five quarters during the financial crisis, and zero otherwise (*Financial Crisis*). In column I of both panels, we limit the analysis to investments in high-technology startups. In columns II and III, we distinguish between lead VCs that are early and later in their fundraising cycle. To make this distinction, we only examine investments by those funds for which we could identify a start date. When a lead VC's investments in a given quarter are drawn from multiple funds, we compute the average age of the funds during that quarter. A lead VC is considered to be late in its fundraising cycle if the average age of its funds is above the sample median; otherwise it is considered to be early in its fundraising cycle. Standard errors (in parentheses) are clustered by lead VC. *, **, and *** denote significance at the 10%, 5%, and 1% level. Definitions of all variables are provided in Appendix A.

**Panel A: # VC investments (log)**

| | | **Distinguishing between VCs that are early or later in their fundraising cycle** | |
|---|---|---|---|
| | **Investments in high-technology startups** | **VCs early in their fundraising cycle** | **VCs later in their fundraising cycle** |
| | (I) | (II) | (III) |
| Financial Crisis | -0.1220*** | -0.1524*** | -0.1266*** |
| | (0.0113) | (0.0178) | (0.0168) |
| Controls | YES | YES | YES |
| VC FE | YES | YES | YES |
| R-squared | 0.5655 | 0.0513 | 0.6275 |
| Observations | 8,534 | 3,908 | 4,279 |

**Panel B: Per-round amount of funding (log)**

| | | **Distinguishing between startup rounds according to the position of their lead VC in its fundraising cycle** | |
|---|---|---|---|
| | **Investments in high-technology startups** | **VCs early in their fundraising cycle** | **VCs late in their fundraising cycle** |
| | (I) | (II) | (III) |
| Financial Crisis | -0.0784** | -0.0025 | -0.1128* |
| | (0.0369) | (0.0521) | (0.0625) |
| Controls | YES | YES | YES |
| VC FE | YES | YES | YES |
| Sector FE | YES | YES | YES |
| Round-stage FE | YES | YES | YES |
| Startup start-year FE | YES | YES | YES |
| R-squared | 0.2260 | 0.2329 | 0.2312 |
| Observations | 9,725 | 5,526 | 3,103 |

**Table 5 – Financial crisis and lead VCs' investment strategies: Investing in VCs' core sectors.** Panel A of this table reports OSL estimates of equation (3) coefficients. The dependent variable is the number of funding rounds invested by a lead VC in its core sectors. Each observation corresponds to a lead VC *i* in quarter *t*. The independent variable of interest is an indicator that equals one for quarters during the financial crisis, and zero otherwise (*Financial Crisis*). Control variables are listed in the paper. Early-stage startups are those that raised their first funding round in 2005 or later. Later-stage startups are those that raised their first funding round in 2004 or before. Panel B reports OLS estimates of equation (4) coefficients. The dependent variable is the amount of funding that a startup receives from its lead VC in a given round. The independent variables of interest are: i) an indicator that equals one for rounds during the financial crisis, and zero otherwise (*Financial Crisis*), ii) an indicator for whether a startup operates in one of its lead VC's core sectors (*Core*), and iii) an interaction between *Financial Crisis* and *Core*. Control variables are listed in the paper. In all three columns of Panel A and columns Ia, IIa, and IIIa of Panel B, standard errors (in parentheses) are clustered by lead VC. In columns Ib, IIb, and IIIb of Panel B, standard errors are double-clustered by lead VC and startup. *, **, and *** denote significance at the 10%, 5%, and 1% level. Definitions of all variables are provided in Appendix A.

**Panel A: # VC investments**

| | **# investments in a VC's core** | **# early-stage investments in a VC's core** | **# later-stage investments in a VC's core** |
|---|---|---|---|
| | (I) | (II) | (III) |
| Financial Crisis | 0.0316** | 0.0161* | -0.0057 |
| | (0.0149) | (0.0084) | (0.0112) |
| # VC investments in *t* | 0.4218*** | | |
| | (0.0243) | | |
| # VC early-stage investments in *t* | | 0.3395*** | |
| | | (0.0354) | |
| # VC later-stage investments in *t* | | | 0.3454*** |
| | | | (0.0325) |
| Controls | YES | YES | YES |
| VC FE | YES | YES | YES |
| R-squared | 0.5615 | 0.552 | 0.5816 |
| Observations | 8,827 | 8,827 | 8,827 |

**Panel B: Per-round amount of funding (log)**

| **Panel B: Startup round amount** | **All rounds** | | **Early-stage rounds** | | **Later-stage rounds** | |
|---|---|---|---|---|---|---|
| | (Ia) | (Ib) | (IIa) | (IIb) | (IIIa) | (IIIb) |
| Financial Crisis | -0.1027** | -0.2315*** | -0.1396* | -0.1734** | -0.0780 | -0.2599*** |
| | (0.0446) | (0.0670) | (0.0798) | (0.0866) | (0.0536) | (0.0917) |
| Core | -0.0300 | 0.0245 | -0.0597 | -0.0995 | -0.0105 | 0.0544 |
| | (0.0268) | (0.0619) | (0.0430) | (0.0853) | (0.0348) | (0.0948) |
| Financial Crisis x Core | 0.0573 | 0.0909 | 0.1875** | 0.1866* | -0.0459 | 0.0454 |
| | (0.0647) | (0.0781) | (0.0949) | (0.1045) | (0.0793) | (0.1048) |
| Controls | YES | YES | YES | YES | YES | YES |
| VC FE | YES | | YES | | YES | |
| Sector FE | YES | | YES | | YES | |
| Round-stage FE | YES | YES | YES | YES | YES | YES |
| Startup start-year FE | YES | | YES | | | |
| VC x Startup FE | | YES | | YES | | YES |
| R-squared | 0.2194 | 0.6991 | 0.1817 | 0.695 | 0.2271 | 0.6895 |
| Observations | 10,272 | 8,375 | 4,009 | 3,290 | 6,263 | 5,085 |

**Table 6 – Financial crisis and lead VCs' investment strategies: Experienced versus less-experienced lead VCs.** Panels A and B of this table present the results from estimating equations (3) and (4), respectively, in subsamples of more and less-experienced lead VCs. We classify VCs as more or less experienced using as a cutoff the median number of investments made by the VCs in the 10 years prior to quarter *t*. In all columns of Panel A and in columns Ia-VIa of Panel B, standard errors (in parentheses) are clustered by lead VC. In columns Ib-VIb of Panel B, standard errors are double-clustered by lead VC and startup. *, **, and *** denote significance at the 10%, 5%, and 1% level. Definitions of all variables are provided in Appendix A.

