Venturing Beyond the IPO:
Financing of Newly Public Firms by Pre-IPO Investors

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February 21, 2017

ABSTRACT

Newly public firms are similar to private firms in their high risk, high demands for capital, and high information asymmetry. Consistent with these similarities, we document that investors specializing in private firms, such as venture capitalists, also have a comparative advantage in evaluating young public firms. These advantages arise from previous investments in the firm and/or expertise in similar firms, and they can prevent Akerlof-type market breakdowns among recent IPO companies seeking to raise capital. The willingness of these pre-IPO investors to invest capital in a company after it goes public positively affects shareholder value.

JEL Classifications: G24, G32.
Keywords: Venture Capitalists, Private Equity, Newly Public Firms, Equity Issuance, IPOs.

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1. Introduction

A wide body of literature emphasizes that venture capitalists (VCs) focus on young private companies, generally in high-tech industries. Metrick and Yasuda (2011) put it succinctly: "A VC invests only in private companies. … A VC's primary goal is to maximize its financial return by exiting investments through a sale or an initial public offering (IPO)." However, we find that these same investors fund companies after the IPO as well. In a sample of private firms going public for the first time, 15% of the firms that were backed by venture capital prior to the IPO received additional funding from similar sources within the first five years after the IPO. Press releases of these financings provide suggestive evidence of their importance to the underlying companies. For example, when Fatbrain.com received funding from their pre-IPO VC (Vulcan Ventures) one year after going public, the company highlighted how the funding would help them to bring their product to market and stated: "We view the increased support of Vulcan as a powerful endorsement of our success."[1]

While public firms are often considered fundamentally different than private firms, we argue that similarities between newly public firms and their private counterparts motivate venture capitalists' post-IPO investments. In particular, we conjecture that venture capitalists have a comparative advantage in assessing the true value of recent IPO firms, and as a result VCs have a unique ability to overcome frictions in the financial market that prevent financing from other market participants. Newly public companies tend to demand large amounts of capital to fund growth opportunities, and only companies that raise the needed capital survive. However, the high information asymmetry of these companies can make it difficult to raise capital at a viable price, as described by Akerlof (1970) and Myers and Majluf (1984). Firms find it costly

[1] See FatBrain.com's 11/1/1999 8-K filing:
https://www.sec.gov/Archives/edgar/data/1066010/000089161899004808/0000891618-99-004808.txt

to issue equity because investors rationally conclude that firms attempting to raise outside equity are overvalued. For firms with high information asymmetry, the extent of possible overvaluation is greater, meaning that the price at which they can raise outside equity is even lower. Absent an intermediary who can differentiate the high intrinsic quality firms from the low quality ”lemons”, many firms are better off not raising outside equity, even if the lack of capital forces them to forego positive NPV projects.

Our descriptive statistics highlight the extent to which companies seek to raise external capital in the years after the IPO. Among our sample of venture-backed IPO firms,[2] 61% raise additional capital within three years of going public, through either a secondary equity offering (SEO), a syndicated loan, a private investment in public equity (PIPE), or a venture capital investment; the analogous percentage is 68% after five years.[3] Across these firms, the lowest percentage relies on PIPEs (6% within the first three years) and the greatest percentage relies on syndicated loans (36% within the first three years). The percent of firms raising capital from a venture capitalist (13% within the first three years) lies between these two extremes.

A venture capitalist’s comparative advantage in serving as a financial intermediary stems from several sources. First, its prior interactions with either the same firm or other similar firms enable it both to identify the extent to which a company is over- or undervalued and to estimate the value of a company’s future growth opportunities. Second, because each VC has an in-depth understanding of the industries in which it invests, management is better able to convey the

[2] Our sample includes any company that SDC lists as having received venture capital funding, which even after excluding reverse LBOs includes some more PE-type companies, e.g., older companies that have never previously been public. For conciseness, because of the increasing ambiguity between VC and PE, and because of the common association between private equity and reverse LBOs, we refer to the investors backing these heretofore private companies as VCs. As discussed in more detail later, startup-type firms represent the majority of our sample and the rate of post-IPO investments is somewhat higher among these cases.

[3] PIPEs are private investments in public equity, where the lead investors are frequently hedge funds. The 6% frequency of PIPEs excludes any cases where the investors are VCs. As discussed in more detail later, post-IPO VC investments represent equity-type investments but occur in many different forms.

business model and the projected uses of capital. Finally, VCs have relatively long investment time horizons, suggesting they may have less liquidity pressures than other providers of capital. In sum, the venture capitalist is well-positioned to prevent a market break-down of the type discussed by Akerlof, and their investments should represent a positive signal to the market regarding true firm value.

