Managing Performance Signals Through Delay: Evidence from Venture Capital

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Abstract

This paper examines whether agency conflicts during venture capital (VC) fundraising impact investment behavior. Using novel investment-level decisions of VCs in the process of raising new funds, we find that venture capitalists take actions hidden from their investors, i.e. limited partners (LPs), that delay revealing negative information about VC fund performance until after a new fund is raised. After fundraising is complete, write-offs double and reinvestments in relatively worse off entrepreneurial firms increase. We find that these observations cannot be explained by strategic bundling of news or effort constraints due to the newly raised fund. Funds with both long and short fundraising track record exhibit this behavior and the delay is costly for fund investors (LPs). This strategic delay shows that fundraising incentives have real impacts on VC fund investment decisions, which are often difficult for LPs to observe.

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The evaluation of managerial talent can be difficult, particularly when managers themselves control the dissemination of information. This problem is important in the venture capital (VC) industry, in which investment characteristics are difficult for outsiders to observe. Investors' assessment of managerial talent impacts the VC's future fundraising ability (see Chung, Sensoy, Stern, and Weisbach (2012) and Hochberg, Ljungqvist, and Vissing-Jörgensen (2014)). VCs typically raise funds from limited partners (LPs) every three to four years, where a newly raised fund guarantees a performance-insensitive fee for up to ten years. This setting provides incentives to manipulate fund valuation, which may lead to inefficient capital allocation among managers. Such actions have yet to be investigated in the context of fundraising, yet they are central to understanding the extent and consequence of agency frictions.

Despite extensive literature studying portfolio activity around fundraising in VC and private equity, whether agency issues manifest themselves in fundraising remains unresolved, as does the way in which reputation — proxied in this paper by length of fundraising track record — mitigates their effects. A potential tool available to VCs is at the center of the extant studies: inflation of the portfolio value prior to fundraising. The collection of evidence bodes well for the efficiency of VC and private equity fundraising: reputation attenuates agency costs and limits most bad behavior (e.g., Brown, Gredil, and Kaplan (2015) and Barber and Yasuda (2016)). Most studies indicate that these actions are confined to a set of low-reputation managers measured by size or firm age. However, because inflation or quickening of exits (Gompers (1996)) are observable to LPs, these actions by VCs can lead to LPs passing on investing in the next fund and thus should rarely be used by VCs. Tests as to whether LPs punish observable manipulation by withholding future capital are in fact tests of LP sophistication and information asymmetry regarding VC actions that are observable by LPs.

Motivated by these observations, we argue that the unit of analysis and data constraints in earlier work cannot rule out the existence of all agency costs. Instead, we explore investment-level outcomes that allow us to test for actions such as window-dressing (i.e., NAV inflation) and strategic delay. This paper asks whether VC funds exhibit strategic delays in the dissemination of negative performance information during fundraising, whether reputation attenuates such agency conflicts and what, if any, are the costs of such actions. Our main contribution is to demonstrate that VCs behave strategically around fundraising in liquidation and reinvestment decisions.

Several papers investigate how fundraising incentives relate to features of VC portfolios that are observable to the LP. In Gompers (1996), the faster exit rates of portfolio companies (i.e., grandstanding) held by unproven VCs reveal that VCs with low reputation take actions in an effort to send a better signal of their type at a cost to their LPs. Similarly, Brown, Gredil, and Kaplan (2015) find that most inflation of NAVs is confined to a set of low-reputation, poor quality funds. In our interpretation, their results suggest that costs are so high for manipulation that in fact the top-performing funds provide relatively conservative estimates of their returns to LPs. We believe that this understating of returns can be interpreted as an attempt to ensure separation in the eyes of the LP from the low-type NAV manipulating VCs. Barber and Yasuda (2016) explore the timing of fundraising and current fund performance and find that fund closings tend to occur at the peaks of investment performance. Again, small and young VCs are much more likely to exhibit this behavior. We argue that these results suggest that LPs are sophisticated and can evaluate talent of VCs based on LP-observable actions. However, inflation of portfolio value is not the only strategy available to VCs, leaving the question unanswered as to whether agency frictions due to fundraising incentives exist in the VC industry.

Two issues arise in an analysis of NAV over the fundraising cycle. First, NAV summarizes the value of the unrealized portion of the portfolio that can be marked to market or kept at book value (i.e., cost). Here, manipulation requires repricing of part of the portfolio. However, investments held at cost comprise a large percentage of the NAV. Second, as shown by Barrot (2014), there are strong time trends in fund investments that cannot be controlled for in a fund-level analysis. This may confound fund age effects and other exogenous characteristics with manipulation. Investment-level analysis allows us to separate these mechanical issues from the economic decisions made by managers.

We investigate a set of actions plausibly hidden at the time of fundraising and ask whether the actions respond to the presence of agency conflicts between VCs and LPs. These actions are types of "strategic delay," which takes two forms: delayed write-off of failed entrepreneurial firms and delayed reinvestments into lower quality opportunities, both of which are postponed until fundraising is completed with the goal of potentially inflating the current fund performance. The analysis tests hypotheses about the relationship between actions and fundraising activity, along with heterogeneity in behavior by VC reputation.

We first hypothesize that LP-observable actions that inflate performance will be confined to low-reputation VCs. To test this, we compare the rate of investment-level write-ups around fundraising. Next, we hypothesize that delayed revelation of information leads to a "signal-jamming" equilibrium wherein investors are unable to distinguish talent.[1] Stein (1989) argues that managers can take actions to avoid revealing their type to investors. In the case of good performance, VCs will disclose information to bolster their assessment by investors. Any hidden actions that attempt to alter performance signals should involve delaying news, specifically concerning negative information.[2] Although delayed news revelation and strategic disclosure have been studied in the context of public firms, an analysis of these actions and their relationship to fundraising has not been done in the VC context. We hypothesize that strategic delay is invariant to VC reputation due to its unobservability by LPs and its benefits are amplified by VC fundraising incentives. Delay of bad news provides a much larger boost to reported unrealized returns than most strategies observable to LPs.[3]

The paper uses venture capital financing and fund data from VentureSource that cover the period of 1992 to 2013. The financing data include entrepreneurial firm characteristics and the relationship between a firm and each of its venture capital investors. The main sample includes

[1] Shin (1994) studies how selective disclosure can affect firm value. Hölmstrom (1982) and Fudenberg and Tirole (1986) provide a general discussion and Stein (1989) offered a discussion in the context of earnings management. Song (2003) models a setting in which interested parties can disclose new information with verifiable reports in the context of asset pricing.

[2] Using market reactions to changes in dividends, Kothari, Shu, and Wysocki (2009) shows that public firm managers tend to delay the release of bad news to the market.

[3] Consider the observable strategy of valuation inflation where a VC reports twice the realized return of an investment. Given the mean Internal Rate of Return (IRR) of firms in VC fund is 14.1% in our sample, this strategy has a limited impact (the total increase is just one percentage point for a hypothetical ten investment fund). To have a larger impact, the VC needs a very high write-up, but such high write-ups on investments to boost fundraising potential will likely be met with skepticism by investors. In contrast, delaying negative information about a write-off (i.e., -100% return) improves reported returns by approximately 11.41 percentage points, which increases portfolio IRR significantly more than valuation inflation strategy. This comparison is for a single delayed versus inflated investment. With nearly 50% of entrepreneurial firms in our sample failing, delaying an investment write-off provides a large boost to reported, unrealized performance. Importantly, the 2.69% IRR from truthful revelation would put the fund in the bottom quartile of fund performance. See `http://www.cambridgeassociates.com/wp-content/uploads/2014/10/Public-USVC-Benchmark-2014-Q2.pdf`.

768 VC firms and 1,453 funds, with investments in 7,814 entrepreneurial firms and 15,564 financing events. We observe both the dates of fund closings and the sizes of funds over a VC's lifetime. Our sample of VCs funds for this time period is comparable to samples used in Barber and Yasuda (2016) and Brown, Gredil, and Kaplan (2015). Multiple funds within a VC firm allow us to include VC firm-level fixed effects, allowing the comparison of fund investment within VC across funds.

To test for agency problems caused by strategic delay around fundraising, we focus on two actions: (i) the timing of writing off a failed firm and (ii) the timing of reinvestment in firms in the VC portfolio. The identification strategy searches for a discontinuity in VCs' incentives to alter their own talent signals around a fundraising event. The results use variation across funds and within VC firms, thus controlling for heterogeneity of VCs unobserved by the econometrician. We estimate how write-offs and investments in lower quality entrepreneurial firms change after fundraising compared to before using a hazard model. After funding is secured, VCs write off investments more often — the rate doubles in years subsequent to fundraising. Reinvestment in a subset of the fund's portfolio firms is also delayed until after the next fund closes. These investments are done in relatively worse firms after a fund closing. We also investigate alternative explanations that could perhaps generate the behavior observed in the data, which may not be related to incentives to inflate performance. Fundraising attempts are more likely to occur in hot markets, which in turn could produce increases in write-offs due to mean reversion in business cycles. The results are robust to this explanation.

Alternatively, the changes in write-offs after fundraising may stem from effort constraints that come from the introduction of a new, possibly larger fund. Here, VCs may walk away from investments in the current fund and focus on the new fund investments. First, we find that the rate of reinvestment in low-quality investments increases after fundraising, suggesting that effort constraints are not the main explanation. Second, we study the differences in write-off events around fundraising. If write-offs are primarily driven by strategic delay, then they should occur after a relatively longer period of time and be more capitalized. A cross-sectional analysis of write-offs around fundraising shows that the failed entrepreneurial firms are older and weakly more capitalized. The collection of evidence supports the interpretation that fundraising incentives lead to strategic delay of bad news by VCs to improve signals of performance to LPs.

Next, we empirically characterize the VC talent-signaling equilibrium in the presence of hidden actions. Delay strategies are not limited to VCs who fail to raise their next fund, suggesting that low performing VCs do not drive results. Similarly, VCs continue to pursue delay strategies over time, even after they have established a reputation through multiple fund closings. Thus, manipulation through delay strategies occurs for both high and low reputation funds, where reputation refers to track record. Such patterns are consistent with a signal-jamming equilibrium. In such an equilibrium, investors (LPs) are unable to distinguish talent in the face of negative signals, and thus it is optimal for all managers (VCs) to employ hidden actions to improve talent signals. The cost of delay to VC funds suggests that investors and VCs are stuck in a situation similar to a prisoner's dilemma (see Stein (1989)). VCs face a tradeoff: suffer deadweight losses due to the signal-jamming strategy or risk getting branded as a less talented VC by LPs — ultimately reducing fundraising potential. Strategic delay of bad news has costs to LPs. The average difference in investment returns between firms in which VCs invest before their own funding and the firms in which they invest after fund closing is approximately 15%.

The evidence does not imply inefficient capital allocation in VC markets in the long run. An analysis of longer term response to fund performance reveals that as delayed news is revealed, LPs can distinguish VC talent. Delayed write-offs have a real impact on total fund N performance, which is observable to LPs when Fund $N+2$ is raised. More write-off events and fewer write-ups in Fund N predict a lower probability of successfully raising the next fund ($N+2$), and if raised, it is smaller. Thus, even though there is signal jamming in the short run, in the long run, low-type VCs do not get funded. The presence of both is likely a result of noisy nature of signals (e.g., performance, initial public offerings) and the limited number of fundraising interactions between LPs and VCs.

The main contribution of the paper is to show that VC firms behave strategically in liquidating and re-evaluating their existing investments around the fundraising events. The evidence shows that VCs delay bad news that would allow limited partners to infer that the VC has a lower talent level. Given the size and importance of the venture capital industry, strategic timing of investments by VCs has important implications for both capital allocation by LPs and to entrepreneurial firms.

These results contribute to the literature on VC performance management and reputation.[4] In contrast to previously discussed work by Brown, Gredil, and Kaplan (2015) and Barber and Yasuda (2016), who find that active fund-level NAV inflation is confined to low-reputation VCs, Jenkinson, Sousa, and Stucke (2013) finds that PE funds of both high- and low-reputation report conservative NAV except during fundraising. We confirm that LP-observable actions that could improve fund valuation are rarely used by high-reputation VCs. At the same time, we expand the set of strategies available to VCs, to search for manifestations of agency conflicts between VCs that are fundraising and their LPs. We identify strategic delay due to agency conflicts as the reason behind certain investment decisions.

Gompers (1996) considers quickening of exits that are potentially unobservable to LPs; however, such actions occur before the next fund closes. The new strategies of delayed write-offs and reinvestment in this paper show that hidden actions can be a powerful tool for VCs. Two studies demonstrate changes in investments over the fund lifecycle that are driven by non-fundraising incentives. Barrot (2014) investigates how VC fund horizon affects the age and riskiness of its investments, while Robinson and Sensoy (2013) study how distributions from VCs to LPs interact with fee timing to reveal additional agency problems between LPs and VCs. This paper focuses on how investment behavior connects to fundraising incentives and the resulting signaling equilibrium.

The features of delayed write-offs in venture capital have previously been found in the banking literature, particularly around financial crises. For example, Vyas (2011) shows that U.S. financial institutions had less timely write-downs during the 2007–2008 financial crisis, while Peek and Rosengren (2005) reveal that regulations in Japan incentivize banks to provide capital to their worse performing loans. The results also extend similar outcomes banking (e.g., Rajan (1994)) and public firms (e.g., Kothari, Shu, and Wysocki (2009)) to the VC setting where information asymmetries are more extreme and the data invite study of impacts on managerial investment decisions. Strategic delay actions studied here allow a novel investigation into how such actions introduce agency conflicts in private equity, where capital allocation decisions by LPs are large and long-term.

[4] Information management is also found in other sectors of the economy. See Cohen, Lou, and Malloy (2014) for a study of strategic selection of analysts by managers.

1 Hypothesis development

Consider a venture capital firm raising its next fund. It provides performance data on its earlier and current funds to prospective investors (LPs). We ask whether current fund investment strategy responds to the fundraising activity of a VC's next fund. Chung, Sensoy, Stern, and Weisbach (2012) and Hochberg, Ljungqvist, and Vissing-Jörgensen (2014) show that limited partners respond to both realized and unrealized performance metrics. The latter metrics — the value of investments in the current fund that have yet to realize a return — are potentially subject to manipulation by a VC. There are two classes of strategies available to alter the signals of their performance. The first class involves inflation of the current portfolio net asset value (NAV) through marking up investments or reinvesting in these companies at higher valuations. Importantly, the outcome of each is observable to the limited partner during the fundraising process. Studies on NAV manipulation find that these actions are confined to low-reputation managers, which supports the Hölmstrom (1979) argument that a principal's (LPs) optimal policy depends on all available information about agent actions.

We introduce a second class of *delay* strategies which more closely map to the hidden actions in a standard principal-agent problem (e.g., Hölmstrom and Milgrom (1987)). Here, VCs take actions unobservable to the LP that temporarily inflate the unrealized portion of the portfolio by delaying news that lowers portfolio value. In public firms, managers have some discretion in revealing information, even with regulations mandating disclosure of certain events. The illiquid and opaque VC market provides extraordinary discretion to VCs on the timing and content of information provided to LPs.

Consider a case in which a VC has positive information about fund performance. Here, it is optimal for the VC to reveal any truthful good news before fundraising. LPs may discount unreliable or non-market increases in valuation before fundraising, while sophisticated LPs may even punish VCs who alter NAV by not investing in their next fund.[5] Now suppose that a VC receives a private negative signal about portfolio performance, for example, that a portfolio company is failing. If delayed revelation is both possible and unobservable by LPs, a VCs may do so to avoid this negative signal about his talent. As this delay is observable only to the VC, he should avoid immediate LP

[5]Lerner, Schoar, and Wong (2007) show a hierarchy of skill among LPs investing in private equity.

punishment (e.g., by not investing in the next fund). Such behavior benefits the agent (VC) at the expense of the principal (LP), and is thus an agency conflict.

These delay strategies may result in an interesting signaling equilibrium if there is significant skill heterogeneity among VCs. All VC portfolios will have some set of failing investments that must be disclosed regardless of the time to next fund closing. If a high-type VC discloses bad news about this part of the portfolio before fundraising, an LP cannot determine whether it was a negative shock to a high-type VC or an expected signal from a low-type VC.[6] Thus, no VC will find it optimal to disclose bad news during fundraising. The result is a pooling equilibrium whereby all VCs delay signals about bad news to avoid being classified as low types. As in Stein (1989), LPs infer that this is the information disclosure regime during fundraising and presumably discount all investors in some manner. Such a conclusion does not imply that LPs cannot identify talent levels because VC types are eventually revealed via verifiable signals sent after fundraising.