**Panel A: # VC investments**

| | **Experienced VCs** | | | **Less-experienced VCs** | | |
|---|---|---|---|---|---|---|
| | **# investments in a VC's core** | **# early-stage investments in a VC's core** | **# later-stage investments in a VC's core** | **# investments in a VC's core** | **# early-stage investments in a VC's core** | **# later-stage investments in a VC's core** |
| | (I) | (II) | (III) | (IV) | (V) | (VI) |
| Financial Crisis | 0.0380 | 0.0216* | -0.0017 | 0.0056 | -0.0030 | -0.0024 |
| | (0.0247) | (0.0128) | (0.0182) | (0.0162) | (0.0111) | (0.0108) |
| # VC investments in *t* | 0.4069*** | | | 0.5265*** | | |
| | (0.0267) | | | (0.0331) | | |
| # VC early-stage investments in *t* | | 0.3047*** | | | 0.4819*** | |
| | | (0.0381) | | | (0.0552) | |
| # VC later-stage investments in *t* | | | 0.3383*** | | | 0.4025*** |
| | | | (0.0341) | | | (0.0556) |
| Controls | YES | YES | YES | YES | YES | YES |
| VC FE | YES | YES | YES | YES | YES | YES |
| R-squared | 0.5290 | 0.5641 | 0.5183 | 0.4789 | 0.4911 | 0.5569 |
| Observations | 4,381 | 4,381 | 4,381 | 4,446 | 4,446 | 4,446 |

**Panel B: Per-round amount of funding (log)**

| | Experienced VCs | | | | | | Less-experienced VCs | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | All rounds | | Early-stage rounds | | Later-stage rounds | | All rounds | | Early-stage rounds | | Later-stage rounds | |
| | (Ia) | (Ib) | (IIa) | (IIb) | (IIIa) | (IIIb) | (IVa) | (IVb) | (Va) | (Vb) | (VIa) | (VIb) |
| Financial Crisis | -0.1307** | -0.2276** | -0.0959 | -0.1472 | -0.1310* | -0.2884** | -0.0734 | -0.2245** | -0.1687 | -0.2341** | 0.0139 | -0.2267 |
| | (0.0556) | (0.0915) | (0.1132) | (0.1273) | (0.0685) | (0.1161) | (0.0793) | (0.0912) | (0.1233) | (0.1177) | (0.0965) | (0.1376) |
| Core | -0.0505 | 0.0032 | -0.0647 | -0.0407 | -0.0005 | -0.0170 | -0.0012 | 0.0508 | -0.0936 | -0.0636 | 0.0228 | 0.1311 |
| | (0.0365) | (0.0942) | (0.0616) | (0.1033) | (0.0454) | (0.1356) | (0.0395) | (0.0838) | (0.0588) | (0.1112) | (0.0561) | (0.1344) |
| Financial Crisis x Core | 0.2328*** | 0.2416** | 0.4304*** | 0.3826*** | 0.0855 | 0.1381 | -0.1357 | -0.0399 | -0.0425 | -0.0122 | -0.2511** | -0.0519 |
| | (0.0809) | (0.1034) | (0.1184) | (0.1322) | (0.1002) | (0.1390) | (0.0972) | (0.1043) | (0.1440) | (0.1431) | (0.1256) | (0.1518) |
| Controls | YES | | YES | | YES | | YES | | YES | | YES | |
| VC FE | YES | | YES | | YES | | YES | | YES | | YES | |
| Sector FE | YES | | YES | | YES | | YES | | YES | | YES | |
| Round-stage FE | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Startup start-year FE | YES | | YES | | YES | | YES | | YES | | YES | |
| VC x Startup FE | | YES | | YES | | YES | | YES | | YES | | YES |
| R-squared | 0.2051 | 0.6427 | 0.1728 | 0.6166 | 0.2300 | 0.6597 | 0.2507 | 0.7398 | 0.2263 | 0.7425 | 0.2537 | 0.7232 |
| Observations | 5,122 | 4,245 | 1,731 | 1,440 | 3,391 | 2,805 | 5,150 | 3,869 | 2,278 | 1,755 | 2,872 | 2,114 |

**Table 7 – Financial crisis, lead VC strategies, and likelihood that portfolio startups have a successful exit.** This table reports estimates of equation (5) coefficients. We present linear probability regression results for the likelihood that a given startup has a successful exit. As such, the dependent variable equals one if the startup either has an IPO or an acquisition by September 2015. The independent variables of interest are: i) an indicator that equals one for whether a startup raised at least one round of funding during the financial crisis (*Crisis Funding*), ii) an indicator for whether the startup operates in a core sector of its lead VC (*Core*), and iii) an interaction between *Crisis Funding* and *Core*. Results in Panel A are for the entire sample while results in Panels B and C are for startups funded by more experienced and less-experienced lead VCs, respectively. To categorize VCs into experienced and less experienced, we use as a cutoff the median number of funding rounds invested by lead VCs in the 10 years prior to each round observed in the sample. Based on this cutoff, a startup is considered to be funded by an experienced lead VC if it received funds from an experienced VC for at least one of the funding rounds that we observe in the sample. In columns I-II of each panel, we present the results for all startups. In columns III-IV and V-VI, we present results for early-stage and later-stage startups, respectively. Startups are classified as early-stage if they raised their first round of funding in 2005 or later, and as later-stage if they raised their first round of funding in 2004 or earlier. Control variables are listed in the paper. Standard errors (in parentheses) are clustered by lead VC. *, **, and *** denote significance at the 10%, 5%, and 1% level. Definitions of all variables are provided in Appendix A.

**Panel A: All VCs**

| | **All startups** | | **Early-stage startups** | | **Later-stage startups** | |
|---|---|---|---|---|---|---|
| | (I) | (II) | (III) | (IV) | (V) | (VI) |
| Crisis Funding | 0.0065 | -0.0160 | 0.0630** | 0.0165 | -0.0335 | -0.0439 |
| | (0.0176) | (0.0232) | (0.0275) | (0.0341) | (0.0243) | (0.0323) |
| Core | 0.0073 | -0.0061 | 0.0317 | 0.0023 | 0.0033 | -0.0025 |
| | (0.0176) | (0.0197) | (0.0330) | (0.0359) | (0.0252) | (0.0273) |
| Crisis Funding x Core | | 0.0513 | | 0.1062** | | 0.0234 |
| | | (0.0312) | | (0.0513) | | (0.0435) |
| Controls | YES | YES | YES | YES | YES | YES |
| VC FE | YES | YES | YES | YES | YES | YES |
| Sector FE | YES | YES | YES | YES | YES | YES |
| Round FE (For the oldest round we observe) | YES | YES | YES | YES | YES | YES |
| Startup start-year FE | YES | YES | YES | YES | YES | YES |
| R-squared | 0.0826 | 0.0831 | 0.0789 | 0.0813 | 0.0682 | 0.0683 |
| Observations | 4,946 | 4,946 | 1,920 | 1,920 | 3,026 | 3,026 |

**Panel B: Experienced VCs**

| | **All startups** | | **Early-stage startups** | | **Later-stage startups** | |
|---|---|---|---|---|---|---|
| | (I) | (II) | (III) | (IV) | (V) | (VI) |
| Crisis Funding | -0.0190 | -0.0704** | 0.0531 | -0.0281 | -0.0588* | -0.0970** |
| | (0.0264) | (0.0325) | (0.0440) | (0.0504) | (0.0337) | (0.0422) |
| Core | 0.0001 | -0.0346 | 0.0101 | -0.0487 | -0.0093 | -0.0339 |
| | (0.0274) | (0.0303) | (0.0577) | (0.0604) | (0.0369) | (0.0395) |
| Crisis Funding x Core | | 0.1312*** | | 0.2056*** | | 0.0983* |
| | | (0.0420) | | (0.0767) | | (0.0572) |
| Controls and FE | YES | YES | YES | YES | YES | YES |
| R-squared | 0.0936 | 0.0968 | 0.0763 | 0.0848 | 0.0791 | 0.0809 |
| Observations | 2,199 | 2,199 | 738 | 738 | 1,461 | 1,461 |