Alternatively, although VCs have information-related advantages, other factors may cause their investments in newly public firms to represent negative signals regarding shareholder value. First, VCs with prior investments in the firm may have incentives that are not perfectly aligned with outside shareholders. Their convex compensation schemes potentially give them incentives to invest additional money in past investments that are under-water, in the hopes of realizing the small probability of a large payoff. Career-type concerns, in which past successes influence both access to the highest potential private companies and ease of raising follow-on funds, further contribute to such lottery-type gambles. Second, VCs with prior investments often hold debt-type instruments in the firm, raising the possibility of a debt overhang problem in which the new equity investment contributes to the value of debt and existing shareholders realize little benefit (Myers, 1977). Third, the VC's equity investment may signal negative information about the company, for example, if it is a source of capital of last resort analogous to what Chaplinsky and Haushalter (2010) and Brophy et al (2009) document for the case of PIPEs.

Across our sample of 1,761 venture-capital backed IPOs between 1995 and 2010, 270 companies received venture capital financing within the first five years after the IPO.[4] The characteristics of firms that receive post-IPO VC financing are consistent with our conjecture

[4] This represents a lower bound on the frequency of VC investment in newly public firms. As discussed in more detail later, we restrict our sample of post-IPO VC financings to those we can independently verify through SEC filings. We also ignore VC financing within the first 7 days after the IPO, as in some of these cases the prospectus states that the VC intends to buy shares shortly after the IPO.

that these firms would be very sensitive to Myers and Majluf-type information asymmetry problems. They tend to be smaller, younger, and to have lower ROA, more negative cash flows, and higher R&D.

We document a high rate of repeat VC investments, consistent with both the information advantage and the incentives of VCs to invest being particularly strong in cases where they have a previous investing relationship with the company. In 60% of the post-IPO VC investments, the VC that funded the company after the IPO also funded the company prior to the IPO. Further supporting the importance of information advantages, we find that in 48% of the companies that receive post-IPO VC financing, the VC has at least one director sitting on the company's board at the end of the fiscal year preceding the investment. In addition, we find that the VC owns shares prior to the investment in 45% of these companies. In multiple specifications, we find that prior ownership, extensive prior experience with the firm, and VC industry specialization are some of the most important determinants of a post-IPO VC investment.

Firm returns support the conjecture that these financings overcome frictions in the market and thus are beneficial for the underlying companies. Average abnormal returns around the time of VC investments are between 5% and 8%, and as high as 15% within subsamples where the VC's information advantage is potentially greatest. In strong contrast to studies of other equity financings such as SEOs or PIPEs, we find no evidence of long-run negative abnormal returns following the VC investment. In fact, the sample of firms with post-IPO VC financing significantly outperforms the sample of firms with PIPEs (defined as private investments in public equity, where the investor did not fund the firm pre-IPO). Finally, we find no evidence that these firms underperformed the market or other similar firms prior to the post-IPO VC financing. In aggregate, these results provide strong support for the conjecture that

venture capitalists' investments are good for the underlying companies, likely by enabling them to pursue positive NPV projects; our results provide no support for the conjecture that venture capitalists' investments are motivated by convex compensation contracts or influenced by debt overhang problems.

Firms face substantial uncertainty regarding external funding in the years after going public, for example because information asymmetry can cause typical sources of capital to be too costly or even completely unavailable.[5] The ability of a newly public firm to raise capital from one's venture capitalist lowers this risk and is therefore valuable. Importantly, the value of this funding alternative should extend beyond those companies that ultimately employ this source of capital. We empirically examine the benefits from potential VC support as well as the extent to which the market prices this advantage. We use the fact that one of the strongest predictors of whether a VC invests after the IPO is whether it invested prior to the IPO. We consider the following strategy: we go long in companies that were backed prior to their IPO by a VC with a high tendency to fund newly public firms after the IPO, and we short all other VC-backed IPOs. Returns on this long-short portfolio are significantly positive. Similarly, we also find differences in rates of delisting: companies are significantly less likely to delist for poor performance if they were funded prior to the IPO by VCs with an above-median tendency to fund companies after the IPO. Our results are consistent with these companies being better able to obtain external capital in adverse states of the world where credit rationing might otherwise be binding, specifically in cases where they have positive NPV growth opportunities but also high information asymmetries that make it difficult to raise capital from other investors at a viable price.

[5] For example, Stiglitz and Weiss (1981) develop a model in which banks facing informationally asymmetric borrowers do not offer loans at higher rates because this itself leads to more bankruptcies; the result is unfunded projects in equilibrium.

Our paper contributes to the literature on financial constraints, and the factors that cause intermediaries to specialize in different types of financing. While there is disagreement on how to best identify financially constrained firms (see, e.g., Kaplan and Zingales 1997; Whited and Wu 2006; Hadlock and Pierce 2010; Farre-Mensa and Ljungqvist 2016), there is broad agreement that access to capital among such firms is critical. Hertzel, Huson, and Parrino (2012) conclude that newly public firms raise capital in stages to overcome costs related to information asymmetry. Diamond (1984), Ramakrishnan and Thakor (1984), and Fama (1985) argue that a single private lender can mitigate information asymmetries, and Boot (2000), Bharath et al (2011), and Hadlock and James (2002) show that the advantages are greater among cases in which firms establish long-term relationships with banks. Our findings suggest that venture capitalists' industry expertise enables them to play a similar role in newly public firms. Our findings also highlight the extent to which many newly public firms are financially constrained. Despite frequently having substantial cash on hand, their high growth trajectories combined with high information asymmetry causes them to have insufficient access to SEOs, public bonds, or syndicated loans to fulfill their capital demands.