Throughout this section, we make two assumptions regarding (i) limited partners' ability to ascertain talent and (ii) the typical VC fund's portfolio composition.

A1: *Limited partners incorporate all observable signals in performance evaluation and can punish manipulation.*

Punishment includes LP non-participation in the next fund or a smaller allocation to the next fund. Signals observable to the limited partner include any change to the fund's NAV that can occur through new financing events, failures, exits (e.g., an IPO) or a change in individual investment valuation made directly by the VC. The first performance signal that we consider is an increase in valuation of the unrealized portion of the portfolio, which is reflected in aggregate NAV. Any inflation of an investment — and thus the VC's portfolio — would occur through a *write-up*. A write-up entails increasing the reported market price of an investment on the VC fund's balance sheet. Such a change can occur through the VC directly "marking" the investment, which would require some evidence provided to the LPs or a refinancing event and thus a new post-money valuation.[7] Without a write-up, investments are typically kept at or near the prior valuation.

[6] This holds because it is not costlier for low-type VCs to also reveal bad news.

[7] After the passage of FAS157, it is difficult for venture capitalists to write up parts of their portfolio without some "market" pricing event.

The second LP-observable signal we consider is a *write-down*, which is a decrease in the valuation of an investment in the VC funds portfolio. Similar to write-ups, VCs can either mark the value of the investment directly in their balance sheet or have a new financing event priced at a lower valuation. At the extreme, a total write-down is a write-off where the investment is set to zero (or some small recovery value). These write-offs typically occur when the entrepreneurial firm fails, which is the most common outcome for VC-backed firms.

As shown by Sahlman (2010), a small fraction of VC investments drive fund returns, while most investments earn less than capital invested. We assume that at each investment decision, the VC invests rationally (i.e., only in positive NPV projects) but has a ranking of quality in its portfolio prior to investment exits. This leads to a simple assumption that invites the strategies we study:

A2: *VC fund portfolios have investments of varying quality.*

1.1 Valuation inflation

The first strategy we consider is a "write-up." Analysis of quarterly NAV changes includes write-ups from both re-investment and book reevaluations. Our data allow us to directly test for changes in the former. Inflating the value of the portfolio improves the interim performance of the VC fund and could improve the LP's assessment of VC skill. These actions, however, are LP-observable and likely verifiable. Thus, we predict that only low-reputation VCs will have the incentive to perform this type of manipulation as they have less to lose. Under assumption (A1), we formulate the major hypothesis thus far tested in the literature concerning inflation and reputation for investment-based inflation:

H1: *High-reputation venture capital funds do not inflate valuations of investments in their fund prior to fundraising.*

We measure reputation in two tangible ways. The first is whether the VC firm has raised more than one fund. Firms raising their first fund have little to no track record and thus provide a clean subsample to test this hypothesis. The second considers the ex-post fundraising outcome measured by whether a fundraising VC firm successfully closed the next fund. Failure to raise a next fund signals LP punishment because of manipulation or poor current fund performance, both of which are scenarios with significant agency problems.

1.2 Delay strategies

In our sample of 20,600 investment-level returns, 12,069 returned less than 25 cents to the dollar invested.[8] The nature of disclosure between VCs and LPs means that only VCs can observe failing but not yet written off portfolio companies at the time of fundraising. As preferred shareholders and possibly board members, VCs also have some control on the timing of write-offs. Keeping a failing firm active in a VC's portfolio costs time from monitoring and possibly capital. Thus, VCs should immediately write off investments whose equity value is zero or where a new investment is negative NPV. However, the benefits of delaying information regarding an eventual firm write-off can be large. In a fund portfolio of ten investments, keeping just one investment at book instead of zero increases the portfolio IRR 11.4 percentage points compared to an 8.6 point increase by doubling the value of that same investment.[9] The next hypothesis posits that the benefits of delaying write-offs due to fundraising incentives may outweigh the costs:

H2: *Write-offs of investments increase after the next fund closes.*

An increase in write-offs after fundraising could stem from our proposed delay incentive or from other frictions around fundraising. Both represent agency conflicts. The next two hypotheses consider these alternative agency-based explanations. Under the delay hypothesis, write-offs are delayed past the optimal time. Similar delay of bad news has been found for public firms. Kothari, Shu, and Wysocki (2009) show that firm management, on average, delays the release of bad news to investors relative to revelation of good news.[10] In our setting, the agency problems leading to delay stem from fundraising incentives:

H2a: *An increase in write-offs after fundraising is driven by delay in the realization of failure.*

Fundraising and its success could also give rise to an increase in write-offs. For example,

[8]The sample of returns has positive selection bias for non-zero returns and perfect coverage of zero outcomes. Thus, the returns distribution does not map directly to the firm outcome distribution.

[9]The mean IRR of firms in an average VC fund in our sample is 14.1%. For a hypothetical 10 investment fund, delaying negative information about a write-off (i.e., -100% return) improves the portfolio IRR 11.4 percentage points. This compares to a 8.6 percentage point increase from doubling the value of that same investment.

[10]The authors use market reactions to dividend increases and decreases to capture the timing of news releases. Alternatively, Acharya, DeMarzo, and Kremer (2011) show theoretically that bad market news can trigger immediate disclosure by firms.

upon raising the next fund, the VC must choose where to exert effort. If the average quality of new investments exceeds that of a subset in the current portfolio (A2), then they will write off the latter. Similarly, the fundraising process could limit VC's attention, leading them to delay investment or decisions in their current portfolio until after fundraising is completed. If they selectively provide effort to their best deals, then we will again see an increase in write-offs after fundraising.

Strategic bundling of news could also lead to changes in write-offs. For example, VCs could seek to bundle these bad news events after the positive news shock of a new fund. Similar strategies have been modeled for public firm managers who, in contrast, may time the release of firm-specific bad news with common shocks or bundle with other bad news. For example, Rajan (1994) notes that banks realize bad loans in adverse states of the economy when reputation is less important. Grenadier, Malenko, and Strebulaev (2014) provide a real options model where agents time abandonment decisions to match shocks that are publicly known in an effort to protect their reputation. The next hypothesis predicts the increase in write-offs follows from bundling or effort constraints:

H2b: *A new fund leads to effort capacity constraints for the VC or an opportunity to bundle bad news with good. This leads to an increase in previous fund write-offs.*

Separating (H2a) and (H2b) requires documenting the characteristics of the investments written off around the next fund closing. Under (H2a), write-offs are delayed after fund closing and will thus be older and possibly more capitalized because the VC kept the investment in the portfolio too long. Under (H2b), the increase in write-offs after fund closing are not delayed, but rather on average sped up in response to bundling benefits or effort provision. Thus, we would predict failures in this period to occur for younger investments with lower capitalizations. Both hypotheses relate to agency problems in fundraising and differ only in their mechanisms.

1.3 Selective reinvestment

The next hypothesis concerning investment strategy considers reinvestment decisions in a subset of the VC fund's portfolio. A reinvestment in any of the fund's portfolio companies can update the value of the investment and thus the fund NAV. In presence of heterogeneity in quality of investments in a portfolio (A2), there is value in delaying the marking-to-market of sub-par investments. Hypothesis (H1) predicts that the average VC will not inflate valuations. However, avoiding the pricing of relatively worse investments can indirectly improve NAV. Hence, a VC may aim to "control the message" during the fundraising period by reinvesting in the best companies (as in Gompers (1996), exiting the best investments) and delaying the reinvestment in the subset of under-performing investments.

H3: *VCs postpone reinvestment in worse firms until after fundraising to delay bad news about their talent level.*

To test (H3), we will use the investment outcome — final exit valuation and exit status — as proxy for its quality. Evidence in favor of (H3) also supports (H2a) as any delayed reinvestment would suggest that effort constraints are not a major problem after fund closing.

1.4 Reputation and investor quality

Notwithstanding our argument that the strategies of delaying bad news are unobservable to the LP and beneficial to fundraising VCs, other forces may also limit some VCs from taking such actions. First, high-reputation VCs may have sufficient experience and track record to be able to safely reveal failures and price all investments at the required time. Second, delaying a write-off past the next fund closing may cost both time and capital. High-reputation VCs have better outside options in their portfolio, so relatively less delay may occur. The next hypothesis predicts that the implications of (H2) and (H3) will be confined to VCs that failed to raise a subsequent fund or to younger, low-reputation VC firms.

H4: *Any delayed write-off or reinvestment is confined to low-reputation VCs.*

A rejection of (H4) supports the existence of a signal-jamming equilibrium (Stein (1989)).

1.5 Procyclical fundraising

We identify agency conflicts by observing investment actions (write-offs/reinvestments) taken by VCs after raising a new fund. However, fund performance and the ability to raise new funds also depend on business cycles. VC funds raised at the peak of such a cycle will thus be followed by worsened market conditions, which could increase write-offs after fundraising (H2) or selective reinvestment in lower quality entrepreneurial firms (H3). This alternative explanation requires an additional hypothesis:

H5: *Funds raised at the peak of the business cycle are the only funds with increased write-offs and delayed reinvestment.*

A rejection of the above hypothesis will confirm that our results are robust to business cycles effects.

1.6 Long-run learning

The delay strategies will benefit short-term fund performance for fundraising of fund $N+1$; however, the performance of the current fund N is eventually revealed. LPs should use this information to update their talent assessments for fundraising of fund $N+2$. The final hypothesis considers the long-term assessment of VCs by LPs.

H6: *Current fund write-offs and refinancings predict fundraising success in the subsequent fund.*

Confirmation of this hypothesis would complement the findings of Chung, Sensoy, Stern, and Weisbach (2012) and Hochberg, Ljungqvist, and Vissing-Jörgensen (2014), who show that performance matters for fundraising success. Furthermore, (H6) would confirm that any evidence in favor of agency conflicts does not imply that LPs are unsophisticated or misled in equilibrium, reconciling our findings with those of Brown, Gredil, and Kaplan (2015).

In sum, this set of hypotheses posits that, given difficult-to-observe actions that can improve performance signals, VCs will delay write-offs and reinvestments in under-performing firms. However, any short-term ability to alter performance signals is eventually revealed to LPs and reflected in later fundraising success.

2 Data

We use the venture capital financing database VentureSource provided by Dow Jones and supplemented by data from quantitative VC fund Correlation Ventures. VentureSource has been supplemented with additional hand-collected data from individual VCs and LPs.[11] The combined dataset is merged with valuation data in Thompson's VentureXpert. The financing data cover equity, debt and exit events for US-based, VC-backed entrepreneurial firms from 1992 through 2013. The sample includes the subset of financing events in which we can observe the VC fund that provided the capital (as opposed to simply knowing the VC firm but not the specific fund). Further, we require that the VC fund makes at least one investment before and after a fund closing. The sample also excludes funds managed by private equity firms, angel groups, non-US investors, buyout funds, and corporations. The main sample of financings with a known US-based VC fund includes 7,814 entrepreneurial firms in 15,564 financing or exit events. This sample represents 39% of all entrepreneurial firms and 31% of all financing events. These financings are merged to characteristics of VC funds for which we know the sequence of closings and the total amount of committed capital. There are 1,453 unique funds associated with 768 VCs. These fund counts are quite comparable to those of contemporary studies using VC funds: there are 450 VC funds in Barber and Yasuda (2016), 627 PE and VC funds in Jenkinson, Sousa, and Stucke (2013), and for a longer time series than used here, Brown, Gredil, and Kaplan (2015) have 1,047 VC funds from 1984 onwards.

Compared to the full sample, the sample with VC fundraising data includes older entrepreneurial firms that have raised more capital in more financing rounds. The VCs in the sample have four times the investing experience (in terms of deals) as the investors without fundraising data.[12] This sample selection could provide too little power to find delay or inflation if only high-reputation VCs are in the dataset. Fortunately, the data have good coverage of first-time funds and failed fundraisers. Some 28% of the VC firms in our sample have only one fund and 36% of funds lack a follow-on fund. These numbers are comparable to those of Brown, Gredil, and Kaplan (2015) and Barber and Yasuda (2016).[13] Thus, we believe there are sufficient funds to give us statistical power

[11]For example, Correlation Ventures provides portfolio analysis for other VCs and receives portfolio data in exchange.

[12]Similar selection issues exist in fund-level data that are sourced by public filings (e.g., Preqin) of pension funds and endowments that have access to the largest, most successful private equity funds.

[13]Barber and Yasuda (2016) do not report these exact numbers, but close analogues that are reported appear similar. Some 40% of the VC funds in their sample (Figure 1, Panel B) do not have a next fund and 42% of funds are "low reputation" which includes, small, young and no track record VC funds. In Brown, Gredil, and Kaplan (2015), 12% of the firms are single-fund firms.

to identify differences in behavior by reputation.

2.1 VCs that fail to raise a fund

The average VC in the sample has over three funds. However, many venture capitalists are unsuccessful in raising capital for a new fund when their past fund under-performs. Following Brown, Gredil, and Kaplan (2015), we include such VCs in our analysis under the assumption that they tried but failed to raise a new fund. Our predictions in Section 1 simply require that a VC intends to raise a new fund, so the inclusion of those that are unsuccessful is reasonable. A VC fund's life is often split into two periods: the investment period (years 1 to 5) and the follow-on period (years 6 to 12). The investment period involves finding new entrepreneurial firms and is thus where we expect to find most of the investment of fund capital. This structure informs the fund closing imputation.

One can track the capital invested by a VC fund over time to measure the capital available for new investments or "dry powder," which is the difference between this sum and the total committed capital. Figure 1 reports this measure for the sample of funds with a next fund. The path of dashed line is consistent with more investment early in a fund and less investment over time as the fund matures.[14] The median (mean) dry powder of funds that successfully raised a fund in the year window around closing is 71% (68%). The number of new investments made by the fund peaks around this value of dry powder as well, which is often the time a VC begins to seek a new fund. For those funds that failed to raise a next fund, we assume that the next fund close date is the time when their current fund has invested 65% of the fund.[15] The sample of firms that failed to raise a new fund are excluded from some regressions to test the hypotheses in Section 1.

2.2 Summary statistics

Table 2 describes the sample of entrepreneurial firms, financings, VCs and funds used throughout the analysis. An entrepreneurial firm and its financings are in the sample if we can match a VC and

[14] The figure does not show the full time window of 10–12 years; hence the fraction does not fall to zero. Moreover, VCs will invest in a first financing of an entrepreneurial firm and then reserve 1–2 times that amount for future needs. The graph only shows the investments.

[15] The results are insensitive to using a value in the range $[60, 75]$. The resulting imputation accounts for 13% of the final sample of funds. However, the exclusion of unsuccessful VCs does not materially affect our results.

fund to a financing event. The top panel shows that the average entrepreneurial firm was founded in 1998 and raised over $6m in its first financing event. A quarter of the firms have failed by the end of the sample, while over 23% have still not exited. These characteristics are similar to those in the full sample of entrepreneurial firms founded in the same time period. The next panel describes the 15,564 financing events associated with these firms. The average financing happens in the year 2001 and has raised $3.1m. The typical VC is about eight years old at the time of the financing and invests out of their third fund. These characteristics show that our sample of financings leans towards older and larger VC firms.

The last two panels of Table 2 detail the set of VC firms and funds in the sample (one observation per firm and fund respectively). The typical VC first entered the market in 1996 and has made over 113 investments by the end of 2013. Finally, the funds associated with these VCs were on average closed in 1999 and were followed by a subsequent fund 70% of the time.

2.3 Main variables

There are several variables of interest tied to the hypotheses detailed in Section 1. The main independent variable is the time around a VC fund's next fund closing. That is, for every investment made by a VC firm out of fund N, we compare its date to the date of the first close of the firm's fund $N+1$. For example, say Fund N of a VC invests from 1998 to 2004. The firm's fund $N+1$ has a first close in 2001. The variable "Time to next close" is in the range $[-3, 0]$ for all investments made out of fund N between 1998 and 2001. Similarly, the post-2001 financings have a range $(0, 3]$. Figure 2 provides a visual representation of how fund overlap defines event time. From this continuous variable, we consider the indicator "One year after fund close," which is one if the investment or other action occurred in the $[0, 1)$ period after the next fund closed. The next set of variables considers the characteristics of investments made by VCs.