**Panel C: Less-experienced VCs**

| | All startups | | Early-stage startups | | Later-stage startups | |
|---|---|---|---|---|---|---|
| | (I) | (II) | (III) | (IV) | (V) | (VI) |
| Crisis Funding | 0.0272 | 0.0426 | 0.0694* | 0.0459 | -0.0105 | 0.0232 |
| | (0.0240) | (0.0340) | (0.0369) | (0.0509) | (0.0348) | (0.0495) |
| Core | 0.0156 | 0.0238 | 0.0472 | 0.0343 | 0.0179 | 0.0339 |
| | (0.0245) | (0.0270) | (0.0408) | (0.0456) | (0.0364) | (0.0413) |
| Crisis Funding x Core | | -0.0318 | | 0.0485 | | -0.0658 |
| | | (0.0471) | | (0.0737) | | (0.0675) |
| Controls and FE | YES | YES | YES | YES | YES | YES |
| R-squared | 0.0880 | 0.0882 | 0.1125 | 0.1130 | 0.0911 | 0.0918 |
| Observations | 2,747 | 2,747 | 1,182 | 1,182 | 1,565 | 1,565 |

**Table 8 – Financial crisis, lead VC strategies, and valuation at exit.** This table reports linear probability regression results for the likelihood that a given startup receives a valuation at exit that is above the sector median. We are able to find valuation information for 53% of the startups that had a successful exit. Following Nanda and Rhodes-Kropf (2013), we use the pre-money valuation of a startup in the case of an IPO. In the case of an acquisition, the startup's value is estimated by the change in equity value of the acquirer. To address possible problems due to outliers and inaccurate reporting of startups' valuation, we discretize the valuation-at-exit using an indicator that equals one if this valuation is larger than the sector median, and zero otherwise. The independent variables of interest are: i) an indicator that equals one for whether a startup raised at least one round of funding during the financial crisis (*Crisis Funding*), ii) an indicator for whether the a startup operates in a core sector of its lead VC (*Core*), and iii) an interaction between *Crisis Funding* and *Core*. Control variables are listed in the paper. Results in columns I-II are for the entire sample while results in columns III-IV and V-VI are for startups funded by more experienced and less experienced lead VCs, respectively. To categorize VCs into experienced and less experienced, we use as a cutoff the median number of funding rounds invested by lead VCs in the 10 years prior to each round observed in the sample. Based on this cutoff, a startup is considered to be funded by an experienced lead VC if it received funds from an experienced VC for at least one of the funding rounds that we observe in the sample. Standard errors (in parentheses) are clustered by lead VC. *, **, and *** denote significance at the 10%, 5%, and 1% level. Definitions of all variables are provided in Appendix A.

| | **All VCs** | | **Experienced VCs** | | **Less-experienced VCs** | |
|---|---|---|---|---|---|---|
| | (I) | (II) | (III) | (IV) | (V) | (VI) |
| Crisis Funding | 0.0636 | -0.0130 | 0.0513 | -0.0693 | 0.0879 | 0.1115 |
| | (0.0476) | (0.0620) | (0.0657) | (0.0755) | (0.0727) | (0.1155) |
| Core | -0.0077 | -0.0470 | -0.0602 | -0.1257** | 0.0140 | 0.0256 |
| | (0.0400) | (0.0427) | (0.0490) | (0.0527) | (0.0725) | (0.0839) |
| Crisis Funding x Core | | 0.1448** | | 0.2472** | | -0.0415 |
| | | (0.0711) | | (0.0961) | | (0.1262) |
| Controls | YES | YES | YES | YES | YES | YES |
| VC FE | YES | YES | YES | YES | YES | YES |
| Sector FE | YES | YES | YES | YES | YES | YES |
| Round FE (For the oldest round we observe) | YES | YES | YES | YES | YES | YES |
| Startup start-year FE | YES | YES | YES | YES | YES | YES |
| Exit quarter FE | YES | YES | YES | YES | YES | YES |
| R-squared | 0.2206 | 0.2243 | 0.3176 | 0.3272 | 0.2768 | 0.2770 |
| Observations | 1,219 | 1,219 | 613 | 613 | 606 | 606 |

**Table 9 – Financial crisis, lead VC strategies, and startup innovation.** This table presents OLS estimates for equation (6) coefficients. The dependent variable captures the startup's innovation and is measured as the number of patent applications (eventually granted) by a startup in the two years following a given round. We exclude startups that do not operate in high technology sectors. The independent variables of interest are: i) an indicator that equals one for whether the given round was raised during the financial crisis (*Financial Crisis*), ii) an indicator for whether the a startup operates in a core sector of its lead VC (*Core*), and iii) an interaction between *Financial Crisis* and *Core*. Control variables are listed in the paper. Results in Panel A are for startup rounds financed by the full sample of lead VCs while results in Panels B and C are for startup rounds financed by more experienced and less experienced lead VCs, respectively. To categorize VCs into experienced and less experienced, we use as a cutoff the median number of funding rounds invested by lead VCs in the 10 years prior to each round observed in the sample. In columns I-II of all three panels, we present the results for all startups. In columns III-IV and V-VI, however, we present results for early-stage and later-stage startups, respectively. Startups are classified as early-stage if they raised their first round of funding in 2005 or later, and as later-stage if they raised their first round of funding in 2004 or earlier. Control variables are listed in the paper. Standard errors (in parentheses) are clustered by lead VC. *, **, and *** denote significance at the 10%, 5%, and 1% level. Definitions of all variables are provided in Appendix A.

**Panel A: All VCs**

| | **Entire sample** | | **Early-stage startups** | | **Later-stage startups** | |
|---|---|---|---|---|---|---|
| | (I) | (II) | (III) | (IV) | (V) | (VI) |
| Financial Crisis | -0.1232*** | -0.0948*** | 0.0120 | -0.0077 | -0.2349*** | -0.1689*** |
| | (0.0205) | (0.0269) | (0.0129) | (0.0147) | (0.0365) | (0.0465) |
| Core | -0.0092 | -0.0017 | 0.0067 | 0.0020 | -0.0318 | -0.0122 |
| | (0.0193) | (0.0202) | (0.0118) | (0.0120) | (0.0414) | (0.0427) |
| Financial Crisis x Core | | -0.0550 | | 0.0386** | | -0.1270** |
| | | (0.0367) | | (0.0189) | | (0.0604) |
| Controls | YES | YES | YES | YES | YES | YES |
| VC FE | YES | YES | YES | YES | YES | YES |
| Sector FE | YES | YES | YES | YES | YES | YES |
| Round-stage FE | YES | YES | YES | YES | YES | YES |
| Startup start-year FE | YES | YES | YES | YES | YES | YES |
| R-squared | 0.3359 | 0.3360 | 0.0923 | 0.0927 | 0.2980 | 0.2986 |
| Observations | 9,725 | 9,725 | 4,789 | 4,789 | 4,936 | 4,936 |