Our paper also contributes to the literature on the role of venture capitalists. Sahlman (1990), Lerner (1995), and Gompers and Lerner (1996), among others, highlight the role of VCs in young private firms, where VCs' overarching objective is to exit the investment through an IPO or via an acquisition. A small number of papers have examined VCs' investments in public firms. For example, Chaplinsky and Haushalter (2012) examine VCs' investments across a broad spectrum of public firms, focusing on the extent to which VCs profit from these investments, and Celikyurt et al. (2012) and Dai (2007) both focus on later stages in firms' life

cycles.[6] In contrast to these papers, we focus on VCs' investments in firms within the first few years after the IPO, a unique point in firms' life cycles and a point when VCs have a strong comparative advantage. To the best of our knowledge, we are the first to examine the ways in which VCs work with newly public firms to alleviate problems related to financial constraints, and we document the associated benefits to the companies in which they invest.

2. Data and Descriptive Statistics

We obtain our sample of IPO firms from Thomson Financial SDC Platinum. Following the prior literature, we omit REITs, ADRs, closed-end funds, unit offerings, reverse LBOs, and IPOs with an offer price of fewer than five dollars.[7] In addition to information regarding the IPO, we also obtain information on venture capital financing rounds from the SDC VenturXpert Database. We limit our sample to IPOs in which there was at least one pre-IPO venture capital financing round. We require all firms to have CRSP data, with a CRSP price within the first ten trading days after the IPO, and Compustat data. This 'SDC sample' consists of 2,459 VC-backed IPOs between 1985 and 2010. The beginning year of 1985 is motivated by data availability on venture capitalists' participation in SDC. We stop the sample in 2010 to enable us to collect five years of data on the post-IPO sources of financing for these firms.

Our data on VC financing rounds, which comes from the VenturXpert Database of Thomson Financial SDC Platinum, includes information on rounds after the IPO. We focus on VC financings that occur up to a maximum of five years after the IPO. Our choice of a five-year

[6] Celikyurt et al. (2012) find that VCs frequently sit on Boards of mature companies, but they emphasize that many of these companies have been public for many years and were never VC-backed. Dai similarly focuses on older firms, and he focuses on the effects of investor identity in providing PIPE-type financing.

[7] To identify reverse LBOs, we rely on the SDC flag for IPOs for the 1985 – 1987 and 1993 – 1995 periods, we thank Laura Field for providing data on IPOs between 1988 and 1992 (as used in Field and Karpoff, 2002), and we read through the company background portion of prospectuses for IPOs in 1996 and later.

cutoff follows prior literature that defines newly public firms as firms that have been public for no more than five years (see, e,g., Field et al., 2013). We also omit cases where firms received VC financing within the first seven days after the IPO because in many of these cases the VC had stated its intention to invest within the prospectus. Across this 1985 – 2010 time period, we find that 29% of VC-backed IPO firms also received venture financing subsequent to the IPO. In 56% of these cases, the VC that invested subsequent to the IPO also invested prior to the IPO. Panel A of Figure 1 shows the time-series patterns of these post-IPO financings.

From this sample of 2,459 VC-backed IPOs over the 1985 – 2010 period of which SDC lists 29% as obtaining post-IPO VC financing, we refine the data along two dimensions. First, we seek to verify the post-IPO VC financings through SEC filings. Second, we examine in more detail the extent to which our designation of VC-backing prior to the IPO captures the presence of true venture capitalists investing in startup-type firms, versus later-stage firms that are more characteristic of private equity.

2.1 Verification of post-IPO VC financings through SEC filings

A broad set of literature has relied on SDC data similar to that described above to analyze venture capital investments prior to the IPO. The accuracy of these data in portraying pre-IPO VC investments should arguably be similar to that for post-IPO VC investments. Nevertheless, to err on the side of caution, we undertake a substantial data-verification exercise, to confirm the validity of these post-IPO VC investments. Specifically, we search through SEC filings on EDGAR to verify every VC investment within five years of the IPO (as recorded in VenturXpert). Because EDGAR filings begin in 1995, our 'verified sample' is restricted to the 1,761 IPOs between 1995 and 2010. Company filings in our search include registration statements of new publicly traded securities (S-3 and S-1), statements of beneficial ownership

(13G), announcements of significant company events (8K), and announcements of material changes in the holdings of company insiders (Form 4). For 42% of the IPOs with post-IPO rounds listed in SDC, we are able to verify the fundings through SEC filings. This leaves us with a sample of 270 verified cases of post-IPO VC investments over a total of 1,761 IPOs over the 1995 – 2010 period, a rate of 15%.