An equity investment made by a venture capitalist in an entrepreneurial firm reveals a valuation. That valuation — called "post-money" — captures the total equity value of the firm. After the first investment in an entrepreneurial firm, we track the slope of changes in firm valuation with the variable "Up round." This is an indicator equal to one if the valuation of the current investment exceeds the last valuation in the previous equity financing.[16]

A common outcome for a VC-backed entrepreneurial firm is failure or shutdown. Some 32% of entrepreneurial firms exit in this manner, returning little, if any, capital invested to investors.[17] The variable "Write-off" is an indicator for these failure events. The date of failure is obtained from VentureSource (the date a firm ceased operations or the last date when the firm's profile was updated) and failure dates from article of incorporation filings.[18] Reassuringly, these write-offs occur on average 4.15 years after a firm's first VC financing, which is similar to the full sample results in Puri and Zarutskie (2012) who use Census data. The Appendix provides more detail of the failure date assignment and a discussion of impacts of any measurement error issues.

The next portfolio strategy available to a VC investor is the timing of the re-investment in the entrepreneurial firm. A reinvestment in an entrepreneurial firm results in an update to the VC fund's NAV and provides a signal of the portfolio's performance. We measure delay with the variable "Years since last financing," which measures the time between a follow-on financing and the previous investment made by the VC investor. This variables forms the basis of the hazard model specification. Of course, this reinvestment event is only defined conditional on the firm's having a new financing event. The write-off variable above covers the remaining non-financed firms.

The last set of variables concern the ultimate investment outcome of the entrepreneurial firm in the VC portfolio outside of failure. We employ three measures of firm prospects. A popular measure of success for entrepreneurial firms is whether such firms have an initial public offering (IPO) or are acquired—the latter defined as cases in which reported exit values exceed twice the capital raised by the firm. The first measure of outcomes is an indicator variable that takes a value of one in case of either of these outcomes.[19] The next measure is the total value created at exit

[16] It is important to note that the sample of financings for which we have valuation is positively selected towards successful investments (see Korteweg and Sorensen (2010)), which we address in our regressions. In effect, the estimation puts more weight on those reported valuations from eventually failed or acquired firms relative to the over-sampled IPO'd firms.

[17] This percentage is almost surely a conservative estimate because many acquisitions are hidden failures (see Puri and Zarutskie (2012)).

[18] We found incorporation information for over 60% of the entrepreneurial firm on their local state's business registry. These profiles often include the last date taxes or business fees were paid, along with the current status of the firm.

[19] The results are robust to simply using acquisition; however, many acquisitions that lack exit valuations may be disguised failures. That is why we only include acquisitions in which the exit value is larger than twice the capital raised.

after controlling for capital raised, which proxies for return to investors.[20] The final measure of firm success is the return earned in a specific financing event. "Log multiple" captures the cash-on-cash return of an equity investment accounting for any dilutive effects of follow-on financings.

3 Do these delay strategies matter?

Two underlying assumptions of our analysis concern (i) the observability of certain actions and (ii) the benefits of inaction given heterogeneity in investment quality (i.e. assumption (A2)). For (ii), it is necessary that delayed write-offs, quality exits or higher rates of write-ups (i.e., "Up round") improve a VC's chances or raising a new (and larger) fund. We are interested in investment-level data rather than quarterly, aggregated portfolio values as they allow measurement of portfolio outcomes that were observable to the LP during fundraising.

Table 3 asks whether these three measures predict fundraising success. If we find that LP-observable write-offs and write-ups weaken (improve) the fundraising success, then we have evidence suggesting that VCs have incentives to alter the timing of the outcomes. The first three columns consider the probability that a current fund raises a subsequent fund. The independent variables include the logarithm of number of write-offs (i.e., failure), "good exits" which is the number of IPOs or high-value acquisitions and the number of "up rounds".[21] Each variable represent information available to LPs at fund closing. Controls include fund size, the number of fund investments made prior to the next fund closing and interactions of fund vintage year and fund industry.[22]

All coefficients in Columns (1)–(3) are consistent with assumptions that delay of bad news is beneficial for VCs in terms of fundraising outcomes. Column (1) shows that the higher the level of write-offs in the pre-fundraising period, the lower the probability of fundraising. The implied marginal effects of a one standard deviation increase in the pre-close failure rate results in a 10% lower probability of a successful fund closing. Column (2) considers observable good news and reports a similar, but opposite relationship to fundraising as write-offs. Column (3) shows a

[20]We use a conservative estimate of 10% of total capital invested in the case of failure, although our results are robust to other estimates.

[21]The quality of exit variable uses all successful exit events in a manner similar to the IPO variable in Gompers (1996).

[22]Fund industry is assigned using the most common industry invested in by the fund.

strong positive relationship between valuation write-ups and fundraising success. Columns (4)–(6) ask whether the intensive margin of fundraising correlates with pre-fundraising disclosures. The conclusions are substantively the same. Column (4) shows that the size of the next fund decreases by 0.3% for each percent increase in the number of write-offs rounds. The final two columns of the table show that quality exits and write-ups also correlate with larger next fund size. Overall, the evidence supports our assumption that there is value in controlling the timing of write-offs, quality exits and changes in valuation.

4 Empirical strategies

The two empirical specifications that we use throughout are a Cox proportional hazard and a VC firm fixed effects model. Both models exploit variation in an entrepreneurial firm's exposure to its VC's fundraising activities. To test the hypothesis that VCs time the write-off or reinvestment of their portfolio companies, we first consider a hazard model. An event is considered a failure in the hazard model setting if the entrepreneurial firm raises a new round of financing or is written off. An exit via an acquisition or public offering is treated as a censored observation. The hazard rate specification of a financing/write-off event for entrepreneurial firm i with investor j at time t is:

$$h(\tau|X_{it}, Z_{jt}) = h_{j0}(\tau) \exp(\beta_1 \text{After fund close}_{jt} + \beta_2 X_{it} + \beta_3 Z_{jt} + \gamma_t) \quad (1)$$

The variable τ is the time since the entrepreneurial firm i has raised its last round of financing. This expression gives the instantaneous hazard of a new event occurring at time τ conditional on survival to that point. The Cox proportional hazard model (1) requires that the covariates multiplicatively shift the baseline hazard $h_{j0}(\tau)$, without imposing a parametric form for the baseline. The specification stratifies the estimator by VC firm, which allows the baseline hazard to be unique to each investor.[23]

Entrepreneurial controls in X_{it} include entrepreneurial firm age and stage (i.e., round number),

[23] This approach allows us to adjust for VC firm fixed effects without directly estimating them. Alternatively, one could incorporate dummy variables into the model for VC firms; however, this introduces the incidental parameters problem common to non-linear estimators.

along with VC firm time-varying controls Z_{jt} which include fund age and fund sequence controls.[24] The latter two controls address trends in VC fund investing, which studies such as Barrot (2014) find are a predictor of VC portfolio characteristics. Figure 3 presents two strong fund investment patterns around the fundraising cycles. First, the number of new investments made by the current fund peaks at or near the closing of the VC's next fund. Similarly, the number of new follow-on investments — reinvestments in existing portfolio companies — dramatically increases after fundraising. These two patterns can lead to co-movement of entrepreneurial firm age and fund age, which also may correlate with write-off and reinvestment rates. Hence all specifications include fund age and firm age controls. Last, all regressions using investment-level observations also include industry-year fixed effects, which help address time variation that could drive valuation and investment success.

Not all portfolio strategies considered fit into the hazard specification. For a dependent variable Y_{ijkt}, where i is the entrepreneurial firm, j is VC firm, k is the VC fund and t represents time, we estimate the following fixed effects equations:

$$\begin{aligned} Y_{ijkt} &= \beta_0 + \beta_1 F_{kt} + \beta_2 X_{it} + \beta_3 Z_{kt} + \gamma_t + \alpha_i + \sum_{s=-4, s\neq -1}^{4} \rho_s \tau_s + \epsilon_{ijkt}. \\ Y_{ijkt} &= \beta_0 + \beta_1 F_{kt} + \beta_2 X_{it} + \beta_3 Z_{kt} + \gamma_t + \alpha_i + \rho \text{After fund close}_{jt} + \epsilon_{ijkt}. \end{aligned} \tag{2}$$

Here, Y_{ijkt} is an indicator variable for an up round or a write-off event. The variable F_{kt} is the fund age in years, a control for trends in the fund life-cycle and the controls X and Z are as defined in equation (1). The main coefficients of interest are ρ_s with time index s, which characterize the relationship between the time to the next fund close and Y_{ijkt}. This specification allows us to capture any changes in VC behavior period by period. In the second specification, we estimate one coefficient ρ to capture the difference in dependent variable Y_{ijkt} just after fundraising from the average value of the dependent variable in the remaining periods. The other controls include VC firm time-varying variables X_{it}, entrepreneurial firm characteristics Z_{kt}, time fixed effects γ_t measured at the financing events and VC firm fixed effects α_j. The inclusion of this last fixed effect

[24] The main results are robust to include of fund age (year) dummies in place of age as discussed in Section 7 and shown in Tables B.3 and B.4 in the Appendix.

is crucial for the interpretation of the estimates. These controls (detailed in Table 1) ensure that we compare the investing activity — Y_{ijkt} — across a VC's multiple funds. If any of the outcome variables do not respond to fundraising, which should be the case absent agency conflicts, then the estimated coefficients $\hat{\rho}_s$ should be zero.

Identification

Here we briefly discuss the variation that identifies the coefficients of interest in Eqs. (1) and (2). The ideal experiment in our setting would be to randomly force some VCs to attempt to raise a fund, while others are forced to wait to raise funding until some later date. We would then compare the portfolio investments of these two sets of VCs over time.

In our specification, we compare entrepreneurial firm financings that have different exposure to the fundraising event of their VCs. The hazard models stratify the estimation by VC firm, allowing unobserved heterogeneity to be reflected in individual baseline hazards. The variation that identifies the "After close" coefficient requires that some set of entrepreneurial firms — otherwise observationally the same — raised capital in the years prior to the next fundraising event. This approach is a cross-sectional regression that compares entrepreneurial firms that had events — write-offs, write-ups or reinvestments — immediately after their VCs closed their next fund to observationally similar firms who raised outside of this window. We do not make causal claims as we discuss the results however, inference requires that VCs cannot anticipate the time to failure ex-ante to correspond to fund closing. This is a safe assumption as the literature on VC returns shows that failure is unavoidable and difficult to forecast (e.g., Sahlman (2010) and Kerr, Nanda, and Rhodes-Kropf (2014)).

5 Portfolio strategies around fundraising

This section considers the three major investment strategies that can respond to fundraising: valuation inflation/write-ups, write-offs and reinvestment decisions.

5.1 Valuation inflation

We begin with an analysis of changes in investment valuations around fundraising. Earlier studies of manipulation by general partners of PE and VC firms around fundraising focus on the full portfolio NAV. Our unique dataset allows us to investigate the disaggregated investment valuations that comprise fund valuation, while providing a connection to the existing literature on fund valuation manipulation.

We consider the variable "Up round" for each entrepreneurial financing event where data are available in the sample. Hypothesis (H1) predicts that any valuation manipulation will be confined to low-reputation VCs. This prediction follows from existing results in the contemporary literature (e.g., Brown, Gredil, and Kaplan (2015) and Barber and Yasuda (2016)) and the observability of the dependent variable. An increase in investment valuation in our data coincides with a new capital infusion made by the VC fund. Thus, the up round (or down round) is observable to the LP because it typically requires a capital call by the VC. Of course, not all increases in investment valuation signal manipulation. We posit that manipulation of fund NAV through increases in individual investment valuations should manifest itself in a break in the rate of such increases around fund closing. This approach requires that we sufficiently control for the underlying trends and baseline hazard of write-ups in the portfolio.

We estimate Eq. (2) for the up round dependent variable. A unit of observation is an entrepreneurial firm financing event matched to a VC fund. Controls include VC fund age and its square to control for the basic trends in the probability of these events over the fund life-cycle. The variable of interest is "After fund close," which is equal to one if the financing occurs after the next fund closes. The specification also includes VC firm age at the time of financing, along with entrepreneurial firm characteristics such as total capital raised by the entrepreneurial firm, firm age and fixed effects for industry, financing year and the stage of the company (i.e. round number). The control "Log fund size" is the log of the current fund size and "Fraction fund K remaining" is the "dry powder" (i.e., capital remaining in fund) measure for the fund investing in the financing. All models also include fixed effects for the interaction of industry and financing year, which help control for procyclicality of both investment valuation and fundraising events.

Here, estimation of the "After fund close" coefficient comes from differences in time to next fund closing across financings within the same industry-year.[25]

Figure 4 presents a basic univariate analysis of rate of up round events around fundraising averaged across all VCs. The patterns suggest that valuations increases peak around the fundraising event. Column (1) of Table 4 presents the baseline regression estimates. Column (2) introduces the variable of interest "After fund close" in a probit specification. As predicted in (H1), there is no relationship between the fund closing and write-ups on average. Column (3) narrows the window of analysis to the two years around fund closing with no change of results.

The final two columns of Table 4 ask whether the behavior of successful fund-raisers or younger VCs with little reputation differs from other VCs. Recall that the analysis of NAV inflation or management conducted in Brown, Gredil, and Kaplan (2015) and Barber and Yasuda (2016) reveal that most manipulation resides in the low-reputation and unsuccessful fund-raisers. In column (4) the indicator variable "Had next fund?" is one if the current VC fund was not followed by a new VC fund (recall that we impute dates of fundraising if no next fund is closed).

The negative coefficient on "After close" in column (4) shows that those VCs who successfully raised a next fund have relatively *less* write-ups prior to fund closing compared to unsuccessful VCs. This result is consistent with LPs seeing through any inflation of NAV and rewarding conservative valuations. Column (5) considers the variable "VC's first fund" which is a dummy variable for the first fund raised by the VC firm. If low-reputation VCs are more likely to inflate, then the interaction of this indicator and "After fund close" should be negative. Here, the interaction is weak but the coefficient sign is as predicted. The regression results are consistent with those of other studies that show that inflation is not found in successful fund-raisers and thus weakly consistent with (H1). This analysis provides support for the view that LPs' ability to observe direct inflation limits its use by VCs and also connects our investment-level data to existing datasets.

[25] The sample of valuations is positively selected, so we follow Korteweg and Sorensen (2010) and weight the observations by the realized exit rates.

5.2 Write-offs around fundraising

We next ask whether the timing of an entrepreneurial firm's failure coincides with its VCs' fundraising outcomes. We posit that venture capitalists raising their next fund benefit from delaying their write-offs (H2). To begin, Figure 5 plots the rate of write-offs around fundraising across all the funds in our sample. Each time unit on the x-axis represents a half-year interval around the next fund closing event, while the y-axis reports the fraction of financing or exits that are write-offs. In the years prior to fund closing, the average rate of write-offs is approximately five percent. In the year immediately after fund closing, this rate more than doubles, followed by a significant upward trend. To what degree can these patterns be explained by fund age?

The fixed fund life of 10–12 years requires that VCs liquidate investments as the fund nears its end. We would thus expect a positive trend of write-off (and exit) rates with fund age. To address the importance of fund age in write-off rates, Figure 6 presents estimates from the following linear probability model where the dependent variable is an indicator for a write-off event of entrepreneurial firm j in fund i at time t:

$$\text{Write-off}_{ijt} = \beta_0 + \beta_1 \text{Fund Age}_{it} + \beta_2 \text{After close}_{it} * \text{Fund age}_{it} + \beta_3 \text{After close}_{it} + \hat{\beta}_4 X_{ijt} + \epsilon_{it} \quad (3)$$

where A_i is the age of fund i when the next fund closed. The vector X_{ijt} includes time-varying controls of the entrepreneurial firm. The interaction term "After close$_{it}$ $*$ Fund age$_{it}$" allows for a discontinuous break in the correlation of write-offs with fund age. Figure 6 shows write-offs trend with fund age and a statistically significant increase in the slope in the year of the next fund closing (i.e. $\hat{\beta}_3 > 0$).[26] The solid line represents the predicted rate of write-offs as a function of fund age for the estimate of Eq. (3). The dots report the residual predicted write-off rate after controlling for the predicted impacts of both the trend and observable $\hat{\beta}_4 X_{ijt}$. As in Figure 5, we see a response of write-off probability to the next fundraising event. Next, we address whether write-offs respond to fundraising in a hazard specification.