**Panel B: Experienced VCs**

| | **Entire sample** | | **Early-stage startups** | | **Later-stage startups** | |
|---|---|---|---|---|---|---|
| | (I) | (II) | (III) | (IV) | (V) | (VI) |
| Financial Crisis | -0.1519*** | -0.1409*** | 0.0305 | 0.0022 | -0.2805*** | -0.2144*** |
| | (0.0308) | (0.0347) | (0.0206) | (0.0218) | (0.0511) | (0.0564) |
| Core | 0.0024 | 0.0058 | 0.0002 | -0.0075 | 0.0099 | 0.0330 |
| | (0.0277) | (0.0306) | (0.0186) | (0.0189) | (0.0529) | (0.0567) |
| Financial Crisis x Core | | -0.0234 | | 0.0598** | | -0.1409* |
| | | (0.0536) | | (0.0286) | | (0.0816) |
| Controls and FE | YES | YES | YES | YES | YES | YES |
| R-squared | 0.3554 | 0.3555 | 0.1332 | 0.1339 | 0.3204 | 0.3211 |
| Observations | 4,931 | 4,931 | 2,247 | 2,247 | 2,684 | 2,684 |

**Panel C: Less-experienced VCs**

| | Entire sample | | Early-stage startups | | Later-stage startups | |
|---|---|---|---|---|---|---|
| | (I) | (II) | (III) | (IV) | (V) | (VI) |
| Financial Crisis | -0.0870*** | -0.0294 | 0.0002 | -0.0002 | -0.1843*** | -0.1041 |
| | (0.0272) | (0.0422) | (0.0157) | (0.0202) | (0.0505) | (0.0857) |
| Core | -0.0053 | 0.0074 | 0.0294** | 0.0293 | -0.0476 | -0.0293 |
| | (0.0258) | (0.0258) | (0.0145) | (0.0151) | (0.0589) | (0.0584) |
| Financial Crisis x Core | | -0.1012** | | 0.0008 | | -0.1324 |
| | | (0.0512) | | (0.0266) | | (0.0964) |
| Controls and FE | YES | YES | YES | YES | YES | YES |
| R-squared | 0.3156 | 0.3163 | 0.0636 | 0.0636 | 0.2865 | 0.2872 |
| Observations | 4,794 | 4,794 | 2,542 | 2,542 | 2,252 | 2,252 |

# Appendix A: Variable Definitions

| | |
|---|---|
| # investments | Number of funding rounds invested by the lead VC *i* (as lead VC) in startups during quarter *t* |
| # investments in a VC's core | Number of funding rounds invested by a lead VC *i* (as lead VC) in its core sectors during quarter *t* |
| Startup round amount | Amount of funding that startup *j* receives from VC *i* in round *r* |
| Likelihood that a startup has a successful exit | Binary variable =1 if a startup experienced either an IPO or an acquisition by September 2015 |
| Likelihood that a startup receives a high valuation at exit | Binary variable=1 if a startup's valuation at exit is larger than the sector median, and 0 otherwise |
| # granted patents | Number of granted patents applied for by a startup in the two years following a given round |
| Financial Crisis | Binary variable=1 for the five quarters spanning 2009Q1–2010Q1, and 0 otherwise |
| Crisis Funding | Binary variable=1 if a startup received at least one round of funding during the financial crisis, and 0 otherwise |
| VC's experience | Number of funding rounds invested by a lead VC in the 10 years prior to quarter *t* |
| Core | Binary variable=1 if the number of funding rounds invested by the lead VC *i* in startup *j*'s sector during the 10 years prior to the quarter of round *r* is the largest of any sector that the lead VC invested in |
| # investors per round | Number of investors participating in a given round |
| Cumulative funding stock | Cumulative amount of funds a startup received prior to round *r* |
| Round number | Ordinal variable for a startup's round number |
| Cumulative patents granted | Number of granted patents a startup applied for prior to round *r* |
| Listed a technology executive in 2008 | Binary variable=1 if a startup listed a technology executive in its 2008 executive roster, and 0 otherwise |
| Listed a marketing executive in 2008 | Binary variable=1 if a startup listed a marketing executive in its 2008 executive roster, and 0 otherwise |
| Board size | Number of board members reported in the 2008 Thomson's Venture Economics dataset |
| Startup-VC geographical distance, as of 2008 | Geographic distance between a lead VC and its portfolio startup |
| Located in Massachusetts | Binary variable=1 if a startup was located in Massachusetts as of 2008, and 0 otherwise |
| Located in California | Binary variable=1 if a startup was located in California as of 2008, and 0 otherwise |
| Trend | Quarterly time trend |

# Appendix B: Additional tests not reported in the paper for brevity

**Table B1 – Financial crisis and lead VCs' investment strategies: Investing in VCs' core sectors.** Panel A of this table reports OLS estimates of equation (3) coefficients. The dependent variable is the number of funding rounds invested by a lead VC in its core sectors in a given quarter. The independent variable of interest is an indicator that equals one during 2008Q1–2010Q1, i.e., including the broader financial crisis (*Financial Crisis*). Other control variables are listed in the paper. We distinguish between early- and later-stage startups. The former are startups that raised their first funding round in 2005 or later while the latter are startups that raised their first funding round in 2004 or before. Panel B of this table reports OLS estimates of equation (4) coefficients. The dependent variable is the amount of funding that a startup receives from its lead VC in a given round. The independent variables of interest are: i) an indicator that equals one for funding rounds raised during the financial crisis, and zero otherwise (*Financial Crisis*); ii) an indicator for whether a startup operates in its lead VC's core sectors (*Core*); and iii) an interaction between *Financial Crisis* and *Core*. Control variables are listed in the paper. In all three columns of Panel A and columns Ia, IIa, and IIIa of Panel B, standard errors (in parentheses) are clustered by lead VC. In columns Ib, IIb, and IIIb of Panel B, standard errors (in parentheses) are double-clustered by lead VC and startup. *, **, and *** denote significance at the 10%, 5%, and 1% level. Definitions of all variables are provided in Appendix A.

**Panel A: # VC Investments (log)**

| | **# investments in a VC's core** | **# early-stage investments in a VC's core** | **# later-stage investments in a VC's core** |
|---|---|---|---|
| | (I) | (II) | (III) |
| Financial Crisis | 0.0262* | 0.0188** | 0.0032 |
| | (0.0152) | (0.0087) | (0.0117) |
| # VC investments in *t* | 0.4208*** | | |
| | (0.0243) | | |
| # VC early-stage investments in *t* | | 0.3387*** | |
| | | (0.0352) | |
| # VC late-stage investments in *t* | | | 0.3458*** |
| | | | (0.0325) |
| Controls | YES | YES | YES |
| VC Fixed Effects | YES | YES | YES |
| R-squared | 0.5615 | 0.5524 | 0.5819 |
| Observations | 8,827 | 8,827 | 8,827 |