The true rate of post-IPO VC investments likely lies between the 29% rate of the 'SDC sample' and the 15% rate of the 'verified sample'. The verified sample underrepresents the true rate because not all venture capitalists investing in the firm are required to file with the SEC. Investments by VCs that are not registered insiders (i.e., because the VC did not sit on the board and the VC owned less than 5%) are less likely to be reported. If the investment is sufficiently large to be deemed to 'be of importance to security holders' it will likely be reported in form 8-K current report filings, but smaller dollar investments by non-insiders are unlikely to be filed with the SEC. Consistent with this, the average dollar size of investments in our 'verified sample' is substantially larger than those that we are unable to verify. However, the SDC sample over-represents the true rate because a small fraction of the reported observations appear to be driven by acquisitions and do not represent new infusions of capital. For example, if a VC owns equity in a target firm and an acquirer purchases that target, then VenturXpert data sometimes suggest that the VC has made an investment in the acquirer. Through the hand-verification process, we eliminate such cases. In sum, the hand-verification process eliminates both some 'false investments' and some 'true investments'. To be conservative we rely on the 'verified sample' throughout the remainder of the paper. Main findings are qualitatively similar across both samples.

Panel B of Figure 1 depicts the rates of post-IPO VC financing using this verified sample. The solid line shows the fraction of IPO firms each year that obtain post-IPO financing within the first five years after the IPO, and the dashed line shows the fraction that obtain post-IPO financing from a venture capitalist that also funded the company prior to the IPO. Between 6 and 20% of all VC-backed IPO firms each year receive additional VC funding after the IPO. We observe some evidence of a time-series pattern, with companies that went public prior to market downturns being more likely to receive post-IPO financing from a VC. For example, 20% of venture-backed firms that went public in 2000 received further funding from a venture capitalist within the first five years after the IPO, compared to just 6% of venture-backed firms that went public in 2002. This is consistent with the companies that went public in 2000 finding it particularly difficult to raise external financing during the years following the crash of the internet bubble and therefore turning to VCs for funding.

The first three rows of Table 1 summarize the rate of post-IPO investments among the verified sample, which represents the sample on which we focus throughout the remainder of the paper. We identify 270 firms that have post-IPO VC financing between 8 days and 5 years post-IPO, which represents 15% of all VC-funded IPOs. Of the 270 firms with post-IPO VC financing, 160 (59%) receive funding from a venture capitalist that also funded the firm prior to the IPO.[8]

2.2 Venture capital backing prior to IPO: startup firms

As described previously, our sample represents IPOs in which there was at least one pre-IPO venture capital financing round, as listed on the VenturXpert Database of Thomson

[8] We are able to identify the VC fund that participated in each round in approximately 72% of the cases with both pre-IPO and post-IPO funding. Among this subset, we find that the same fund that provided financing prior to the IPO also provided financing after the IPO in 58% of the cases.

Financial SDC Platinum. While we explicitly exclude any reverse-LBOs, it is still the case that some of the remaining cases represent substantially older firms, rather than the start-ups that represent the traditional focus of venture-capitalists

In many cases, it is difficult to definitively identify those companies fitting a traditional venture-backed classification of startup-type firms. The line between venture capital and private equity is in some cases blurred, with some firms participating in both venture capital and private equity financing (e.g., Warburg Pincus). Such issues notwithstanding, the SDC venture capital backed flag appears to capture important variation. Of the 1,761 IPOs over the 1995 – 2010 period, the SDC New Issues Database labels the company as being venture capital backed (i.e., the venture capital backed flag equals 'yes') in eighty percent of cases. In contrast, in the 20% of cases for which SDC lists a pre-IPO venture capital round but does not label the company as VC backed, it is more likely that the company receiving funding has characteristics of private equity. Consistent with this approach capturing meaningful differences in company type, companies for which the venture capital backed flag equals 'yes' tend to be younger and smaller.

As shown in the middle and bottom of Table 1, the rate of post-IPO investments by pre-IPO type investors is higher among firms that SDC specifically labels as VC-backed and which we label as Startup Firms: 16.7%, versus 10.7% among companies whose pre-IPO financing is potentially a mix of venture capital investors and private equity. This difference is consistent with our main conjecture that the benefits of post-IPO financing by pre-IPO type investors are highest among firms with the highest information asymmetry, i.e., among start-up type firms. For conciseness, because of the increasing ambiguity between VC and PE, and because we include many other proxies for the extent of information asymmetry that are arguably more precisely defined, we include all 1,761 IPOs in our final sample. We also include a control for

Startup Firm in empirical tests, to differentiate them from firms whose pre-IPO financing is potentially more characteristic of private equity. As discussed later this proxy is consistently insignificant – a fact that further mitigates any concerns related to our sample composition.

2.3 Descriptive statistics on final sample

In sum, our final sample consists of the 1,761 IPOs over the 1995 – 2010 period for which SDC lists one or more venture capitalists as providing funding prior to the IPO. We refer to all 1,761 of our sample companies as VC-backed and to these investors as venture capitalists. We categorize a company as receiving VC financing after the IPO only if both: SDC reports an instance of such financing, and we can verify the existence of such a financing through SEC filings.