We estimate the hazard model in Eq. (1) where the time variable is the years from last capital

[26] Figure B.1 in the Appendix presents a similar graph for a model that requires a continuous break in the trend.

raised to either write-off or another financing event. We test if the covariate of interest — "After fund close" — shifts the baseline hazard of a write-off event. The data is structured to allow for time-varying covariates, measured each month. The sequence of observations stops at the failure event or end of sample and constitutes a "spell." We predict that the coefficient β_1 on the post-closing variable will be positive (H2). That is, the rate of write-offs changes after the fund closes and the LPs can no longer incorporate fund performance into their decisions. Table 5 presents the results.

All specifications include controls for fund age trends and its square. Fixed effects for event year and the interaction of year and industry help to control for procyclicality of fundraising and any subsequent mean reversion (see Section 5.4 for specific tests of this issue). Column (1) shows a strong trend in the rate of write-offs as a function of fund age, attenuating slightly as the fund matures. Column (2) introduces the control "After fund close," which varies within a financing spell. The coefficient implies a 32% increase in the hazard of a write-off relative to the baseline hazard after an investor's next fund closes. Column (3) breaks out the dynamics of the write-off changes using indicator variables for each of the years around fund-closing. The economically and statistically significant coefficient on "1 year after after close" indicates that write-offs respond quickly to the funding event.[27]

The next two columns of Table 5 ask whether the results are driven by either those VCs that failed to raise their next fund or low-reputation VCs. Column (4) breaks down the sample of VC funds into those that successfully closed their next fund versus those that failed to do so. If the average LP can observe the strategic timing of write-offs in a VC fund's portfolio, then they will not provide capital for the next fund. Thus, the coefficient on the interaction "Had next fund X After close" should be negative. We find the opposite result, suggesting that the failed fund-raisers do not drive our results. The positive coefficient, however, does warrant further investigation as it is consistent with non-delay explanations stemming from effort constraints (see Section 6.1). Next, Column (5) asks whether reputation drives the results. Younger VCs with short track records

[27] In the Internet Appendix we also confirm that the increase in write-offs is not driven by concurrent timing of fundraising — every 3–4 years — and the time to failure of entrepreneurial firms. When we ignore new funds raised in the 3–4 year window or funds that close around the average time to failure 2–3 years, the results are unchanged.

should find strategic write-offs more beneficial than those VCs with multiple past funds. The interaction term of the low-reputation control with the post-close dummy variable — "First fund X After close" — is negative, suggesting that VC's in their first fund delay relatively less. This coefficient again goes in the opposite direction predicted by low-reputation VCs driving the main results.[28]

How much of the invariance in write-off probabilities across reputation is driven by the fact that many first time funds fail to raise a second fund? Column (6) considers only those first time funds that raised a next fund as compared to the set of all non-first time funds. The negative coefficient disappears but the relationship captured by the coefficient "After close" remains. We conclude that the patterns of delayed write-offs are not confined to a set of failed fundraisers or low-reputation VCs. Overall, the estimates indicate that the likelihood that an investor writes off an investment increases significantly after fund closing and is consistent with the delay hypothesis (H2).

5.3 Delayed reinvestment around fundraising

The extensive margin of delaying bad news delay is a write-off. We next investigate the intensive margin: delayed and selective reinvestment. Hypothesis (H3) predicts VCs will avoid reinvesting in those investments with falling valuation. We again use the hazard model of Eq. (1) to test this prediction, where now, "failure" is a refinancing event of an active portfolio firm in the VC fund. We focus on those entrepreneurial firms that do not subsequently fail to better isolate the delay here from write-off strategies.[29] The hazard specification allows us to study how the baseline hazard of a new financing event relates to fundraising. The empirical strategy is similar to the Townsend (2015) study of reinvestment decisions after the crash of the technology boom. To measure investment quality, we use the ratio of final exit valuations (e.g IPO or acquisition) to total capital invested. This forward-looking approach proxies for returns earned by investors and simply requires that the VCs know the relative quality of their investments at the time of refinancing (A2).

Table 6 presents the results where column (1) has the basic specification of the reinvestment

[28] In the Internet Appendix Table B.1, we consider alternative measures of reputation following the same logic as "First fund." For example, we can consider funds 1 and 2 vs. all later funds or interact "After close" with the fund sequence. As we find here, the results are not confined to these alternative low-reputation funds.

[29] The results are quantitatively similar if we include failed firms in the analysis.

event with controls for fund age, capital, dry powder, firm age and year-industry fixed effects. As before, a spell in the hazard model begins at the entrepreneurial firm's last financing event and ends either at the end of the sample or when new capital is raised. The positive coefficient on fund age shows there is a trend in the likelihood of a new financing as the fund ages. Hypothesis (H3) predicts that VCs will delay reinvestment in their lower quality investments. Column (2) introduces dummy variables and indicators for these investments. "Low quality" is one if the entrepreneurial firm eventually exited for a price less than capital invested or did not exit within seven years of the first VC financing. "High quality" is one if entrepreneurial firm exits at twice capital invested or had an IPO. These variables represent 25% and 21% of the financings respectively. Across all specifications, the coefficient on "High quality" is positive, suggesting that better outcomes occur more quickly. The interaction "Low quality X After close" has a positive and statistically significant coefficient. That is, the hazard of a reinvestment increases after fund closing only for those firms in the portfolio that eventually lose capital.

Column (3) considers the sub-sample of funds that successfully raised a next fund as a test of whether the patterns in column (2) stem from unsuccessful fundraisers. The coefficient on "Low quality X After close" is slightly smaller, but still statistically significant. Next, hypothesis (H4) predicts that low-reputation VCs will be more likely to use these delay strategies. If the results are driven by low-reputation VCs, then the estimates for the subsample of non-first funds will show no evidence for delay. Column (4) exhibits similar patterns as before, while the results for the subsample of only first funds — i.e. when all VCs have no track record — also continues to show delayed reinvestment in low quality investments. The coefficient in column (5) is larger than the previous three columns, but statistically similar.

Overall, the evidence in Table 6 is consistent with hypothesis (H3) and shows that VCs delay bad news about the VC fund's performance until after the LPs have committed capital to the fund. The selective reinvestment into lower quality investments improves the reported NAV before fundraising. Importantly, such reinvestment delay is difficult to observe for an LP, as it requires an estimate of the baseline hazard and the ability to identify the low quality investments in the portfolio. The lack of observability can explain the similarity in results across the low-reputation and successful fundraising VCs, which provides evidence against hypothesis (H4) and supports the signal-jamming explanation for delay. The delayed reinvestment also supports the delay strategy hypothesis (H2a) over the effort constraint explanation (H2b), addressed in Sections 6.1 and 6.2.

5.4 Procyclical fundraising

The results in Tables 4 - 6 all include fixed effects for the year of the event, the industry of the entrepreneurial firm and their interaction. These controls help to address the likely procyclicality of fundraising: VCs are much more likely to raise new funds when public market returns are high. The fixed effects ensure that we compare write-offs or reinvestments within the same industry-year cohorts and compare outcomes by differential exposure to fund closing events. Any equity market cyclicality naturally generates mean reversion that even this set of fixed effects cannot completely address. Following the prediction of hypothesis (H5), we now consider a direct test of whether the write-off and reinvestment patterns above can be explained by the timing of fund closing around market peaks.

To begin, we split the sample of funds closed in the sample into three terciles based on the one year returns to the S&P 500 in the quarter of the closing. Table 7 includes four columns, where the first three are the sub-samples of funds raised split by the equity market returns. For example, the "Top 33%" sample of funds were raised when the S&P 500 returns were at the highest. Column (4) pools all the funds in the sample and interacts the fund closing dummy with indicators for the top 33% and bottom 33% return quarters. Panel A reports the write-off hazard results. If procyclical fundraising and subsequent mean reversion drives results, then we would predict that the write-offs would be confined to the funds in column (1). However, the patterns are consistent — with less power due to sample size — across sub-samples. Column (4) presents the full interaction model. Here, we can test the null hypothesis that the coefficients on the interactions are the same to identify whether hot market funds drive the results. The p-value for this test is large at 0.659, so we cannot reject the null that funds raised across different parts of the business cycle exhibit similar delayed write-offs.

Panel B of Table 7 reports a set of results similar to those in Panel A, now for the delayed reinvestment analysis. Here the coefficients of interest are "Low quality X After close" which capture potentially delayed reinvestments in lower quality startups. Again, we find little evidence that funds raised in hot markets drive our results, which is also confirmed in column (4) with the test of differences between the triple interaction variables "Hot mkt X High quality X After close" and "Cold mkt X Low quality X After close." The collection of results suggest that hot market fundraising does not fully explain increases in write-offs or reinvestments in low quality startups.

6 Cost of delay strategies and equilibrium implications

This section investigates the consequences of strategic delay of bad news around VC fundraising events.

6.1 Characteristics of write-offs around fund closings

We pose two alternative agency conflicts (H2a and H2b) for the delayed write-offs and delayed reinvestments in lower quality firms: strategic delay versus bundling or effort constraints. Under the strategic delay (H2a), VCs had to support the delay with more financings and investments in the entrepreneurial firms. Write-offs that occur after fundraising should thus be older or more capitalized. If the VCs instead write off investments to limit portfolio size due to effort constraints or to bundle bad news with good, then we would predict quicker failures after fundraising (H2b).

We consider several observable features of written-off companies to test these separate hypotheses. Entrepreneurial firms kept in operation longer than is optimal may require additional board meetings, monitoring, or advising. We measure these with age of the entrepreneurial firm, the number of financing events and the time since the VC last invested in the firm. Next, keeping a firm in operation requires capital investment. Hence, a firm that is kept in operation longer to avoid write-offs needs more capital.

Table 8 analyzes the set of written-off firms and asks whether delay strategies result in more capital being invested, more financing rounds, and longer time to failure. We compare all written-off investments within the three year window around fund closing, where a unit of observation is the entrepreneurial firm.[30] The main controls are indicators for each year around fund closing and also year. Column (1) first asks whether the time since the last capital infusion before write-off differs by when the fund close occurs. If VCs delay as we predict, then this variable should be relatively larger after fund closing. The coefficient on "0–1 year after close" indicates just that. Economically, firms that fail in the one year after fund closing occurs wait three more months since the previous capital infusion relative to those that shut down in the year prior to fund closing. This difference represents a 17% longer period of time between events than the average time between financing and failure.[31] Column (2) asks whether those firms that fail after fund closing had more financing events as well. The estimates from a poisson regression (the dependent variable is a count) suggest that there is neither delay nor quickening of write-offs as measured by financing count. Column (3) asks whether the VC firm held the investment in the written-off firm for a longer time conditional on raising a fund. Under (H2a), firms written off after fund closing will have been held relatively longer. The estimates show that in the year immediately after closing, write-offs are indeed seen in longer-held investments.

Finally, Column (4) asks whether write-offs that occur immediately after fund closing have raised more or less capital than write-offs in other years. We find little evidence for more capital invested in write-offs in the year immediately after, but some evidence that those firms written off in the 1–2 years after funding are more capitalized. The most direct implication of these estimates is that firms written-off are not capital starved. Overall, the evidence shows that delay (H2a) rather than effort constraints or distraction (H2b) explains the increase in write-offs after fund closing. They also point to the mechanism used to delay: holding firms in the portfolio rather than investing more capital or financings to extend their lives.[32]

[30] The results are similar with the four-year window. We constrain to this smaller sample to ensure that we are comparing similar entrepreneurial firms by age and capitalization.

[31] The average time to next financing is approximately 1.4 years.

[32] Although we ruled out two forms of non-strategic delay (H2b), another form of effort capacity could be at play. VCs may raise funds immediately after they have a successful exit in their current fund (e.g., Barber and Yasuda (2016) show that VCs time funds at peak performance). In unreported results, the patterns of delayed write-off and reinvestment are unchanged if we exclude funds raised immediately after large exits in the current fund.

6.2 Costs of delay strategies

The fundraising process shifts the timing of write-offs and the reinvestment in under-performing portfolio companies. We next ask whether these responses manifest themselves in the outcomes that impact returns earned by limited partners. Table 9 compares a set of financings in the two years prior to the two years after the next fund closes. The sample only includes the first investment made by the VC fund in an entrepreneurial firm, so we compare similar first-time investments of similar age and stage. All specifications include VC firm, industry and year fixed effects, while the unreported controls include firm age, log fund size and an indicator for whether the entrepreneurial firm reported revenues.

Column (1) of Table 9 shows that new financings made immediately after the next fund closes IPO at a lower rate. The implied marginal effects are approximately 7%. Columns (2) and (3) show that the realized valuations of any exits are 16% lower for investments done in the two years after fund closing. The lower exits valuations are not driven by failed exits, as the coefficient in Column (3) is almost the same as that in Column (2). Last, the differences in exit types and valuations manifest themselves in lower returns earned, as shown in Column (4). Investments made in the years prior to the fund closing have 15% higher returns than those occurring immediately after. These differences are likely not due to lower risk taken post-fundraising, which could provide an alternative theory for lower returns.[33] The results in Table 9 show that investment quality differs around fundraising. They also show that the delayed write-offs and reinvestments manifest themselves in returns earned by the current fund LPs. Finally, these return differences provide additional evidence in favor of the strategic delay hypothesis H2a because they show VCs delay relatively worse investments.

6.3 Learning about VC quality over time

Managerial quality must eventually reveal itself since delay strategies cannot hide information indefinitely. For example, a write-off's impact on the total fund return does not depend on the timing of the exit (unless more capital is spent keeping it alive). We next study whether the

[33] Assuming a Sharpe ratio of 0.5 (for U.S. stock market), the VC funds would have to reduce risk from, say, 48% to 16% (the S&P 500 standard deviation) post-fundraising to justify the 15% reduction in returns.

eventual release of a delayed negative signal leads to a response from LPs (i.e., hypothesis (H6)), which would imply a separating equilibrium of VCs by talent (slowed by the delay). We consider the information about performance from two time periods of the current fund: pre- and post-close. The latter characterizes the events that took place in fund N after the fund $N+1$ was raised. "Pre-close" events are those outcomes that were observable to the LP before fund $N+1$ was raised.

Table 10 considers the probability that the $N+2$'th fund is raised and its size if so. By this time, both pre- and post-closing information have been revealed. Column (1) asks whether the number of write-offs in fund N predicts fundraising success in fund $N+2$. Both the pre- and post-close write-offs correlate strongly with the ability to raise a subsequent fund, suggesting both benefit from avoiding and delaying write-offs. Interestingly, Columns (2) indicate that good exits prior to closing have little predictive power for fundraising for fund $N+2$.

The last two columns of the table condition on successful fundraising of fund $N+2$. The results for write-offs are smaller, showing that write-offs matter more on the extensive margin. Good exits both pre- and post-close in fund N have some predictive power on the intensive margin, i.e., for the size of fund $N+2$. The collection of evidence demonstrates that although delayed bad news in fund N may improve the chances of raising fund $N+1$, LPs incorporate these signals when they are eventually revealed into future fundraising decisions.

7 Robustness

This section conducts some additional tests to provide further confidence in our results.

7.1 Who makes write-off decisions?

As an alternative test of whether fundraising VCs drive these decisions, we next ask whether differences in investor power can explain delay strategies. The strategic delay results suggest that VC investors have the power to slow write-off decisions or reinvestment events. Most VCs will hold preferred stock that provides significant control rights and thus tools to delay the write-off or reinvestment decision. Additional variation in decision-making power comes from a VC being a lead investor or having a board seat. The former are investors who invested the largest amount of capital in the current or previous rounds. If fundraising VCs are indeed drivers of delay, then we should see stronger results for those with board seats or past lead investor stakes. Column (1) of Table B.2 in the Appendix repeats the write-off hazard with an interaction for whether the VC investor either (i) has a board seat or (ii) was ever a "lead" investor. The interaction "After close X Board / Lead investor" is positive as predicted. Although the coefficient is statistically insignificant, the loading on the coefficient suggests that a large part of the effects observed in Table 5 stem from funds closed by lead investors or board members.

A similar question arises as to how these delay decisions are made in a syndicate of multiple investors. For example, syndicates with investors on similar fundraising cycles should more easily coordinate on strategic delay. At the extreme, an unsyndicated deal will be the easiest to delay. We proceed to test these implications using a measure of how the set of investors' fundraising schedules are synched. Investors that are each pre-fund closing are "synched" while any syndicates where some investors are post- and some are pre-fund closing are "unsynched." The prediction is that the synched financings/investors will be more likely to delay because it is easier for them to coordinate. Columns (2) and (3) of Table B.2 in the Internet Appendix present the write-off regressions with interactions for the synch variable. Syndicates with synched fundraising drive much of the delay in write-offs. That is, when a syndicate of investors have conflicting fundraising schedules, there is less strategic write-offs, likely due to conflicting incentives. Coordination among VCs in an important prerequisite for delay to manifest itself.