**Panel B: Per-round amount of funding (log)**

| | **All rounds** | | **Early-stage rounds** | | **Later-stage rounds** | |
|---|---|---|---|---|---|---|
| | (Ia) | (Ib) | (IIa) | (IIb) | (IIIa) | (IIIb) |
| Financial Crisis | -0.1272*** | -0.2070*** | -0.1755** | -0.1790** | -0.0720 | -0.2401*** |
| | (0.0449) | (0.0657) | (0.0755) | (0.0857) | (0.0597) | (0.0891) |
| Core | -0.0309 | 0.0274 | -0.0575 | -0.0961 | -0.0122 | 0.0548 |
| | (0.0270) | (0.0608) | (0.0435) | (0.0845) | (0.0348) | (0.0939) |
| Financial Crisis x Core | 0.0790 | 0.0865 | 0.2080** | 0.1912* | -0.0358 | 0.0549 |
| | (0.0651) | (0.0786) | (0.0940) | (0.1037) | (0.0854) | (0.1063) |
| Controls | YES | YES | YES | YES | YES | YES |
| VC Fixed Effects | YES | | YES | | YES | |
| Sector Fixed Effects | YES | | YES | | YES | |
| Round-stage Fixed Effects | YES | YES | YES | YES | YES | YES |
| Startup start-year Fixed Effects | YES | | YES | | | |
| VC x Startup pair Fixed Effects | | YES | | YES | | YES |
| R-squared | 0.2195 | 0.6988 | 0.182 | 0.695 | 0.2269 | 0.6891 |
| Observations | 10,272 | 8,375 | 4,009 | 3,290 | 6,263 | 5,085 |

**Table B2 – Financial crisis and lead VCs' investment strategies.** Panel A of this table reports OLS estimates of equation (1) coefficients. The dependent variable is the number of funding rounds invested by a lead VC (as lead VC) in a given quarter. In column I, we count the total number of funding rounds; in column II, we count the number of funding rounds in early-stage startups; and in column III, we count the number of funding rounds in later-stage startups. Early-stage startups are those that raised their first funding round in 2005 or later. Later-stage startups are those that raised their first funding round in 2004 or before. The independent variable of interest (*Financial Crisis*) is an indicator that equals one for quarters during the financial crisis, and zero otherwise. Standard errors (in parentheses) are clustered by lead VC. Panel B reports OLS estimates of equation (2) coefficients. The dependent variable is the amount of funding that a startup receives from its lead VC in a given round. In columns Ia and Ib, we consider the entire sample; in columns IIa and IIb, we examine rounds raised by early-stage startups; and in columns IIIa and IIIb, we examine rounds raised by later-stage startups. Startups are classified into early/late stage as in Panel A. The independent variable of interest is an indicator that equals one for rounds during the financial crisis, and zero otherwise (*Financial Crisis*). In columns Ia, IIa, and IIIa, standard errors (in parentheses) are clustered by lead VCs. In columns Ib, IIb, and IIIb, standard errors are double-clustered by lead VC and startup. *, **, and *** denote significance at the 10%, 5%, and 1% level. Definitions of all variables are provided in Appendix A.

**Panel A: # VC investments (log)**

| | **# VC investments (log)** | **# VC early-stage investments (log)** | **# VC later-stage investments (log)** |
|---|---|---|---|
| | (I) | (II) | (III) |
| Financial Crisis | -0.0854*** | -0.0744*** | -0.0598*** |
| | (0.0103) | (0.0108) | (0.0106) |
| VC's experience (log) | 0.0616*** | 0.0067 | 0.0573*** |
| | (0.0167) | (0.0170) | (0.0130) |
| Trend (log) | -0.0434*** | 0.0670*** | -0.0915*** |
| | (0.0074) | (0.0082) | (0.0075) |
| Constant | 0.1369*** | -0.0294 | 0.1673*** |
| | (0.0399) | (0.0403) | (0.0310) |
| Controls for Lead VC's experience in each sector | YES | YES | YES |
| VC FE | YES | YES | YES |
| R-squared | 0.5235 | 0.1746 | 0.2812 |
| Observations | 10,802 | 10,802 | 10,802 |

**Panel B: Per-round amount of funding (log)**

| | All startups | | Early-stage startups | | Later-stage startups | |
|---|---|---|---|---|---|---|
| | (Ia) | (Ib) | (IIa) | (IIb) | (IIIa) | (IIIb) |
| Financial Crisis | -0.0535* | -0.1621*** | -0.0051 | -0.1065* | -0.1042** | -0.2147*** |
| | (0.0311) | (0.0475) | (0.0475) | (0.0582) | (0.0430) | (0.0670) |
| # investors per round (log) | 0.7278*** | 0.8182*** | 0.7450*** | 0.8156*** | 0.7293*** | 0.8073*** |
| | (0.0245) | (0.0388) | (0.0359) | (0.0565) | (0.0315) | (0.0480) |
| Core | -0.0325 | 0.0502 | -0.0550 | -0.0331 | -0.0210 | 0.0985 |
| | (0.0234) | (0.0563) | (0.0365) | (0.0748) | (0.0335) | (0.0811) |
| Lead VC's experience (log) | -0.0141 | 0.1104* | -0.0273 | 0.0149 | 0.0632 | 0.1995*** |
| | (0.0300) | (0.0563) | (0.0438) | (0.0792) | (0.0513) | (0.0710) |
| Cumulative funding stock (log) | 0.0909*** | -0.2554*** | 0.0372 | -0.3040*** | 0.1584*** | -0.3655*** |
| | (0.0155) | (0.0237) | (0.0267) | (0.0336) | (0.0206) | (0.0436) |
| Round number | -0.0895*** | 0.0832*** | -0.0949*** | 0.1697*** | -0.0855*** | 0.0654** |
| | (0.0096) | (0.0203) | (0.0283) | (0.0343) | (0.0113) | (0.0264) |
| Cumulative patents granted (log) | 0.0810*** | 0.2822*** | 0.0383 | 0.2363*** | 0.0841*** | 0.3392*** |
| | (0.0101) | (0.0606) | (0.0245) | (0.0807) | (0.0129) | (0.0889) |
| Located in Massachusetts | -0.0122 | | -0.0510 | | 0.0139 | |
| | (0.0401) | | (0.0598) | | (0.0577) | |
| Located in California | 0.0589* | | 0.0116 | | 0.0775* | |
| | (0.0333) | | (0.0510) | | (0.0437) | |
| Trend (log) | 0.0362** | -0.0567 | 0.0196 | 0.0835 | 0.0277 | -0.0383 |
| | (0.0172) | (0.0358) | (0.0337) | (0.0719) | (0.0218) | (0.0415) |
| Constant | 0.7676** | | 0.8914** | | 0.1585 | |
| | (0.3079) | | (0.4149) | | (0.3790) | |
| Lead VC FE | YES | | YES | | YES | |
| Sector FE | YES | | YES | | YES | |
| Round-stage FE | YES | YES | YES | YES | YES | YES |
| Startup start-year FE | YES | | YES | | YES | |
| VC x Startup FE | | YES | | YES | | YES |
| R-squared | 0.2010 | 0.7186 | 0.1706 | 0.7288 | 0.2118 | 0.6984 |
| Observations | 13,216 | 10,105 | 5,900 | 4,355 | 7,316 | 5,750 |