Figure 2 provides evidence on the typical time between the IPO and the first post-IPO VC financing. Approximately 4% of venture-backed firms receive venture financing within the first year after the IPO, an additional 5% within the second year for a cumulative percentage of 9%, and an additional 3% during the third year for a cumulative percentage of 12%. The percent of firms receiving post-IPO VC financing each year continues to decline as the number of years since the IPO lengthens, and it reaches a total of slightly above 15% by year five.

We obtain the year of founding from Jay Ritter's website and use this to calculate firm age.[9] For the 270 firms with post-IPO VC financing, we collect data as of the last fiscal year end prior to the financing. Specifically, we collect ownership and Board seats held by any venture capitalist, in each case differentiating between VCs that provided post-IPO VC funding versus those that did not. These data come from proxy statements filed following the IPO but

[9] We thank Jay Ritter for making these data publicly available: https://site.warrington.ufl.edu/ritter/files/2015/08/FoundingDates.pdf . See Field and Karpoff (2002) and Loughran and Ritter (2004) for further details.

prior to the post-IPO financing event. In total, we are able to obtain information on the ownership and directorships of VCs in the year prior to the post-IPO VC financing for 240 firms.[10]

Additional details and examples of post-IPO investments by VC firms are provided in Appendices I and II. Appendix I lists the frequency, by VC, of pre-IPO versus post-IPO investments. For example, Kleiner Perkins was involved in 94 deals over our 1995 – 2010 sample period; in 3.2% of these cases it invested both prior to the IPO and within the five years after the IPO. In comparison, New Enterprise Associates was involved in a similar number of deals (89), but was much more likely to invest after the IPO: in 11.2% of cases it invested both prior to and following the IPO.

Appendix II lists all the IPO firms in which New Enterprise Associates made a post-IPO investment within five years of the IPO as well as the SEC form on which this funding can be found. For completeness, we include all funding deals as listed on SDC over the 1995 – 2010 period. As shown in Appendix II, for all but four deals we are able to confirm the funding on an SEC form.[11] Thus, these four deals are omitted from our 'verified sample'.

Panel A of Table 2 provides descriptive statistics on firm-years with versus without post-IPO VC financing.[12] Firms are included for up to the lesser of five years or the first year in which they receive post-IPO VC financing. (We report at this observational level to make descriptive statistics consistent with subsequent regressions.) The sample in column 1, which includes firms that received a post-IPO VC round, consists of 665 firm-years. Column 2, which

[10] Many of the firms for which we cannot find proxies obtained financing within the first year after the IPO, meaning there is unlikely to be a proxy statement prior to the post-IPO VC funding. In these cases, we employ data from the IPO prospectus.
[11] Across the four cases in which we do not find an SEC form, we do observe an increase in shares outstanding around this time. In many cases the increase in shares outstanding times the share price at that time is approximately equal to the round amount.
[12] Variable descriptions are available in Appendix III.

shows statistics for firms without post-IPO VC rounds, consists of 6,306 firm-years. Results suggest that post-IPO VC financing is more likely for firms that are characterized by high information asymmetry and high growth. For example, firm-years with a post-IPO VC round are smaller, with an average $128 million in sales, compared to $304 million for all other firm-years. Firms with post-IPO VC financing also have weaker operating performance. For example, they have mean ROA of –55%, compared to -23% for other firm-years. Seventy-eight percent of firm-years with a post-IPO VC round have negative cash flow from operations (CFO), compared to 47% of other firm years. Looking at proxies for growth opportunities, R&D/assets, CapEx/assets, and Tobin's Q, are all significantly higher in firm-years with post-IPO VC financing. To the extent that growth opportunities tend to decrease over the life-cycle, the finding that firm-years with post-IPO financing represent younger firms is also consistent with growth opportunities being related to post-IPO VC funding, where firm age is defined as the number of years since incorporation.

We also compare 'Time to IPO', which is measured as the number of years from the first VC investment to IPO. It is possible that some firms go public especially early, for example, because market conditions are particularly favorable. In this case, the company may not be sufficiently developed to raise necessary external capital post-IPO to fund growth opportunities. The finding that 'time to IPO' is sufficiently lower for firms that ultimately raise post-IPO VC financing is consistent with this conjecture. However, the economic magnitude of the difference is just six months, casting doubt on this being the primary factor. Companies that raise post-IPO capital from VCs go public 4.2 years after their first VC investment, compared to 4.8 years for other companies. We later control for time to IPO in our empirical estimations.

Consistent with some of the above differences in terms of firm size and age, companies receiving this type of post-IPO financing are significantly more likely to be startup-type companies, i.e., significantly less likely to be companies whose pre-IPO investments are more characteristic of private equity. Finally, we find that firm-years with post-IPO VC rounds represent firms that are substantially more likely to have been backed by a top-10 VC prior to the IPO: 33% of these firms were backed by a top-10 VC, compared to only 24% of other firms.