7.2 Additional robustness

The main specifications for write-off events and reinvestment timing included controls for fund age and its square to control for any mechanical trend over the fund life-cycle. First, in Tables B.3 and B.4 in the Appendix, we instead use fund age dummies controls to address trends. The patterns for the coefficients show an decreasing (increasing) probability of write-ups (write-offs) over the fund lifecycle. The main results are unchanged in both tables. Columns (5) and (6) of Table B.4 show the results are also robust to alternative specifications for the fund age trend (e.g., the model in Figure 6). We conclude that both the hazard specification itself and direct controls for fund age address any concerns about underlying trends driving the estimates. Finally, we randomly move the fund closing date forward or backward up to two years to construct a placebo test. A mechanical relationship between write-offs and fund closing that is not driven by our agency explanations may produce similar coefficient patterns as in Tables 5 and 6. As expected, after randomizing the fund closing, the results for both disappear.

8 Conclusion

It is often said that a venture capitalist has two jobs: investing in entrepreneurial firms and raising the next fund. That next fund provides a new, valuable, and steady stream of performance-insensitive management fees for at least ten years. Performance evaluation by the capital providers to VCs is thus an area ripe for manipulation with high stakes.

This paper studies a new set of actions that can temporarily boost fund performance and thus reveals the existence of agency frictions during VC fundraising. We investigate strategic delay of VC liquidation decisions and reinvestments in lower-quality portfolio companies. VCs delay the revelation of bad news until after their next fund closes, and this behavior improves VCs fundraising prospects. The evidence shows even under the assumption that LPs can limit portfolio manipulation that is perhaps observable to LPs, information asymmetry between VCs and LPs remains that allows the average VC to strategically delay actions in his portfolio to improve his talent signal. We also consider alternative explanations, but do not find evidence that they are driving our results.

The patterns found here mirror some of the results found in banks during financial crises and public firms around earnings announcements. Our contribution is to provide the first study of analogous behavior in the venture capital industry, which faces high information asymmetry and large, illiquid capital allocation decisions by LPs. Given the size and importance of the venture capital industry, such agency conflicts can have significant costs for all stakeholders.

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Figures and Tables

Figure 1: Dry powder and reinvestments around fundraising

Notes: The figure reports the estimated fraction of capital remaining in the current fund around the closing of the next VC fund. Each point represents the average fraction of capital and the average fraction of reinvestments (i.e., follow-on investments) within the same VC fund, centered at the time of the next fund closing. The solid lines reports the average number of reinvestments made in already existing portfolio companies by the current fund. The sample includes all funds that were followed by another fund closing.

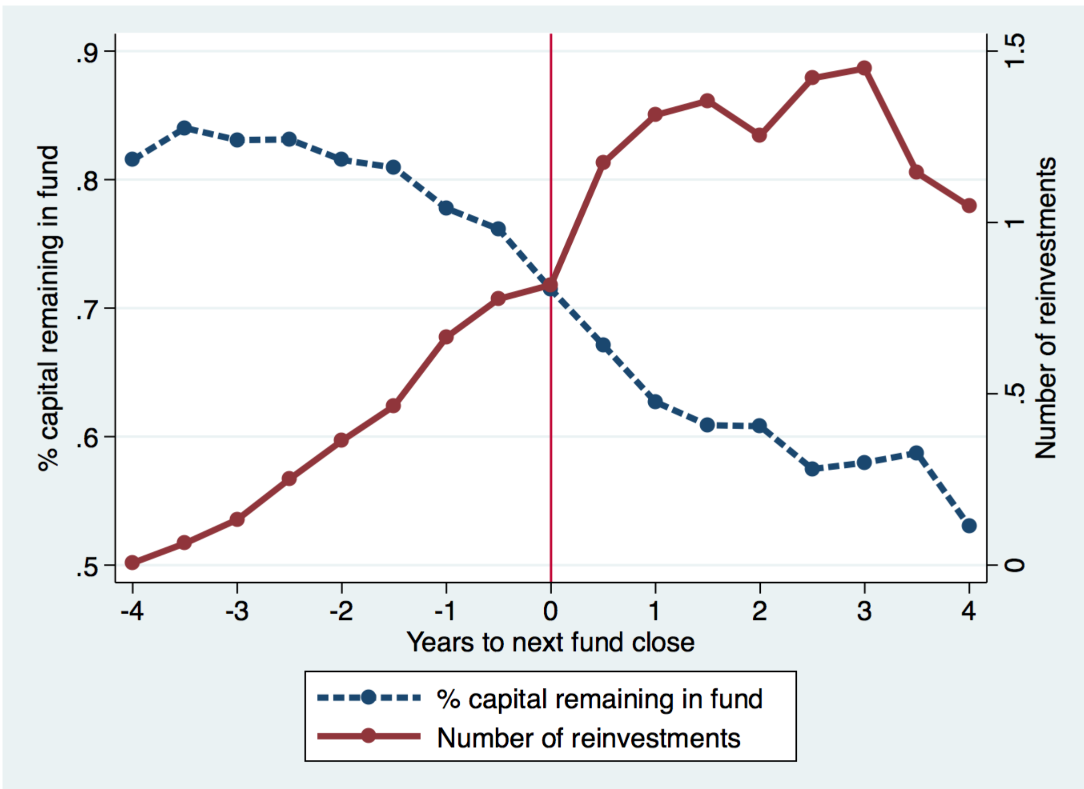

Figure 2: Overlapping nature of fundraising

Notes: The figure shows the usual time line of fundraising for VCs. Times T and T' are the dates of the closing of fund N and $N+1$. On average, the next fund is raised 3 to 4 years after the previous fund is raised. The overlap between fundraising for the next fund and investment activity represents the identifying variation throughout the paper.

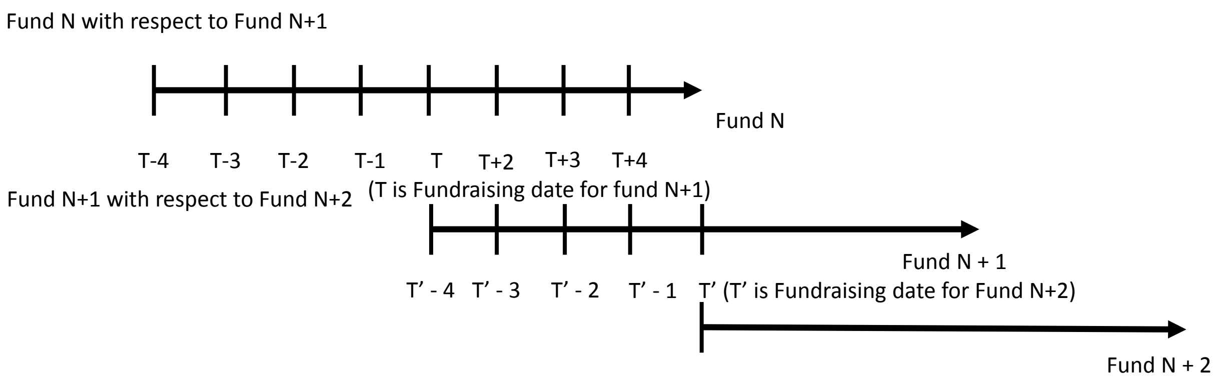

Figure 3: New and follow-on investments within funds

Notes: The figure reports the average number of two types of investments made by a fund. "New investments" are the first to be made in an entrepreneurial firm by a fund and "Follow-on investments" are all subsequent investments in the entrepreneurial firm made by the fund.

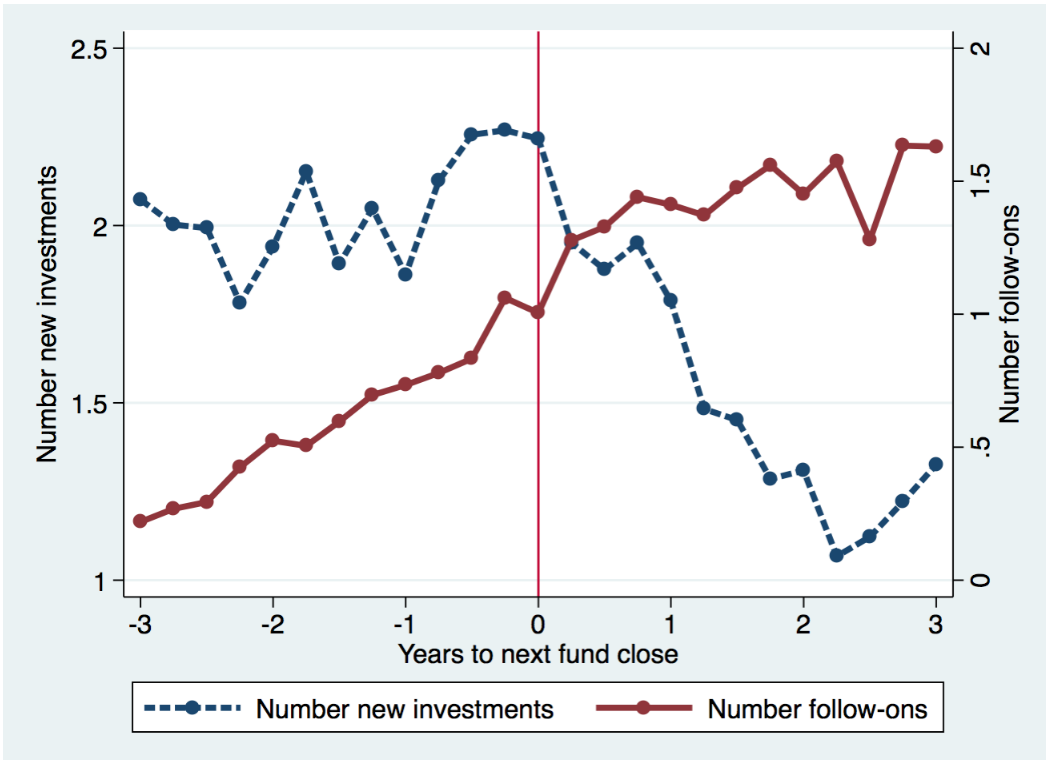

Figure 4: Financing write-ups around the fund lifecycle

Notes: The figure reports the fraction of financings in a VC fund's portfolio that have a write-up in valuation for each 6 month period around the next fund closing. The average is computed across all VC funds in the sample that have at least one write-off over the sample period.

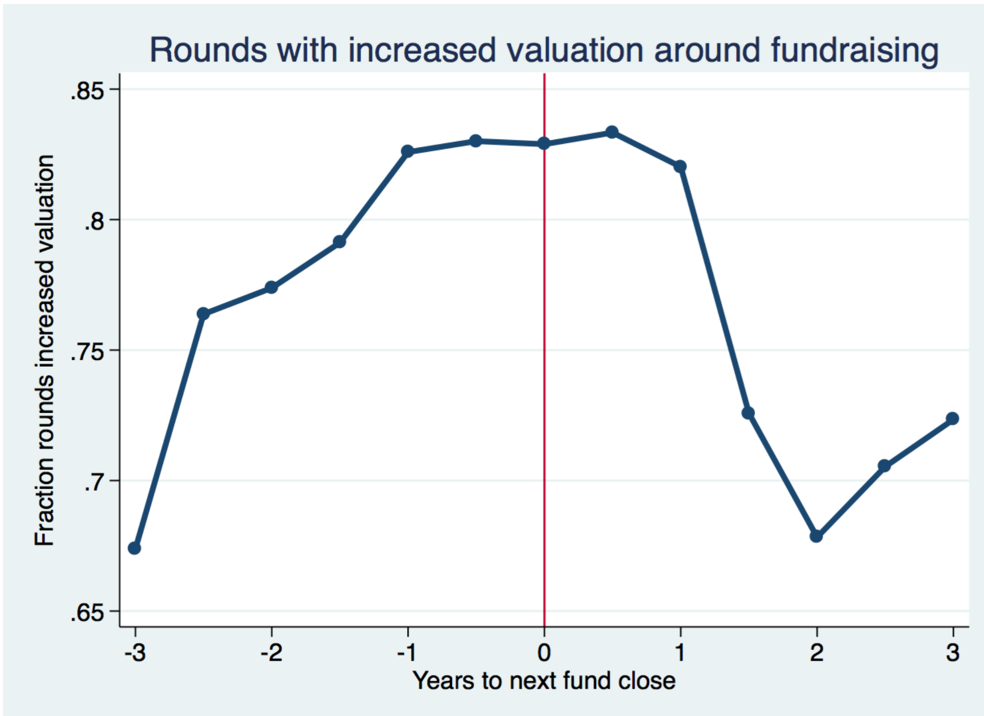

Figure 5: Write-offs around fundraising

Notes: The figure reports the average fraction of write-offs in a VC fund's portfolio around fundraising in a given six month period. A write-off is an instance where an entrepreneurial firm in the portfolio is listed as failed or had its assets acquired. The x-axis is centered around the closing date for the next fund, relative to the current fund making the investment.

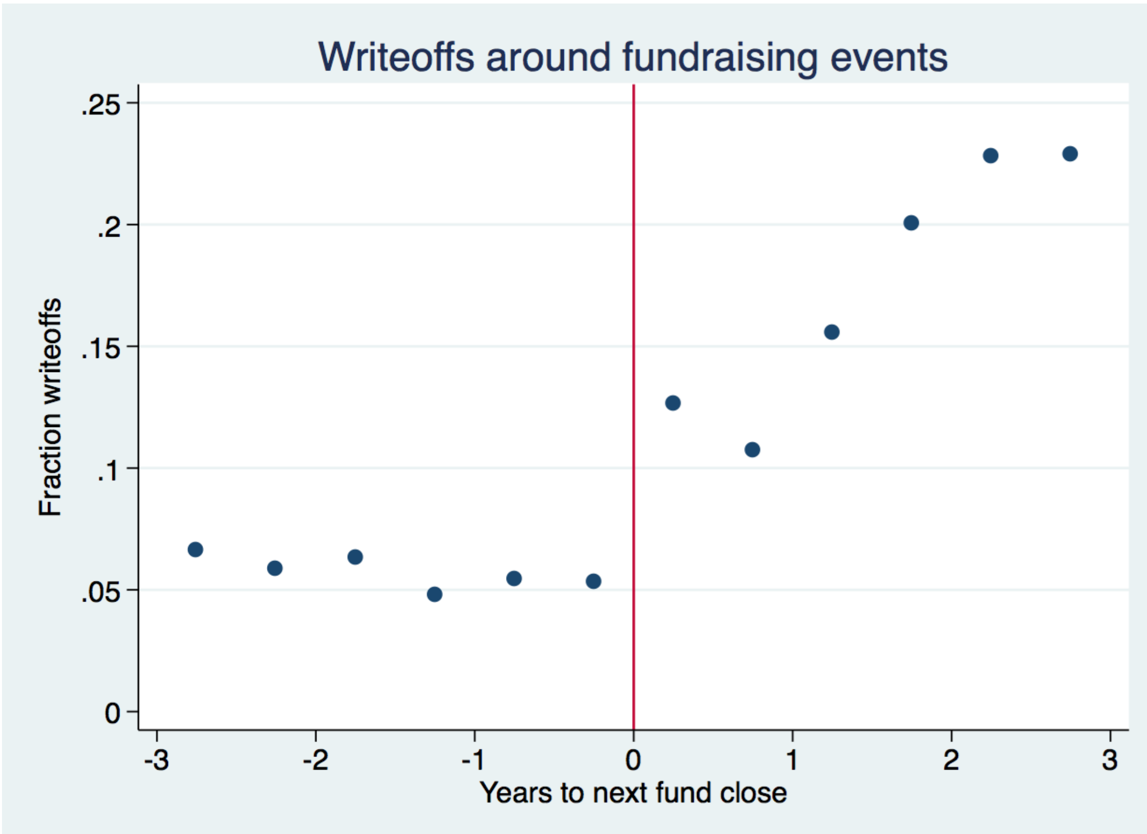

Figure 6: Write-offs over the fund life-cycle: Break in fund-age trend

Notes: The figure reports the predicted rate of write-offs as a function of fund age from the following linear probability regression:

$$\text{Write-off}_{ijt} = \beta_0 + \beta_1 \text{Fund Age}_{it} + \beta_2 \text{After close}_{it} * \text{Fund age}_{it} + \beta_3 \text{After close}_{it} + \hat{\beta}_4 X_{ijt} + \epsilon_{it}$$

The solid lines report the predictions of the trend from the above regression (i.e. $\hat{\beta}_0 + \hat{\beta}_1 \text{Fund Age}_{it} + \hat{\beta}_2 \text{After close}_{it} * \text{Fund age}_{it}$) while the dots represent the residual predicted write-off rate after demeaning by the predicted $\hat{\beta}_4 X_{ijt}$. The solid vertical line is the mean fund age at the time of the next fund closing.