**Table B3 – Financial crisis and lead VCs' investment strategies: Investing in VCs' core sectors.** Panel A of this table reports OSL estimates of equation (3) coefficients. The dependent variable is the number of funding rounds invested by a lead VC in its core sectors. Each observation corresponds to a lead VC *i* in quarter *t*. The independent variable of interest is an indicator that equals one for quarters during the financial crisis, and zero otherwise (*Financial Crisis*). Control variables are listed in the paper. Early-stage startups are those that raised their first funding round in 2005 or later. Later-stage startups are those that raised their first funding round in 2004 or before. Panel B reports OLS estimates of equation (4) coefficients. The dependent variable is the amount of funding that a startup receives from its lead VC in a given round. The independent variables of interest are: i) an indicator that equals one for rounds during the financial crisis, and zero otherwise (*Financial Crisis*), ii) an indicator for whether a startup operates in one of its lead VC's core sectors (*Core*), and iii) an interaction between *Financial Crisis* and *Core*. Control variables are listed in the paper. In all three columns of Panel A and columns Ia, IIa, and IIIa of Panel B, standard errors (in parentheses) are clustered by lead VC. In columns Ib, IIb, and IIIb of Panel B, standard errors are double-clustered by lead VC and startup. *, **, and *** denote significance at the 10%, 5%, and 1% level. Definitions of all variables are provided in Appendix A.

**Panel A: # VC investments**

| | **# investments in a VC's core** | **# early-stage investments in a VC's core** | **# later-stage investments in a VC's core** |
|---|---|---|---|
| | (I) | (II) | (III) |
| Financial Crisis | 0.0313** | 0.0233** | -0.0060 |
| | (0.0138) | (0.0101) | (0.0099) |
| # VC investments in *t* | 0.4220*** | | |
| | (0.0207) | | |
| # VC early-stage investments in *t* | | 0.3777*** | |
| | | (0.0268) | |
| # VC late-stage investments in *t* | | | 0.3420*** |
| | | | (0.0311) |
| Controls | YES | YES | YES |
| VC FE | YES | YES | YES |
| R-squared | 0.5906 | 0.5782 | 0.5941 |
| Observations | 10,802 | 10,802 | 10,802 |

**Panel B: Per-round amount of funding (log)**

| | **All rounds** | | **Early-stage rounds** | | **Later-stage rounds** | |
|---|---|---|---|---|---|---|
| | (Ia) | (Ib) | (IIa) | (IIb) | (IIIa) | (IIIb) |
| Financial Crisis | -0.0939** | -0.2231*** | -0.0927 | -0.1991*** | -0.0993* | -0.2432*** |
| | (0.0399) | (0.0591) | (0.0616) | (0.0725) | (0.0536) | (0.0829) |
| Core | -0.0490** | 0.0242 | -0.0996*** | -0.0750 | -0.0193 | 0.0871 |
| | (0.0245) | (0.0589) | (0.0372) | (0.0756) | (0.0342) | (0.0834) |
| Financial Crisis x Core | 0.0848 | 0.1240* | 0.1827** | 0.1849** | -0.0105 | 0.0589 |
| | (0.0523) | (0.0712) | (0.0725) | (0.0908) | (0.0708) | (0.0959) |
| Controls | YES | | YES | | YES | |
| VC FE | YES | | YES | | YES | |
| Sector FE | YES | | YES | | YES | |
| Round-stage FE | YES | YES | YES | YES | YES | YES |
| Startup start-year FE | YES | | YES | | YES | |
| VC x Startup FE | | YES | | YES | | YES |
| R-squared | 0.2012 | 0.7188 | 0.172 | 0.7293 | 0.2118 | 0.6984 |
| Observations | 13,216 | 10,105 | 5,900 | 4,355 | 7,316 | 5,750 |

**Table B4: Financial crisis and lead VCs' investment strategies: Experienced versus less-experienced lead VCs.** Panels A and B of this table present the results from estimating equations (3) and (4), respectively, in subsamples of more and less-experienced lead VCs. We classify VCs as more or less experienced using as a cutoff the median number of investments made by the VCs in the 10 years prior to quarter *t*. In all columns of Panel A and in columns Ia-VIa of Panel B, standard errors (in parentheses) are clustered by lead VC. In columns Ib-VIb of Panel B, standard errors are double-clustered by lead VC and startup. *, **, and *** denote significance at the 10%, 5%, and 1% level. Definitions of all variables are provided in Appendix A.

**Panel A: # VC investments**

| | **Experienced VCs** | | | **Less-experienced VCs** | | |
|---|---|---|---|---|---|---|
| | **# investments in a VC's core** | **# early-stage investments in a VC's core** | **# later-stage investments in a VC's core** | **# investments in a VC's core** | **# early-stage investments in a VC's core** | **# later-stage investments in a VC's core** |
| | (I) | (II) | (III) | (IV) | (V) | (VI) |
| Financial Crisis | 0.0266 | 0.0312** | -0.0103 | 0.0019 | -0.0053 | -0.0007 |
| | (0.0220) | (0.0147) | (0.0168) | (0.0161) | (0.0128) | (0.0087) |
| # VC investments in *t* | 0.4093*** | | | 0.4942*** | | |
| | (0.0228) | | | (0.0316) | | |
| # VC early-stage investments in *t* | | 0.3619*** | | | 0.4546*** | |
| | | (0.0279) | | | (0.0579) | |
| # VC later-stage investments in *t* | | | 0.3414*** | | | 0.4553*** |
| | | | -0.0326 | | | (0.0461) |
| Controls | YES | YES | YES | YES | YES | YES |
| VC FE | YES | YES | YES | YES | YES | YES |
| R-squared | 0.5666 | 0.5861 | 0.5362 | 0.5016 | 0.5206 | 0.5727 |
| Observations | 5,370 | 5,370 | 5,370 | 5,432 | 5,432 | 5,432 |

**Panel B: Per-round amount of funding (log)**

| | Experienced VCs | | | | | | Less-experienced VCs | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | All rounds | | Early-stage rounds | | Later-stage rounds | | All rounds | | Early-stage rounds | | Later-stage rounds | |
| | (Ia) | (Ib) | (IIa) | (IIb) | (IIIa) | (IIIb) | (IVa) | (IVb) | (Va) | (Vb) | (VIa) | (VIb) |
| Financial Crisis | -0.1375** | -0.2450*** | -0.0870 | -0.1607 | -0.1833*** | -0.3171*** | -0.0332 | -0.1711** | -0.0914 | -0.2072** | 0.0604 | -0.1322 |
| | (0.0551) | (0.0814) | (0.0937) | (0.1135) | (0.0684) | (0.0999) | (0.0598) | (0.0802) | (0.0877) | (0.0980) | (0.0819) | (0.1271) |
| Core | -0.0872** | 0.0479 | -0.1352** | -0.0162 | -0.0351 | 0.0605 | -0.0135 | 0.0394 | -0.0768 | -0.0690 | 0.0110 | 0.1370 |
| | (0.0353) | (0.0837) | (0.0542) | (0.1075) | (0.0473) | (0.1162) | (0.0369) | (0.0765) | (0.0531) | (0.0957) | (0.0526) | (0.1245) |
| Financial Crisis x Core | 0.2548*** | 0.2443** | 0.3600*** | 0.2904** | 0.1525* | 0.1777 | -0.1046 | -0.0213 | 0.0086 | 0.0757 | -0.2693** | -0.1133 |
| | (0.0715) | (0.0985) | (0.1008) | (0.1228) | (0.0905) | (0.1284) | (0.0732) | (0.0959) | (0.1024) | (0.1259) | (0.1066) | (0.1364) |
| Controls | YES | | YES | | YES | | YES | | YES | | YES | |
| VC FE | YES | | YES | | YES | | YES | | YES | | YES | |
| Sector FE | YES | | YES | | YES | | YES | | YES | | YES | |
| Round-stage FE | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Startup start-year FE | YES | | YES | | YES | | YES | | YES | | YES | |
| VC x Startup FE | | YES | | YES | | YES | | YES | | YES | | YES |
| R-squared | 0.1985 | 0.6549 | 0.1885 | 0.6469 | 0.2099 | 0.6629 | 0.216 | 0.7598 | 0.1829 | 0.7678 | 0.2351 | 0.7340 |
| Observations | 6,594 | 5,284 | 2,602 | 2,032 | 3,992 | 3,252 | 6,622 | 4,561 | 3,298 | 2,228 | 3,324 | 2,333 |