Panel B of Table 2 provides descriptive statistics on VC round amounts. We have data on round amounts for 89% of our sample, and thus Panel B of Table 2 focuses on this subsample. We focus on the rounds closest to the IPO, i.e., the last round prior to the IPO and the first round after the IPO. We find that average round amounts are similar before and after to the IPO: an average of $44.3 million pre-IPO, versus $45.5 million post-IPO. Looking in more detail at the size of the pre-IPO rounds, we find that the average round prior to the IPO is similar between firms that did versus did not receive post-IPO financing: $42.5 million versus $44.6 million. Among firms that obtain post-IPO VC financing, post-IPO round amounts are slightly smaller in cases where the post-IPO funding was provided by at least one VC that also funded the company prior to the IPO: $42.4 million versus $50.3 million. However, none of these differences are significant at conventional levels.

Finally, Panel C provides evidence on venture capitalists' involvement with the company, among the subset of companies that obtained post-IPO VC funding. Looking first at the top portion of the table, we see that the venture capitalists that provide post-IPO funding sit on the company's Board prior to this funding in 48.3% of companies, with an average of 1.66 directors on the Board. Somewhat surprisingly, another VC, i.e., a VC other than that which provided the post-IPO funding, sits on the Board in 68.8% of companies, with an average 2.24 directors on the

Board related to another VC. In the vast majority of cases, 89.2%, at least one VC sits on the Board at the time of post-IPO funding. This statistic is notable, given that these funding rounds occur up to five years after the IPO. This finding is consistent with Field, Lowry, and Mkrtchyan (2013) who argue that VCs' experience is useful for directors in newly public firms.

The middle portion of Panel C focuses on equity ownership, where statistics are based on ownership positions reported in proxy statements, which includes ownership by registered insiders and ownership positions greater than 5%. We find that in 45% of the companies, the venture capitalists that provide post-IPO funding own significant equity stakes prior to this funding, and average ownership among these VCs is 26%. In contrast, other VCs only own reported stakes in 25% of companies, and average ownership is a much smaller 15.4%. In total, at least one VC owns a significant equity stake prior to the post-IPO funding in 58% of companies. Finally, the last portion of the table highlights the extent to which Board membership and share ownership overlap. In 40% of the companies, the VC that provides the post-IPO funding both has a seat on the Board and owns shares. In these cases, this VC has an average 1.7 directors on the Board and average ownership equals 26%. On the flip side, in 47% the VC has neither a Board seat nor an ownership position greater than 5%. We later examine the extent to which post-IPO VC financings are concentrated in cases where the VCs have the largest informational advantages, and if the benefits to firms are larger in these cases.

3. Factors that influence post-IPO venture investments

3.1 Determinants of Post-IPO VC financing

This section examines whether the univariate evidence regarding venture capitalists' post-IPO investments holds up in a multivariate framework that controls for firm characteristics

and allows for time trends. Table 3 presents multiple regression models of the determinants of post-IPO VC investments. Much of the evidence is consistent with that gleaned from the univariate analyses in Table 2. In columns one and two, the dependent variable equals one if any VC invests over the five years subsequent to the IPO, while in columns three and four the dependent variable equals one if a pre-IPO VC (or multiple pre-IPO VCs) invests subsequent to the IPO. Column one uses the broadest subset of verified data: all venture-backed IPOs from 1995 to 2010.[13] In column two we limit the sample to those cases for which we have data on VC directorships and VC ownership at the time of the IPO.[14] Consistent with the dependent variable being an indicator variable, column one represents a logistic regressions. However, column two includes an interaction term, and thus we employ a linear probability model.[15] Columns three and four have a format similar to that of columns one and two. All regressions include year fixed effects and standard errors clustered by firm.

We find that the characteristics of the pre-IPO VC, the operating characteristics of the firm, firm age, and the firm's financing structure all have significant loadings, and there is some evidence that the firm's growth opportunities are also relevant. Regarding VC characteristics, firms that had a top ten ranked pre-IPO VC, firms that received more pre-IPO VC funding, and firms whose pre-IPO VC had greater ownership at the time of the IPO are all significantly more likely to receive post-IPO financing. The finding that firms receiving post-IPO VC financing were more likely backed by a highly ranked VC prior to the IPO suggests that they may be firms

[13] The sample sizes in column 3 is slightly lower than that in column 1. This is due to the fact that these are logit regressions with year fixed effects. There are some years in which there were no post-IPO VC rounds with the same VC, and these observations are dropped from the column 3 sample.
[14] Because prospectuses were filed online starting in May 1996, we are unable to collect pre-IPO data for firms that went public prior to this. We are also missing data on firms for which we cannot locate prospectuses.
[15] As described by Ali and Norton (2003) and Greene (2010), the use of interaction terms in nonlinear regressions is problematic, potentially resulting in biased estimates of the interaction coefficient and its standard error.

with better long-term prospects (see, e.g., Sorenson (2007), Nahata (2008), Krishnan et al (2011)).