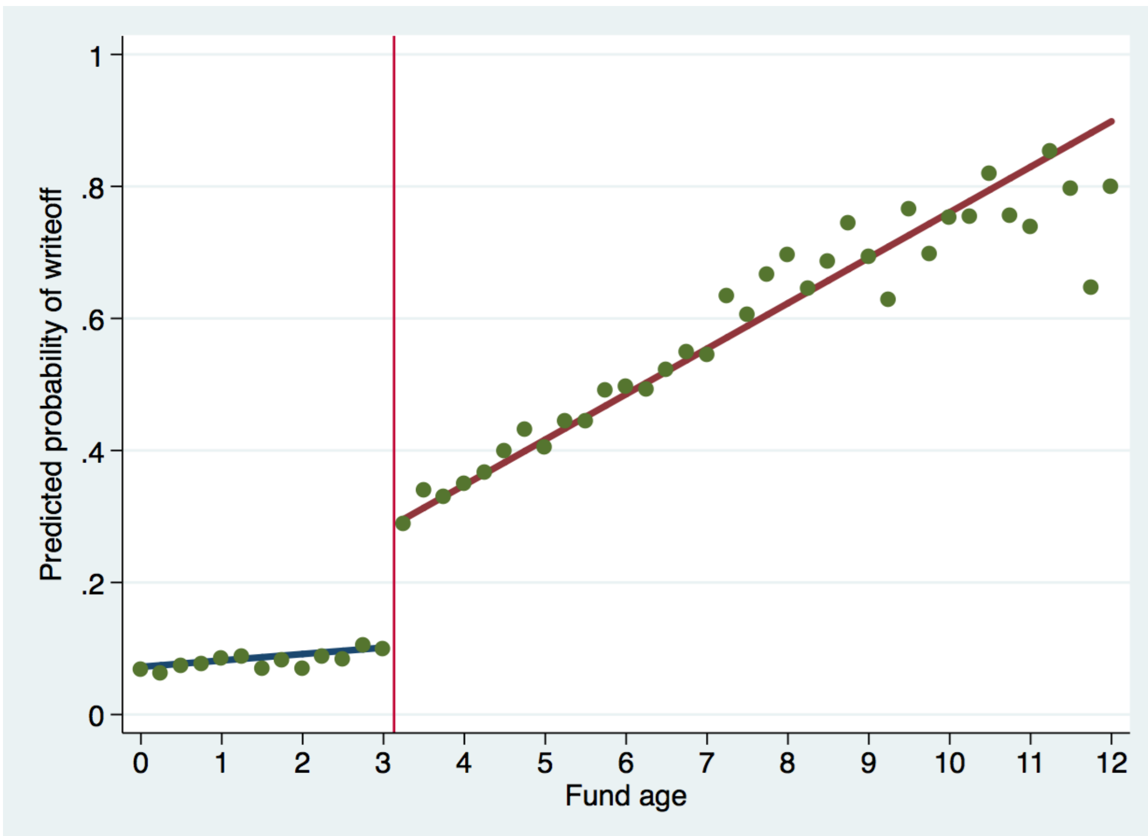

Table 1: Variable description

Notes: Definitions of the main variables used throughout the text.

Variable	Description
N years to closing	A dummy for a VC fund's investment that occurred N (0 to 3) years (rounded to the quarter) to the next realized or predicted fund closing.
N years after after closing	A dummy for a VC fund's investment that occurred N years (rounded to the quarter) after the first fund to close after the current fund.
After close	A dummy equal to one if the VC fund's investment occurred in the year of or years after the next fund closing. The excluded group is the financings in the two years prior (samples with this control have a three-year window around each fund closing).
Log VC age (years)	The log of the number of years since the VC firm first invested.
Fund age (years)	The age of the VC fund at the time of the financing or exit event.
Log total capital raised	The log of the sum of capital raised (in millions), as of each entrepreneurial firm's financings.
Up round	A dummy equal to one if the valuation of the financing for the entrepreneurial firm is at least as large as the previous equity valuation.
Has revenues	A dummy equal to one if, at the time of the entrepreneurial firm's financing, the firm reported revenue.
Profitable	A dummy equal to one if, at the time of the entrepreneurial firm's financing, the firm reported profits.
Log firm age (yrs.)	The log of the age of the entrepreneurial firm as of each financing event.
Log fund size (m)	The log of the total capital raised in the current fund (in millions).
Industry FE	Categorical dummies for one of four major industry categories: Business/Consumer/Retail, Healthcare, Information Technology and Other.
Fin. year FE	Dummies for the year of the entrepreneurial firm financing event.
Year X Ind. FE	Dummies for the interaction of financing year and entrepreneurial firm industry.
Stage FE	Fixed effects for the development stage of the entrepreneurial firm: early, middle, and late.
Had next fund?	Indicator equal to one if the current VC fund was followed (by 2013) by a new fund closing.
Fraction fund K remaining	The fraction of the fund's initial capital that remains by the financing event (i.e. "dry powder").
VC's first fund	Indicator equal to one for the first fund raised by a VC firm (for the sample of VCs with at least two funds).
IPO	An indicator for whether the entrepreneurial firm had an IPO or a successful acquisition (greater than $100m valuation) as of the end of 2013.
Log return	The log of the gross multiple for the return to investing in a financing event. The multiple captures the cash-on-cash return accounting for any dilution and assumes common equity. Many returns are missing due to missing valuations.
Log valuation	The log of the value of the entrepreneurial firm at exit, set to 10% of total capital raised if a failure. Some exit valuations are missing because the sale price is not reported.
High quality	The entrepreneurial firm had an exit that was at least two times capital invested.
Low quality	The entrepreneurial firm had an exit that was less than capital invested.

Table 2: Summary statistics

Notes: The table provides summary statistics for the main control variables used throughout the paper (defined in Table 1). The sample of financings and investors includes the full set that encompasses all the tables below.

	Entrepreneurial firm variables						
	mean	sd	min	p25	p50	p75	max
Year founded	1998.2	5.42	1937	1996	1999	2001	2013
First capital raised	6.31	22.6	0.0100	1.46	3.23	7	1500
Had IPO	0.11	0.31	0	0	0	0	1
Still private	0.23	0.42	0	0	0	0	1
Acquired	0.38	0.49	0	0	0	1	1
Failed	0.25	0.43	0	0	0	0	1
Information Tech.	0.51	0.50	0	0	1	1	1
Biotech	0.25	0.43	0	0	0	1	1
California	0.40	0.49	0	0	0	1	1
Texas	0.055	0.23	0	0	0	0	1
New York	0.045	0.21	0	0	0	0	1
Observations	7814						
	Financing variables						
	mean	sd	min	p25	p50	p75	max
Financing year	2001.8	4.03	1992	1999	2001	2005	2013
Capital raised ($)	3.15	4.60	0.0055	0.90	2	3.87	175.0
Mid-stage	0.32	0.47	0	0	0	1	1
Avg. VC age	7.83	5.10	0.100	3.82	7.04	10.9	43.9
Late stage	0.18	0.38	0	0	0	0	1
Years since last financing event	0.91	0.90	0	0	0.80	1.37	17.5
Total capital raised	27.1	39.0	0.050	6.20	15.5	34.0	1693.9
Round #	2.92	1.86	1	1	2	4	10
Debt (+ Bridge)	0.096	0.29	0	0	0	0	1
Has revenues	0.56	0.50	0	0	1	1	1
Profitable	0.044	0.20	0	0	0	0	1
Firm age (years)	3.98	3.93	0	1.45	3.07	5.33	67.6
Syndicate size (funds)	3.19	2.04	1	2	3	4	16
Avg. fund sequence	3.58	2.98	1	1.33	3	5	26
Avg. fund size	241.6	338.0	0	60	125	290	6500
Observations	15564						
	VC firm variables						
	mean	sd	min	p25	p50	p75	max
Year first investment	1996.2	6.36	1980	1994.5	1998	2000	2008
Number investments	113.9	178.9	1	23.5	54	125	2107
Total funds	2.80	2.63	1	1	2	3	26
Observations	768						
	VC fund variables						
	mean	sd	min	p25	p50	p75	max
Vintage year	1999.1	4.20	1969	1997	1999	2001	2006
Total fund size	168.7	312.6	0	30.5	76	189	6500
Fund number	3.05	2.75	1	1	2	4	26
Raised next fund?	0.70	0.46	0	0	1	1	1
Number separate closings	1.17	0.48	1	1	1	1	8
Observations	1453						

Table 3: Learning from interim performance: probability of raising fund and fund size

Notes: The table reports probit and Ordinary Least Squares (OLS) regressions of fundraising success and the log of a VC fund size on a set of controls for the set of non-first-time VC funds. The analysis includes all firms with first vintage year post-1995. The main control variables measure the number of exit and financing types that occurred in the previous fund immediately prior to the current fund's closing. "Log # failure pre-close" counts the number of write-offs in the previous fund up to the first closing of the current fund. "Log # up rounds pre-close" counts the number of financings with an increased valuation in the previous fund and "Log # good exits pre-close" counts the number of IPOs or high-value acquisitions prior to the current fund close. "Log Fund N size" is the log of the previous fund size. "Log # pre-fund close invs." is the log of the total number of unique investments made out of the previous fund as of the next fund's first close. "Vintage year FE?" are fixed effects for the previous fund vintage year, while "Fund N +1 vintage year FE?" are fixed effects for the current fund's vintage year. "Fund industry FE" are fixed effects for the fund industry, measured with the most popular industry invested in by the fund over its life. "Fund industry X Vintage FE" are interactions of this industry dummy and the vintage year dummy variable. Robust standard errors are reported in parentheses, clustered at the vintage year. * , **, *** represent significance at the 10%, 5%, and 1% levels, respectively.

	(1) Raised fund?	(2) Raised fund?	(3) Raised fund?	(4) Log Fund $N+1$ size	(5) Log Fund $N+1$ size	(6) Log Fund $N+1$ size
Log # failure pre-close	-0.480***			-0.298***		
	(0.108)			(0.109)		
Log # good exits pre-close		0.268**			0.305***	
		(0.137)			(0.102)	
Log # up rounds pre-close			0.268***			0.287***
			(0.0885)			(0.0822)
Log Fund N size	0.246***	0.243***	0.232***	0.672***	0.668***	0.658***
	(0.0331)	(0.0331)	(0.0332)	(0.0380)	(0.0380)	(0.0387)
Log # pre-fund close invs.	0.166***	0.0511	-0.0311	0.0674	-0.0160	-0.105*
	(0.0436)	(0.0424)	(0.0539)	(0.0428)	(0.0434)	(0.0567)
Constant	-2.535***	-3.143***	-3.030***	2.012**	1.602**	1.793**
	(0.852)	(0.729)	(0.738)	(0.833)	(0.800)	(0.755)
Observations	1206	1206	1206	761	761	761
Pseudo-R^2	0.256	0.247	0.250			
R^2				0.461	0.461	0.465
Num. VCs	736	736	736	436	436	436
Num funds	1206	1206	1206	761	761	761
Model	Probit	Probit	Probit	OLS	OLS	OLS
Vintage year FE?	Y	Y	Y	Y	Y	Y
Fund industry FE?	Y	Y	Y	Y	Y	Y
Fund industry X Vintage FE?	Y	Y	Y	Y	Y	Y
Fund $N+1$ vintage year FE?	Y	Y	Y	Y	Y	Y

Table 4: Financing valuations around fundraising

Notes: The table reports probit estimates for a regression of the change in the entrepreneurial firm valuation for VC fund investments on a set of observables. The dependent variable is one if the firm's financing valuation (i.e. post-money) was higher than the last known valuation. The unit of observation is the entrepreneurial firm financing event paired with a VC fund (thus, the financing may be repeated if there are multiple funds investing). To account for the non-random, positive selection of financing valuations, the observations are weighted using exit probability similar to that used in Korteweg and Sorensen (2010). The sample includes all entrepreneurial firm financings between 1992 and 2013 for which a VC investor had a fund close before 2007. The control "Fund age" is the age of the current fund in years. "After fund close" is a dummy variable equal to one if the financing event occurred after the next fund closing for the VC firm. Columns (1) and (2) compare the probability of an up round in the three years prior to three years after closing. Column (3) narrows the window to the two years around fund closing. Column (4) introduces the dummy "Had next fund" which is equal to one if the VC raised a next fund (imputed if not). Column (5) introduces the dummy "First fund" for the VC firm's first fund as a test for reputation differences. Other control variables are defined in Table 1. Standard errors in parentheses, clustered at the VC firm level. * , **, *** represent significance at the 10%, 5%, and 1% levels, respectively.

	Increase in valuation?				
	(1)	(2)	(3)	(4)	(5)
	Full	Full	$[-2, 2]$	Full	Full
Fund age (yrs)	-0.0344	0.00880	-0.0465	-0.0176	-0.0129
	(0.0420)	(0.0170)	(0.0623)	(0.0450)	(0.0467)
Fund age sq. (yrs)	0.00374		0.00496	0.00270	0.00215
	(0.00402)		(0.00584)	(0.00413)	(0.00415)
After fund close		-0.101	-0.0659	-0.315**	-0.0904
		(0.0619)	(0.0750)	(0.156)	(0.0769)
Had next fund?				-0.0275	
				(0.118)	
Had next fund? X After close				0.269	
				(0.173)	
First fund					0.0116
					(0.137)
First fund X After Close					-0.00974
					(0.130)
Log VC age (years)	-0.103**	-0.103**	-0.0287	-0.107**	-0.0976
	(0.0459)	(0.0434)	(0.0495)	(0.0436)	(0.0721)
Log total capital raised	0.0209	0.0245	0.0240	0.0221	0.0242
	(0.0516)	(0.0426)	(0.0506)	(0.0429)	(0.0427)
Firm age (years)	-0.0388**	-0.0390***	-0.0381***	-0.0390***	-0.0390***
	(0.0161)	(0.0115)	(0.0133)	(0.0115)	(0.0115)
Log fund size (m)	0.0598**	0.0607**	0.0421	0.0518*	0.0609**
	(0.0293)	(0.0283)	(0.0342)	(0.0292)	(0.0283)
Fraction fund K remaining	-0.0228	-0.0241	0.0453	-0.0234	-0.0251*
	(0.0225)	(0.0149)	(0.0572)	(0.0155)	(0.0149)
Constant	5.395***	5.356***	5.963***	5.416***	5.397***
	(0.566)	(0.412)	(0.459)	(0.418)	(0.439)
Observations	5441	5441	3826	5441	5441
Pseudo R^2	0.213	0.214	0.229	0.215	0.214
Num. VCs	411	411	236	411	411
Num funds	830	830	579	830	830
Num. firms	2487	2487	1977	2487	2487
Industry FE?	Y	Y	Y	Y	Y
Fin. year FE?	Y	Y	Y	Y	Y
Fin. year X Ind. FE?	Y	Y	Y	Y	Y
Stage FE?	Y	Y	Y	Y	Y