**Table B5 – Financial crisis, lead VC strategies, and likelihood of a startup's successful exit.** This table reports estimates of equation (5) coefficients. We present linear probability regression results for the likelihood that a given startup has a successful exit. As such, the dependent variable equals one if the startup either has an IPO or an acquisition by September 2015. The independent variables of interest are: i) an indicator that equals one for whether a startup raised at least one round of funding during the financial crisis (*Crisis Funding*), ii) an indicator for whether the startup operates in a core sector of its lead VC (*Core*), and iii) an interaction between *Crisis Funding* and *Core*. Results in Panel A are for the entire sample while results in Panels B and C are for startups funded by more experienced and less-experienced lead VCs, respectively. To categorize VCs into experienced and less experienced, we use as a cutoff the median number of funding rounds invested by lead VCs in the 10 years prior to each round observed in the sample. Based on this cutoff, a startup is considered to be funded by an experienced lead VC if it received funds from an experienced VC for at least one of the funding rounds that we observe in the sample. In columns I-II of each panel, we present the results for all startups. In columns III-IV and V-VI, we present results for early-stage and later-stage startups, respectively. Startups are classified as early-stage if they raised their first round of funding in 2005 or later, and as later-stage if they raised their first round of funding in 2004 or earlier. Control variables are listed in the paper. Standard errors (in parentheses) are clustered by lead VC. *, **, and *** denote significance at the 10%, 5%, and 1% level. Definitions of all variables are provided in Appendix A.

**Panel A: All VCs**

| | **All startups** | | **Early-stage startups** | | **Later-stage startups** | |
|---|---|---|---|---|---|---|
| | (I) | (II) | (III) | (IV) | (V) | (VI) |
| Crisis Funding | -0.0074 | -0.0261 | 0.0406** | 0.0008 | -0.0416* | -0.0397 |
| | (0.0144) | (0.0183) | (0.0203) | (0.0235) | (0.0221) | (0.0301) |
| Core | 0.0062 | -0.0085 | 0.0192 | -0.0196 | -0.0054 | -0.0042 |
| | (0.0160) | (0.0186) | (0.0247) | (0.0295) | (0.0236) | (0.0259) |
| Crisis Funding x Core | | 0.0438* | | 0.0961*** | | -0.0043 |
| | | (0.0256) | | (0.0357) | | (0.0401) |
| Controls | YES | YES | YES | YES | YES | YES |
| VC FE | YES | YES | YES | YES | YES | YES |
| Sector FE | YES | YES | YES | YES | YES | YES |
| Round FE (for the oldest round we observe) | YES | YES | YES | YES | YES | YES |
| Startup start-year FE | YES | YES | YES | YES | YES | YES |
| R-squared | 0.0523 | 0.0528 | 0.0376 | 0.0401 | 0.0470 | 0.0470 |
| Observations | 6,731 | 6,731 | 3,137 | 3,137 | 3,594 | 3,594 |

**Panel B: Experienced VCs**

| | **All startups** | | **Early-stage startups** | | **Later-stage startups** | |
|---|---|---|---|---|---|---|
| | (I) | (II) | (III) | (IV) | (V) | (VI) |
| Crisis Funding | -0.0151 | -0.0572** | 0.0518 | 0.0044 | -0.0597* | -0.0900** |
| | (0.0218) | (0.0278) | (0.0328) | (0.0374) | (0.0312) | (0.0420) |
| Core | -0.0071 | -0.0421 | 0.0061 | -0.0435 | -0.0225 | -0.0431 |
| | (0.0247) | (0.0286) | (0.0386) | (0.0485) | (0.0344) | (0.0366) |
| Crisis Funding x Core | | 0.1060*** | | 0.1206** | | 0.0757 |
| | | (0.0373) | | (0.0577) | | (0.0548) |
| Controls and FEs | YES | YES | YES | YES | YES | YES |
| R-squared | 0.0615 | 0.0639 | 0.0521 | 0.0558 | 0.0577 | 0.0588 |
| Observations | 2,972 | 2,972 | 1,222 | 1,222 | 1,750 | 1,750 |

**Panel C: Less-experienced VCs**

| | All startups | | Early-stage startups | | Later-stage startups | |
|---|---|---|---|---|---|---|
| | (I) | (II) | (III) | (IV) | (V) | (VI) |
| Crisis Funding | -0.0016 | 0.0115 | 0.0340 | 0.0138 | -0.0087 | 0.0467 |
| | (0.0201) | (0.0252) | (0.0273) | (0.0318) | (0.0311) | (0.0435) |
| Core | 0.0187 | 0.0281 | 0.0314 | 0.0133 | 0.0126 | 0.0427 |
| | (0.0219) | (0.0253) | (0.0323) | (0.0387) | (0.0343) | (0.0397) |
| Crisis Funding x Core | | -0.0284 | | 0.0462 | | -0.1113* |
| | | (0.0353) | | (0.0474) | | (0.0606) |
| Controls and FEs | YES | YES | YES | YES | YES | YES |
| R-squared | 0.0587 | 0.0589 | 0.0629 | 0.0635 | 0.0573 | 0.0597 |
| Observations | 3,809 | 3,809 | 1,930 | 1,930 | 1,879 | 1,879 |

**Table B6 – Financial crisis, lead VC strategies, and valuation at exit.** This table reports linear probability regression results for the likelihood that a given startup receives a valuation at exit that is above the sector median. We are able to find valuation information for 53% of the startups that had a successful exit. Following Nanda and Rhodes-Kropf (2013), we use the pre-money valuation of a startup in the case of an IPO. In the case of an acquisition, the startup's value is estimated by the change in equity value of the acquirer. To address possible problems due to outliers and inaccurate reporting of startups' valuation, we discretize the valuation-at-exit using an indicator that equals one if this valuation is larger than the sector median, and zero otherwise. The independent variables of interest are: i) an indicator that equals one for whether a startup raised at least one round of funding during the financial crisis (*Crisis Funding*), ii) an indicator for whether the a startup operates in a core sector of its lead VC (*Core*), and iii) an interaction between *Crisis Funding* and *Core*. Control variables are listed in the paper. Results in columns I-II are for the entire sample while results in columns III-IV and V-VI are for startups funded by more experienced and less experienced lead VCs, respectively. To categorize VCs into experienced and less experienced, we use as a cutoff the median number of funding rounds invested by lead VCs in the 10 years prior to each round observed in the sample. Based on this cutoff, a startup is considered to be funded by an experienced lead VC if it received funds from an experienced VC for at least one of the funding rounds that we observe in the sample. Standard errors (in parentheses) are clustered by lead VC. *, **, and *** denote significance at the 10%, 5%, and 1% level. Definitions of all variables are provided in Appendix A.