Regarding operating characteristics, firms with negative cash flows from operations and (in some specifications) firms with lower sales are significantly more likely to receive post-IPO VC financing. We find some evidence that growth opportunities, as measured by R&D/assets, are positively related to the incidence of post-IPO VC financing, but this effect is not consistent across all specifications. Time to IPO (measured as number of years between first VC round and IPO date) is significantly negative in four of the four specifications but has low economic magnitude, providing only weak evidence consistent with the conjecture that firms that go public earlier in their life cycle are more likely to receive VC financing after the IPO. Finally, we also find some evidence of a negative relation with years since IPO, which is similarly consistent with a life-cycle effect. Together, these findings suggest that the firms most likely to receive post-IPO VC financing are firms with strong potential, who are at an earlier stage of their lifecycle and are not generating positive cash flows. Controlling for these effects, we find no evidence that the subsample of firms most characteristic of startup firms has a significantly different probability of obtaining funding from such sources post-IPO. This is consistent with both the above variables capturing important differences between these firm types and with the ambiguity in what classifies as startup funding versus later stage funding.

Consistent with our predictions, our findings indicate that firms with high demands for capital and that are sensitive to Myers and Majluf-type information asymmetry problems are significantly more likely to obtain post-IPO financing from a VC. In addition, the positive significance of the presence of a syndicated loan indicates that, on average, these firms are obtaining some capital in the form of debt. Among the firms with syndicated loans, those with

low cash flows from operations are particularly likely to obtain post-IPO financing from a VC, potentially because their low cash flows prevent them from taking on more leverage.

Columns three and four indicate that the determinants of post-IPO financing from the VC that provided VC pre-IPO funding, as opposed to any VC as in columns one and two, are largely similar. Overall, our results suggest that VCs are more likely to finance young, small firms with significant growth potential but lack of easy access to capital. In sum, VCs serve as a valuable financing channel for firms in the crucial early stage of public life.

3.2 Alternative sources of financing

While in a Modigliani and Miller (1958) setting firms are indifferent between alternative forms of financing, it is commonly recognized that violations of the assumptions underlying the theory cause deviations from this indifference. Our results in the prior subsection showing that firms with high information asymmetry are more likely to rely on VCs for post-IPO financing are consistent with such deviations; such firms are particularly far from satisfying the assumption of 'perfect information' across managers and market participants, and therefore the net benefits of raising financing from a concentrated group of shareholders who have an information advantage are higher. We expand on these ideas in this section, by contrasting firms' choices of post-IPO financing across multiple sources.

Figure 3 shows the extent to which our sample firms (i.e., VC-backed IPO firms) rely on multiple forms of financing over the five years following the IPO: syndicated loans, seasoned equity offerings (SEOs), venture capital, and PIPEs, where PIPEs represent private investments

in public equity, and as discussed by Dai (2007) and Brophy, Ouimet, and Sialm (2009), hedge funds represent frequent investors in PIPEs.[16]

Looking first at Panel A, approximately 40% of VC-backed IPO firms have either a syndicated loan or an SEO, approximately 15% receive additional VC financing after the IPO, and about 10% raise equity through a PIPE, within the first five years after the IPO. While the IPO is widely perceived as a critical event in the lifecycle of the firm, this figure suggests that a firm's ability to successfully raise capital in the following several years is critical.

Panel B shows that among the subsample firms that receive post-IPO VC financing, 40 to 45% of firms rely on SEOs and/or syndicated loans and 30% raise capital through PIPEs, in addition to the VC funded private rounds. This is consistent with the previous finding that firms raising post-IPO capital through venture capitalists represent high growth firms, suggesting that they will have high demands for capital. It is unlikely that a VC will find it feasible to supply the total capital that these firms demand. Panel C highlights this point, by showing proceeds raised through each form of financing relative to IPO proceeds, among firms with post-IPO VC financing. Over the five years after the IPO, capital from the VC represents 80% of what the firm obtained in IPO proceeds. For this subsample of firms, money raised through SEOs represents a similar magnitude, 90% of proceeds, while money raised through syndicated loans represents a much greater 180% of IPO proceeds. In sum, results suggest that the post-IPO VC financing is an important source of financing for this subset of firms, but that these firms' capital demands are sufficiently large that they rely on other forms of financing as well.

Table 4 examines the ways in which firms' choices regarding post-IPO financing relate to underlying firm characteristics. Each column shows a linear probability model estimation, where

[16] By our definition, PIPEs and post-IPO VC financing are defined as mutually exclusive. In other words, a PIPE in which we can verify that a VC is involved is not included in our PIPE sample.

the dependent variable equals one if the firm obtained the designated form of financing within the year, and zero otherwise.[17] Firms are included in the regression until they obtain the designated form of financing, or if they do not obtain this type of financing until the earlier of delisting or five years after the IPO. Column one focuses on whether a firm obtained VC financing in one of the five years after the IPO, column two on PIPEs, column three on SEOs, and column four on syndicated loans. Findings indicate that lower growth, larger firms with higher profitability and more tangible assets are significantly more likely to have bank financing (column 4). In contrast, firms with smaller sales, negative cash flows from operations, and higher growth are more likely to raise capital through PIPEs (column 2). Finally, firms with higher cash flows from operations but also high growth are more likely to have SEOs (column 3).