Table 5: Write-off probabilities around fundraising: hazard models

Notes: Table presents the Cox proportional hazard regression of write-off events around VC fundraising. A unit of observation (i.e., spell) is an entrepreneurial firm financing event. A financing may be associated with multiple funds, but each fund can have its own fundraising schedule. A failure in the model is an equity financing that is followed by a write-off. Alternatively, the financing can be followed by a new equity round, an exit or no event at all (these are non-failures). The variable "After fund close" varies over time within each spell and is one for periods after an investor's next fund closes. A positive coefficient demonstrates a higher hazard of the event — here a write-off. The control "Fund age" is the age of the current fund in years. "N years to (after) closing" are dummy variables for specific periods around fund closing. "Had next fund" is a dummy variable if the VC raised a new fund. "VC's first fund" is a dummy variable equal to one if the current fund is the VC firm's first fund. The sample in Column (6) —"Had 2nd"— includes all non-first funds and all first funds that were followed by a second fund. All other controls are as defined in Table 4. "Fin. year FE" are fixed effects for financing year and "Industry FE" are fixed effects for the entrepreneurial firm's industry. "Fin. year X Ind. FE?" are fixed effects for the interaction of the two. The baseline hazards in all models are stratified at the VC firm-level. Standard errors reported in parentheses with clustering at the entrepreneurial firm. * , **, *** represent significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6) Had 2nd
Fund age (yrs.)	0.248***	0.197**	0.204***	0.179**	0.196**	0.134
	(0.0762)	(0.0779)	(0.0787)	(0.0779)	(0.0779)	(0.0818)
Fund age sq. (yrs)	-0.0148**	-0.0110	-0.0116	-0.0105	-0.0109	-0.00400
	(0.00746)	(0.00749)	(0.00753)	(0.00754)	(0.00753)	(0.00761)
After fund close		0.278***		0.00749	0.380***	0.392***
		(0.0934)		(0.180)	(0.109)	(0.110)
3 years to closing			-0.223			
			(0.166)			
2 years to closing			0.151			
			(0.121)			
1 year after closing			0.281**			
			(0.117)			
2 years after closing			0.291*			
			(0.170)			
3 years after closing			0.269			
			(0.187)			
Had next fund?				-0.106		
				(0.120)		
Had next fund? X After close				0.346*		
				(0.202)		
First fund					-0.0515	-0.0779
					(0.121)	(0.147)
First fund X After Close					-0.321*	-0.0327
					(0.185)	(0.212)
Log total capital raised	-0.357***	-0.375***	-0.376***	-0.341***	-0.379***	-0.379***
	(0.0504)	(0.0507)	(0.0510)	(0.0515)	(0.0504)	(0.0540)
Firm age (years)	-0.00959	-0.0118	-0.0125	-0.0155	-0.0128	-0.0195
	(0.0109)	(0.0109)	(0.0110)	(0.0121)	(0.0112)	(0.0124)
Log fund size (m)	-0.0600	-0.0508	-0.0477	-0.0608	-0.0813*	-0.0845*
	(0.0411)	(0.0414)	(0.0417)	(0.0423)	(0.0439)	(0.0480)
Fraction fund K remaining	0.0443	0.0558	0.0576	0.0387	0.0534	0.0803
	(0.0430)	(0.0567)	(0.0563)	(0.0457)	(0.0512)	(0.0753)
Spells	7813	7813	7813	7813	7813	7101
Pseudo-R^2	0.0664	0.0674	0.0679	0.0556	0.0681	0.0705
Number firms	3936	3936	3936	3936	3936	3681
Number VCs	609	609	609	609	609	460
Number funds	1118	1118	1118	1118	1118	969
Fin. year and Industry FE?	Y	Y	Y	Y	Y	Y
Fin. year X Ind. FE?	Y	Y	Y	Y	Y	Y

Table 6: Reinvestment decisions around fundraising: hazard models

Notes: Table presents the Cox proportional hazard regression of new equity or debt financing events for an entrepreneurial firm around VC fundraising for the sample of firms that did not fail. A spell is the time between the last financing and a next refinancing event (or censoring). The unit of observation is an entrepreneurial firm financing event matched to a VC fund. Variables are as defined in Table 5. The variable "After close" varies over time within a financing's spell and is equal to one after the investor's next fund closes. A positive coefficient on a variable implies a higher hazard of a new equity or debt financing event for the entrepreneurial firm. Column (1) presents the baseline specification. Column (2) introduces an interaction of the "After close" dummy variable and an indicator for whether the entrepreneurial had a high or low quality exit (ex-post). A high quality exit is an IPO or an exit that resulted in at least two times capital returned to investors. A low quality exit is an exit that resulted in some loss of capital (excluding failures). The interaction "Low quality X After close" asks whether the hazard of a new financing event differs for firms that eventually have poor exit outcomes. The excluded category are the outcomes outside of the left and right tail. Column (3) considers only those VC funds that are followed by a next fund, while columns (4) and (5) break the sample into first time and non-first time funds. All controls are as defined in Table 4. The baseline hazards in all models are stratified at the VC firm-level. Standard errors reported in parentheses with clustering at the entrepreneurial firm. * , **, *** represent significance at the 10%, 5%, and 1% levels, respectively.

	(1) All	(2) All	(3) Had Next	(4) Fund > 1	(5) First fund
Fund age (yrs.)	0.145***	0.100***	0.158***	0.162***	0.0934**
	(0.0266)	(0.0216)	(0.0310)	(0.0295)	(0.0390)
Fund age sq.	-0.00952***	-0.00698***	-0.0106***	-0.0103***	-0.00717**
	(0.00237)	(0.00191)	(0.00273)	(0.00254)	(0.00339)
After fund close		-0.0372	0.0207	-0.0000270	-0.0730
		(0.0375)	(0.0480)	(0.0482)	(0.0637)
Low quality X After close		0.111**	0.0906*	0.0918*	0.139*
		(0.0436)	(0.0529)	(0.0532)	(0.0774)
High quality X After close		-0.000628	-0.0471	-0.0836	0.0232
		(0.0527)	(0.0624)	(0.0647)	(0.102)
Low quality		-0.251***	-0.235***	-0.242***	-0.252***
		(0.0365)	(0.0441)	(0.0448)	(0.0653)
High quality		0.235***	0.284***	0.299***	0.119
		(0.0433)	(0.0528)	(0.0560)	(0.0783)
Log total capital raised	-0.138***	-0.104***	-0.0875***	-0.138***	-0.0672***
	(0.0154)	(0.0129)	(0.0142)	(0.0172)	(0.0223)
Firm age (yrs.)	-0.0131***	-0.0147***	-0.00105	-0.00695*	-0.0103*
	(0.00384)	(0.00374)	(0.00397)	(0.00390)	(0.00605)
Fraction fund K remaining	-0.0245	-0.0256*	-0.0332	-0.0236	-0.0353
	(0.0204)	(0.0154)	(0.0238)	(0.0259)	(0.0274)
Spells	6718	6718	5214	5098	1955
Pseudo-R^2	0.0127	0.00608	0.0146	0.0114	0.00613
Number firms	3321	3321	2725	2615	1216
Number VCs	569	569	400	362	373
Number funds	1072	1072	778	717	373
Fin. year FE?	Y	Y	Y	Y	Y
Industry FE?	Y	Y	Y	Y	Y
Fin. year X Ind. FE?	Y	Y	Y	Y	Y

Table 7: Fundraising in hot markets

Notes: The table repeats the main regressions in Tables 5 and 6 for subsamples based on the state of the public equity markets. For the quarter in which a fund was closed, we calculate the S&P 500 return over the previous year. Returns are then split into terciles (the row "S&P return" reports the means). To test for differences in coefficients across the sub-sample, column (4) pools the data and interacts the "After close" dummy with the top and bottom tercile dummy. The row "p-value test of interaction equality" reports the p-value from the test that the interactions of the hot and cold markets are the same. Panel A repeats the hazard model for write-off events in Table 5 and Panel B repeats the reinvestment hazard in Table 6. All regressions include the controls and fixed effects, as found in those tables ("Controls?"). Standard errors in parentheses, clustered at the VC firm-level. * , **, *** represent significance at the 10%, 5%, and 1% levels, respectively.

	Panel A			
	Write-off hazard model			
	(1)	(2)	(3)	(4)
	S&P 500 returns at fundraising			
	Top 33%	Middle 33%	Bottom 33%	All
After fund close	0.441	0.562**	0.233	0.562***
	(0.280)	(0.233)	(0.199)	(0.198)
Hot mkt X After close				-0.174
				(0.297)
Cold mkt X After close				-0.303
				(0.268)
Hot mkt				-0.125
				(0.227)
Cold mkt				0.152
				(0.172)
Fund age (yrs.)	0.305*	0.262	0.135	0.238**
	(0.181)	(0.250)	(0.147)	(0.0954)
Fund age squared	-0.0192	-0.0127	-0.00551	-0.0136
	(0.0162)	(0.0254)	(0.0132)	(0.00870)
S&P return	0.257	0.0942	-0.138	0.0481
Spells	1870	2249	1827	5946
VC funds	282	260	253	795
Pseudo-R^2	0.129	0.109	0.0890	0.0698
	p-value test of interaction equality:			.659
Controls?	Y	Y	Y	Y
Fin. year X Ind. FE?	Y	Y	Y	Y

	Panel B			
	(1)	(2)	(3)	(4)
	Top 33%	Middle 33%	Bottom 33%	All
Low quality X After close	0.0421	0.116*	0.00895	0.137**
	(0.0945)	(0.0659)	(0.0694)	(0.0624)
High quality X After close	-0.215**	0.0929	0.0445	0.0605
	(0.103)	(0.0855)	(0.0953)	(0.0796)
Low quality	-0.100	-0.309***	-0.219***	-0.259***
	(0.0826)	(0.0500)	(0.0561)	(0.0521)
High quality	0.368***	0.105	0.124	0.185***
	(0.0878)	(0.0667)	(0.0762)	(0.0666)
Hot mkt X High quality X After close				-0.223*
				(0.129)
Cold mkt X Low quality X After close				-0.0943
				(0.112)
S&P return	0.241	0.0980	-0.0818	0.0786
Spells	1705	3410	3113	5212
VC funds	262	565	544	777
Pseudo-R^2	0.0145	0.0165	0.0110	0.0109
	p-value test of triple interaction equality:			.472
Controls?	Y	Y	Y	Y
Fin. year X Ind. FE?	Y	Y	Y	Y

Table 8: Characteristics of write-offs around fund closing

Notes: The table reports entrepreneurial firm investment characteristics for the set of entrepreneurial firms that failed (i.e., were written off) by the end of 2013. All models except column (2) are OLS where the unit of observation is a write-off event with one observation per entrepreneurial firm. Column (2) uses a poisson model for the count dependent variable. The sample considers all write-off events that occurred in the 4 year window around a next fund closing. "Years since last K" is the number years from the last capital infusion to the write-off event. "# rounds" is the total number of financing events before exit and "Years VC-backed" is the total amount of years from first VC financing to write-off event. "Log capital invested" sums the total capital invested by VCs into the entrepreneurial firm by its exit. The main controls are dummies variables for six-month intervals around fund closing. For example, "0 – 1 year after close" is one if the write-off occurred in the 12 month window after the next fund closing. "Log round #" is the log of total financings to write-off and "Fund age" is the log of fund age at the time of the write-off. "Start year FE" are fixed effects for the year of the firm founding. All other fixed effects are as defined in Table 6. Standard errors are clustered at the entrepreneurial firm founding year level. * , **, *** represent significance at the 10%, 5%, and 1% levels, respectively.

	Characteristics of write-offs			
	Years since last K	# rounds	Years VC-backed	Log capital invested
	(1)	(2)	(3)	(4)
2 - 3 years to close	0.129	0.0826	0.216	0.226*
	(0.141)	(0.0641)	(0.177)	(0.118)
1 - 2 years to close	-0.0897	0.0631	0.00895	0.0542
	(0.140)	(0.0539)	(0.181)	(0.0692)
0 - 1 year after close	0.349*	0.0164	0.416*	0.0115
	(0.176)	(0.0424)	(0.202)	(0.0438)
1 - 2 years after close	-0.434***	-0.0777*	-0.559**	0.146***
	(0.108)	(0.0409)	(0.219)	(0.0359)
2 - 3 years after close	-0.453***	-0.0157	-0.526*	0.102**
	(0.135)	(0.0412)	(0.258)	(0.0459)
Fund age	1.131***	0.438***	1.528***	-0.0743*
	(0.0902)	(0.0352)	(0.389)	(0.0369)
Log round #	-0.154*		2.141***	1.033***
	(0.0782)		(0.196)	(0.0339)
Constant	-4.015***	2.474***	-3.852**	-0.550***
	(0.336)	(0.217)	(1.686)	(0.121)
Observations	2277	2277	2277	2276
R^2/Pseudo-R^2	0.254	0.0748	0.596	0.443
Specification	OLS	Poisson	OLS	OLS
Start year FE?	Y	Y	Y	Y
Industry FE?	Y	Y	Y	Y
Start year X Industry FE?	Y	Y	Y	Y

Table 9: Entrepreneurial firm outcomes around fundraising

Notes: The table reports the VC firm fixed effect estimates of several entrepreneurial firm outcome measures on a set of observables. In Column (1), the dependent variable is equal to one if the entrepreneurial firm went public by the end of the sample. Column (2) uses the log of the exit valuations (log(.01) if failed) for the firms that have a known value, while Column (3) considers the same dependent variable excluding failed firms. Column (4) has a dependent variable that is the log of the gross multiple return of an investment accounting for dilution. The unit of observation is the entrepreneurial firm financing event paired with a VC fund (thus, the financing may be repeated if there are multiple funds investing). The sample includes all entrepreneurial firm financings between 1992 and 2013 for which a VC investor had a fund close before 2007. We consider the first investment made by a fund in the entrepreneurial firm in the four-year window around fundraising. The variable "0–2 years after close" is a dummy for the post-closing investments. Other control variables are defined in Table 1. Column (1) is a conditional logit with a VC firm FE, while Columns (2) – (4) use standard VC firm fixed effects. Standard errors in parentheses, clustered at the VC firm level. * , **, *** represent significance at the 10%, 5%, and 1% levels, respectively.

	Financing outcomes			
	IPO	Log Valuation	Log Valuation	Log Return
	All	All	Non-failed	All
	(1)	(2)	(3)	(4)
0-2 years after close	-0.148**	-0.163**	-0.176***	-0.135*
	(0.0699)	(0.0811)	(0.0517)	(0.0711)
Fund age (yrs)	0.00483	0.000968	0.0288*	0.0217
	(0.0263)	(0.0303)	(0.0156)	(0.0278)
Log VC age (years)	-0.0931	-0.135	-0.0484	-0.0691
	(0.0714)	(0.0895)	(0.0678)	(0.0858)
Log total capital raised	0.513***	0.775***	0.349***	0.109***
	(0.0370)	(0.0417)	(0.0392)	(0.0339)
Has revenues	-0.0257	0.149**	0.0701	0.335***
	(0.0723)	(0.0753)	(0.0642)	(0.0732)
Profitable	0.772***	1.218***	0.539***	1.450***
	(0.150)	(0.153)	(0.116)	(0.159)
Firm age (years)	-0.0160	-0.0228***	-0.0423***	-0.00971
	(0.0110)	(0.00855)	(0.00751)	(0.00868)
Log fund size (m)	-0.216***	-0.257***	-0.0991***	-0.179***
	(0.0460)	(0.0629)	(0.0377)	(0.0625)
Years to exit				0.0175
				(0.0144)
Constant		2.113***	4.449***	-0.285
		(0.402)	(0.281)	(0.349)
Observations	8665	5909	4742	4311
Pseudo R^2	0.0962			
R^2		0.181	0.0835	0.133
Specification	C. Logit	FE	FE	FE
VC FE?	Y	Y	Y	Y
Round # FE?	Y	Y	Y	Y
Industry FE?	Y	Y	Y	Y
Fin. year FE?	Y	Y	Y	Y
Fin. year X Industry FE?	Y	Y	Y	Y

Table 10: Fund N performance and fund $N+2$ outcomes

Notes: The table reports regressions of fund characteristics on the outcomes of the fund closed in the past. The dependent variable in Columns (1)–(2) are dummy variables for whether this fund closed, while Columns (3)–(4) are the logarithm of the fund size of fund $N+2$. The control variables are all measured for the fund sequence N in the past. Thus, the table asks whether proxies for Fund N performance correlate with the characteristics of future funds. "Log # failures (pre/post close)" is the log of the total number of failures in Fund N both pre and post-closing of Fund $N+1$. "Log # good exits (pre/post close)" are the number of successful exits in Fund N around the closing of Fund $N+1$. "Log Fund $N+1$" is the log of the intervening fund and "Log # fund N investments" sums the total investments done in Fund N. "Fund N vintage year FE" are fixed Robust standard errors in parentheses. * , **, *** represent significance at the 10%, 5%, and 1% levels, respectively.