| | **All VCs** | | **Experienced VCs** | | **Less-experienced VCs** | |
|---|---|---|---|---|---|---|
| | (I) | (II) | (III) | (IV) | (V) | (VI) |
| Crisis Funding | 0.0747 | 0.0059 | 0.0886 | -0.0417 | 0.1000 | 0.1431 |
| | (0.0478) | (0.0633) | (0.0654) | (0.0777) | (0.0777) | (0.1207) |
| Core | -0.0094 | -0.0439 | -0.0610 | -0.1302** | 0.0277 | 0.0484 |
| | (0.0404) | (0.0433) | (0.0501) | (0.0550) | (0.0793) | (0.0874) |
| Crisis Funding x Core | | 0.1295* | | 0.2607*** | | -0.0775 |
| | | (0.0712) | | (0.0955) | | (0.1421) |
| Controls | YES | YES | YES | YES | YES | YES |
| VC FE | YES | YES | YES | YES | YES | YES |
| Sector FE | YES | YES | YES | YES | YES | YES |
| Round FE (For the oldest round we observe) | YES | YES | YES | YES | YES | YES |
| Startup start-year FE | YES | YES | YES | YES | YES | YES |
| Exit quarters FE | YES | YES | YES | YES | YES | YES |
| R-squared | 0.2085 | 0.2115 | 0.3017 | 0.3127 | 0.2603 | 0.2612 |
| Observations | 1,241 | 1,241 | 642 | 642 | 599 | 599 |

**Table B7 – Financial crisis, lead VC strategies, and startup innovation.** This table presents OLS estimates for equation (6) coefficients. The dependent variable captures the startup's innovation and is measured as the number of patent applications (eventually granted) by a startup in the two years following a given round. We exclude startups that do not operate in high technology sectors. The independent variables of interest are: i) an indicator that equals one for whether the given round was raised during the financial crisis (*Financial Crisis*), ii) an indicator for whether the a startup operates in a core sector of its lead VC (*Core*), and iii) an interaction between *Financial Crisis* and *Core*. Control variables are listed in the paper. Results in Panel A are for startup rounds financed by the full sample of lead VCs while results in Panels B and C are for startup rounds financed by more experienced and less experienced lead VCs, respectively. To categorize VCs into experienced and less experienced, we use as a cutoff the median number of funding rounds invested by lead VCs in the 10 years prior to each round observed in the sample. In columns I-II of all three panels, we present the results for all startups. In columns III-IV and V-VI, however, we present results for early-stage and later-stage startups, respectively. Startups are classified as early-stage if they raised their first round of funding in 2005 or later, and as later-stage if they raised their first round of funding in 2004 or earlier. Control variables are listed in the paper. Standard errors (in parentheses) are clustered by lead VC. *, **, and *** denote significance at the 10%, 5%, and 1% level. Definitions of all variables are provided in Appendix A.

**Panel A: All VCs**

| | **Entire sample** | | **Early-stage startups** | | **Later-stage startups** | |
|---|---|---|---|---|---|---|
| | (I) | (II) | (III) | (IV) | (V) | (VI) |
| Financial Crisis | -0.0795*** | -0.0660*** | -0.0068 | -0.0206** | -0.2393*** | -0.1745*** |
| | (0.0144) | (0.0184) | (0.0076) | (0.0094) | (0.0364) | (0.0462) |
| Core | -0.0072 | -0.0020 | 0.0074 | 0.0012 | -0.0337 | -0.0148 |
| | (0.0147) | (0.0164) | (0.0076) | (0.0080) | (0.0414) | (0.0425) |
| Financial Crisis x Core | | -0.0268 | | 0.0280** | | -0.1244** |
| | | (0.0245) | | (0.0111) | | (0.0595) |
| Controls | YES | YES | YES | YES | YES | YES |
| VC FE | YES | YES | YES | YES | YES | YES |
| Sector FE | YES | YES | YES | YES | YES | YES |
| Round FE | YES | YES | YES | YES | YES | YES |
| Startup start-year FE | YES | YES | YES | YES | YES | YES |
| R-squared | 0.3547 | 0.3547 | 0.0486 | 0.0491 | 0.2946 | 0.2952 |
| Observations | 12,457 | 12,457 | 7,436 | 7,436 | 5,021 | 5,021 |

**Panel B: Experienced VCs**

| | **Entire sample** | | **Early-stage startups** | | **Later-stage startups** | |
|---|---|---|---|---|---|---|
| | (I) | (II) | (III) | (IV) | (V) | (VI) |
| Financial Crisis | -0.0968*** | -0.0965*** | -0.0016 | -0.0238* | -0.2667*** | -0.2036*** |
| | (0.0220) | (0.0246) | (0.0122) | (0.0134) | (0.0515) | (0.0554) |
| Core | 0.0052 | 0.0053 | 0.0007 | -0.0092 | 0.0045 | 0.0256 |
| | (0.0219) | (0.0249) | (0.0120) | (0.0124) | (0.0525) | (0.0557) |
| Financial Crisis x Core | | -0.0006 | | 0.0476*** | | -0.1339* |
| | | (0.0365) | | (0.0176) | | (0.0795) |
| Controls and FE | YES | YES | YES | YES | YES | YES |
| R-squared | 0.3761 | 0.3761 | 0.0679 | 0.0690 | 0.3217 | 0.3223 |
| Observations | 6,352 | 6,352 | 3,553 | 3,553 | 2,799 | 2,799 |

**Panel C: Less-experienced VCs**

| | Entire sample | | Early-stage startups | | Later-stage startups | |
|---|---|---|---|---|---|---|
| | (I) | (II) | (III) | (IV) | (V) | (VI) |
| Financial Crisis | -0.0567*** | -0.0280 | -0.0101 | -0.0100 | -0.1855*** | -0.1124 |
| | (0.0190) | (0.0291) | (0.0094) | (0.0131) | (0.0503) | (0.0853) |
| Core | -0.0061 | 0.0042 | 0.0185* | 0.0186 | -0.0663 | -0.0490 |
| | (0.0193) | (0.0210) | (0.0104) | (0.0113) | (0.0600) | (0.0601) |
| Financial Crisis x Core | | -0.0524 | | -0.0003 | | -0.1204 |
| | | (0.0344) | | (0.0143) | | (0.0955) |
| Controls and FE | YES | YES | YES | YES | YES | YES |
| R-squared | 0.3274 | 0.3277 | 0.0321 | 0.0321 | 0.2699 | 0.2705 |
| Observations | 6,105 | 6,105 | 3,883 | 3,883 | 2,222 | 2,222 |