	Raised Fund $N+2$?		Log Fund $N+2$ size	
	(1)	(2)	(3)	(4)
Log # failure pre-close	-0.481***		-0.179	
	(0.154)		(0.188)	
Log # failures post-close Fund N	-0.274***		0.0352	
	(0.0984)		(0.122)	
Log # good exits pre-close		-0.0756		0.299**
		(0.135)		(0.141)
Log # good exits post-close Fund N		0.378***		0.441***
		(0.0996)		(0.120)
Log Fund N size	0.191***	0.154***	0.590***	0.529***
	(0.0413)	(0.0425)	(0.0616)	(0.0618)
Log # fund N investments	0.409***	0.0381	-0.0902	-0.378***
	(0.0763)	(0.0740)	(0.0947)	(0.105)
Constant	-0.784***	-0.504*	2.669***	3.076***
	(0.277)	(0.277)	(0.372)	(0.374)
Observations	756	756	370	370
R^2			0.329	0.355
Pseudo R^2	0.170	0.167		
Num. VCs	413	413	199	199
Num funds	756	756	370	370
Model	Probit	Probit	OLS	OLS
Fund N vintage year FE	Y	Y	Y	Y
Fund $N+1$ vintage year FE	Y	Y	Y	Y

Managing Performance Signals Through Delay: Evidence from Venture Capital (Internet Appendix)

A Identifying failure dates

Most databases of venture capital financings do not include explicit dates for failed investments. Failure here involves the official dissolution of the firm in which all employees are terminated and any assets are sold off. We exploit three types of information to identify approximate dates of these events. The first is a status from VentureSource where they identify when the firm "ceased operations." If this is unavailable, we then use a field that reveals the last time that they spoke to either an investor in the firm or a contact at the entrepreneurial firm itself. VentureSource aims to have at least one of these contacts each year. Finally, for a large percentage of the failed companies, we gathered their incorporation information from Delaware and California, two of the most popular states for incorporation. Both states require an annual fee to maintain status, so the last paid fee revealed on the website is a close approximation of the date the firm shut down. Any last incorporation filing that occurred prior to the previous two VentureSource dates is the primary failure date used.

How, if at all, could measurement error in this date impact the results? It is clear that each of these dates are all likely upper bounds on the true failure date. Any systematic delay in assigning failure would simply shift the estimated jump in write-off events back in time. Importantly, given the semi-annual surveys conducted by VentureSource and the annual taxes due in CA and DE, these failure dates are off by an average of six months and a maximum of one year. In unreported regressions, the results are unchanged if we adjust all failure dates that were found with the noisier incorporation information back by six months.

B Figures and tables

Figure B.1: Write-offs over the fund life-cycle

Notes: The figure reports the predicted rate of write-offs as a function of fund age from the follow linear probability regression:

$$\text{Write-off}_{ijt} = \beta_0 + \beta_1 \text{Fund Age}_{it} + \beta_2 \text{After close}_{it}(\text{Fund age}_{it} - A_i) + \hat{\beta}_3 X_{ijt} + \epsilon_{it}$$

where A_i is the age of fund i when the next fund closed. The solid lines report the predictions of the trend from the above regression (i.e. $\hat{\beta}_0 + \hat{\beta}_1 \text{Fund Age}_{it} + \hat{\beta}_2 \text{After close}_{it}(\text{Fund age}_{it} - A_i)$) while the dots represent the residual predicted write-off rate after de-meaning by the predicted $\hat{\beta}_3 X_{ijt}$. The solid vertical line is the mean fund age at the time of next fund closing.

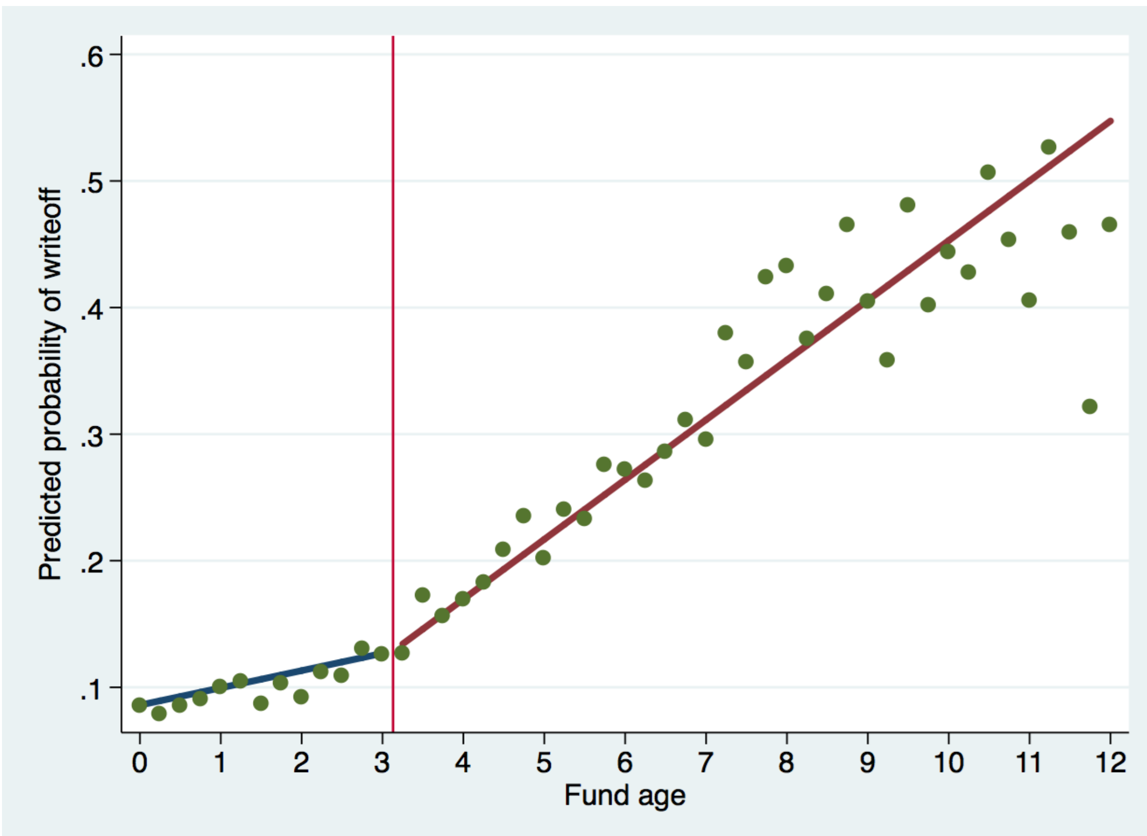

Table B.1: Alternative measures of reputation and write-off probabilities

Notes: Table reports the write-off hazard regressions found in Table 5 with alternative measures for reputation. The variables "Fund N" are dummy variables for each fund sequence for a VC firm (the excluded category is the 5th and greater fund if it exists). The variable "Fund 1 or 2" is a dummy for whether the fund in question is the first or second fund of the VC firm (the excluded category is all other fund numbers). The last column includes the variable "Fund 1,2 or 3" which is one if the fund is one of the first three for a VC firm. Additional control variables (not shown for space) are as included in Table 5. The baseline hazards in all models are stratified at the VC firm-level. Standard errors reported in parentheses with clustering at the entrepreneurial firm. * , **, *** represent significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)
Fund age (yrs.)	0.188**	0.195**	0.197**	0.194**
	(0.0793)	(0.0776)	(0.0778)	(0.0778)
Fund age squared	-0.0118	-0.0111	-0.0112	-0.0111
	(0.00767)	(0.00748)	(0.00749)	(0.00748)
Fund 1 X After close	-0.147			
	(0.252)			
Fund 2 X After close	0.0172			
	(0.261)			
Fund 3 X After close	0.636**			
	(0.302)			
Fund 4 X After close	0.157			
	(0.339)			
Fund 1	0.113			
	(0.164)			
Fund 2	0.267			
	(0.167)			
Fund 3	-0.164			
	(0.218)			
Fund 4	0.0466			
	(0.234)			
After fund close	0.229	0.393***	0.466***	0.281*
	(0.203)	(0.109)	(0.135)	(0.164)
VC's first fund		0.0201		
		(0.118)		
First fund X After Close		-0.321*		
		(0.185)		
Fund 1 or 2			0.205*	
			(0.117)	
Fund 1 or 2 X After close			-0.312*	
			(0.176)	
Fund 1,2 or 3				0.104
				(0.128)
Fund 1,2 or 3 X After close				0.0158
				(0.191)
Spells	7813	7813	7813	7813
Pseudo-R^2	0.0566	0.0677	0.0677	0.0674
Number firms	3936	3936	3936	3936
Number VCs	609	609	609	609
Number funds	1118	1118	1118	1118
Controls?	Y	Y	Y	Y
Fin year. FE?	Y	Y	Y	Y
Industry FE?	Y	Y	Y	Y
Fin. year X Ind. FE?	Y	Y	Y	Y

Table B.2: Write-off probabilities around fundraising: syndicates in fund closing synch

Notes: Table presents the Cox proportional hazard regression of write-off events around VC fundraising. A unit of observation (i.e. spell) is an entrepreneurial firm financing event. The variable "Board / Lead investor" is equal to one if the investor (VC fund) has a board seat at the entrepreneurial firm or was ever a lead investor in a previous financing. The variables "Synched" and "Synched syndicate" are equal to one if the syndicate in the last financing event are all either pre-fundraising or post-fundraising. All other controls from Table 5 are included but not reported here. The baseline hazards in all models are stratified at the VC firm-level. Standard errors reported in parentheses with clustering at the entrepreneurial firm. * , **, *** represent significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)
After fund close	0.179	0.0374	
	(0.159)	(0.156)	
After close X Board / Lead investor	0.123		
	(0.185)		
Board / Lead investor	-0.452***		
	(0.127)		
After close X Synched		0.511***	
		(0.191)	
Synched syndicate		0.0427	0.167
		(0.140)	(0.201)
3 years to closing			0.0422
			(0.345)
2 years to closing			0.230
			(0.254)
1 year after closing			0.178
			(0.223)
2 years after closing			0.0176
			(0.277)
3 years after closing			0.138
			(0.270)
Synched X 3 years before closing			-0.331
			(0.386)
Synched X 2 years before closing			-0.152
			(0.289)
Synched X 1 years after closing			0.798**
			(0.361)
Synched X 2 years after closing			0.742*
			(0.382)
Synched X 3 years after closing			0.216
			(0.263)
Spells	7813	7813	7813
Pseudo-R^2	0.0691	0.0568	0.0579
Number firms	3936	3936	3936
Number VCs	609	609	609
Number funds	1118	1118	1118
Controls?	Y	Y	Y
Fin. year FE?	Y	Y	Y
Industry FE?	Y	Y	Y
Fin. year X Ind. FE?	Y	Y	Y

Table B.3: Valuation around fundraising: fund age dummies

Notes: The table reports the estimates of both probit estimates for a regression of the change in the entrepreneurial firm valuation for VC fund investments on a set of observables. It is the same specification as Table 4 where we instead introduce dummies for the age of the fund, where all variables are defined. The dummy variables "Fund N years old" are indicators for each fund age of the current fund. The excluded category is the first year of the fund. Regressions include all the same controls as in Table 4, excluded here for space. Other control variables are defined in Table 1 (some unreported). Standard errors in parentheses, clustered at the VC firm-level. * , **, *** represent significance at the 10%, 5%, and 1% levels, respectively.

	Increase in valuation?				
	(1)	(2)	(3)	(4)	(5)
	Full	Full	$[-2, 2]$	Full	Full
Fund 2 yrs. old	0.110	0.130	0.132	0.130	0.124
	(0.105)	(0.109)	(0.119)	(0.108)	(0.111)
Fund 3 yrs. old	-0.0239	0.00105	-0.00638	0.0114	0.00500
	(0.108)	(0.112)	(0.127)	(0.111)	(0.115)
Fund 4 yrs. old	-0.00365	0.0233	0.116	0.0337	0.0383
	(0.111)	(0.114)	(0.128)	(0.108)	(0.113)
Fund 5 yrs. old	0.0384	0.0612	0.104	0.0777	0.0883
	(0.122)	(0.136)	(0.146)	(0.121)	(0.125)
Fund 6 yrs. old	-0.112	-0.101	-0.0526	-0.0753	-0.0622
	(0.141)	(0.180)	(0.199)	(0.152)	(0.162)
Fund 7 yrs. old	0.0365	0.0409	0.174	0.111	0.0913
	(0.157)	(0.199)	(0.204)	(0.164)	(0.172)
Fund 8 yrs. old	0.135	0.113	0.127	0.172	0.180
	(0.234)	(0.270)	(0.259)	(0.227)	(0.233)
Fund 9 yrs. old	0.222	0.166	0.148	0.273	0.246
	(0.234)	(0.263)	(0.268)	(0.221)	(0.234)
Fund 10 yrs. old	0.0527	0.00769	1.234**	0.175	0.0990
	(0.330)	(0.411)	(0.515)	(0.361)	(0.360)
After fund close		-0.0928	-0.0949	-0.323**	-0.0873
		(0.0669)	(0.0725)	(0.157)	(0.0784)
Had next fund?				-0.0256	
				(0.117)	
Had next fund? X After close				0.284	
				(0.174)	
First fund					0.0126
					(0.135)
First fund X After Close					-0.00679
					(0.131)
Observations	5441	5441	4331	5441	5441
Pseudo R^2	0.214	0.215	0.227	0.217	0.215
Num. VCs	411	411	397	411	411
Num funds	830	830	786	830	830
Num. firms	2487	2487	2187	2487	2487
Specification	Probit	Probit	Probit	Probit	Probit
Controls?	Y	Y	Y	Y	Y
Industry FE?	Y	Y	Y	Y	Y
Fin. year FE?	Y	Y	Y	Y	Y
Fin. year X Ind. FE?	Y	Y	Y	Y	Y
Stage FE?	Y	Y	Y	Y	Y

Table B.4: Write-off probabilities around fundraising: hazard models with fund age dummies and trend adjustments

Notes: The table presents the Cox proportional hazard regression of write-off events around VC fundraising. A unit of observation (i.e. spell) is an entrepreneurial firm financing event. It is the same specification as Table 5 where the fund age and its square are replaced by a set of dummies for each year of fund age (the first year as the excluded group). Columns (5) and (6) introduce alternative controls for the relationship between write-offs and fund age. The final column excludes all VC funds that were raised in the 3–4 year window after the previous fund closed. All other controls from Table 5 are included but not reported here. The baseline hazards in all models are stratified at the VC firm-level. Controls are unreported but are the same as found in Table 5. Standard errors reported in parentheses with clustering at the entrepreneurial firm. * , **, *** represent significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Fund 2 yrs.	0.0509	0.121	0.116	0.129			
	(0.572)	(0.573)	(0.574)	(0.577)			
Fund 3 yrs.	0.247	0.261	0.266	0.272			
	(0.571)	(0.572)	(0.573)	(0.576)			
Fund 4 yrs.	0.472	0.451	0.441	0.462			
	(0.572)	(0.573)	(0.574)	(0.577)			
Fund 5 yrs.	0.342	0.313	0.309	0.333			
	(0.582)	(0.582)	(0.583)	(0.587)			
Fund 6 yrs.	0.534	0.505	0.491	0.508			
	(0.587)	(0.587)	(0.588)	(0.592)			
Fund 7 yrs.	0.833	0.812	0.801	0.818			
	(0.593)	(0.593)	(0.594)	(0.597)			
Fund 8 yrs.	0.825	0.786	0.772	0.798			
	(0.627)	(0.628)	(0.630)	(0.633)			
Fund 9 yrs.	1.142*	1.062*	1.099*	1.089*			
	(0.634)	(0.636)	(0.636)	(0.641)			
Fund 10 yrs.	0.335	0.294	0.308	0.324			
	(0.741)	(0.746)	(0.746)	(0.749)			
After fund close		0.264***	0.0210	0.355***	0.315*	0.303**	0.338***
		(0.0929)	(0.179)	(0.109)	(0.173)	(0.125)	(0.0986)
Had next fund?			-0.127				
			(0.119)				
Had next fund? X After close			0.333				
			(0.203)				
VC's first fund				0.0210			
				(0.118)			
First fund X After Close				-0.278			
				(0.186)			
Fund age (yrs.)					0.0757***	0.0739***	0.196**
					(0.0286)	(0.0227)	(0.0855)
After close X fund age					-0.00496		
					(0.0419)		
After close X (Fund age - age at close)						-0.00533	
						(0.0819)	
Spells	7814	7814	7814	7814	7813	7813	6223
Pseudo-R^2	0.0552	0.0560	0.0563	0.0564	0.0549	0.0548	0.0632
Number firms	3936	3936	3936	3936	3936	3936	3384
Number VCs	610	610	610	610	609	609	570
Number funds	1119	1119	1119	1119	1118	1118	951
Controls?	Y	Y	Y	Y	Y	Y	Y
Fin year. FE?	Y	Y	Y	Y	Y	Y	Y
Industry FE?	Y	Y	Y	Y	Y	Y	Y
Fin. year X Ind. FE?	Y	Y	Y	Y	Y	Y	Y