It is noteworthy that time to IPO (defined as the number of years between first VC financing and IPO date) is negative across all specifications, and significant in two of the four (post-IPO VC and PIPE). Firms that go public earlier tend to have higher demands for capital in the years following the IPO, and they raise multiple forms of capital to fulfill these demands. One less year in private status increases the probability of raising post-IPO financing through a VC, PIPE, and SEO by 0.11%, 0.08%, and 0.22%, respectively. In aggregate, these results do not support the conjecture that post-IPO VC funding is primarily driven by some firms going public particularly early and the VC consequently substituting the pre-IPO funding to after the IPO.

Evidence from this subsection highlights several findings. First, firms' choices regarding sources of financing after the IPO are consistent with implications of Myers and Majluf. For

[17] We estimate OLS regressions rather than logistic regression to allow the inclusion of the interaction term between syndicated loan and CFO.

example, while newly public firms are generally characterized by high information asymmetry, those that are most sensitive to these issues rely on an intermediary to whom they are best able to credibly convey their value. In contrast, recent IPO firms that are larger and/or have more positive cash flows from operations are better able to issue an SEO or obtain more financing through syndicated loans. Second, newly public firms are characterized by high growth and the IPO is only one stage in a series of financing events. Over the first several years after the IPO, most firms rely on multiple sources of financing to satisfy their capital demands. Third, the VC provides a meaningful amount of the total capital demanded by these firms, but these firms rely on other sources of financing as well.

3.3 Venture capitalist type

To the extent that the post-IPO VC has a unique ability to overcome information asymmetries, it follows that the characteristics of the post-IPO VC are important. The financing decision is inherently a matching problem: the characteristics of the firm demanding the financing must be matched with the VC that can best overcome the frictions that impede the firm's access to capital. Table 5 examines in more detail the types of venture capitalists that are most likely to provide post-IPO financing to each firm. We base our predictions on factors likely related to a VCs' information advantage and a VC's reputation concerns.

First, we conjecture that the information advantage of a VC is greater in some firms than others. In particular, a VC that either invested in the firm prior to the IPO or has more experience in the firm's industry should have a greater information advantage, and thus be more likely to make a post-IPO investment. To further identify the relative information advantage of a VC, we compare across the multiple VCs that invested in a firm prior to the IPO. We predict

that a VC who made its last pre-IPO investment closer to the IPO, who was involved in more pre-IPO rounds, and who invested more dollars pre-IPO would be more involved in the firm and thus have a greater information advantage.

Second, we conjecture that VCs differ in the extent of reputation concerns. Ex-ante the effects of reputation, which we proxy for using VC rank, on the tendency of a VC to invest in a firm are not clear. Higher ranked VCs may have more experience and be better able to determine when a post-IPO investment will be most valuable. Moreover, they may be motivated to protect their strong reputation by providing post-IPO capital if this enhances their ability to exit the pre-IPO investment at the highest possible value. Alternatively, less highly ranked VCs may be more motivated to build their reputation, for example by supporting their pre-IPO investments after the IPO.

We test these effects through a series of logistic regressions in Table 5. Panel A examines the tendency of any venture capital firm to invest in a firm after its IPO, while Panel B focuses on the tendency of each of the pre-IPO VCs to provide financing after the IPO. Each column shows a logit regression, where the dependent variable equals one if a particular VC invests in a specific firm, zero otherwise. Looking first at Panel A, the sample in column one includes all 1,761 VC-backed firms in our sample, interacted with each of the VCs that has at least one round within the five years beginning on the firm's IPO date, yielding a total of about 1.9 million observations, corresponding to all the possible combinations of companies and VCs. The sample in column 2 is limited to the subset of firms that received at least one round of post-IPO VC financing, which reduces the sample to just under 300,000 observations. Results across both columns provide strong support for the conjecture that VCs with a stronger information advantage are significantly more likely to make a post-IPO investment. VCs that funded the firm

prior to the IPO and VCs with more industry experience are significantly more likely to provide post-IPO financing. In addition, we also find that more highly ranked VCs are significantly more likely to provide post-IPO financing.

Panel B provides further evidence on the extent to which the information advantage of a VC in a particular firm is related to the tendency to invest. In this panel, we restrict the set of VCs to the ones that participated in a round with the firm before the IPO. We find that VCs that made a pre-IPO investment closer to the IPO, that invested in a greater number of pre-IPO rounds, and that invested in a greater percent of pre-IPO rounds are significantly more likely to continue to invest in a company after the IPO.

In sum, while approximately 15% of VC-backed IPO firms receive VC financing within the first five years after the IPO, the VC that provides the financing is far from random. Rather, this financing is significantly more likely to be provided by a VC that has an especially strong information advantage with respect to this particular firm. This evidence supports the notion that VCs play the role of informed investors that can overcome the adverse selection problems highlighted by Akerlof and Myers-Majluf.

4. Market Performance around post-IPO VC investments

To the extent that the presence of informed investors that are willing to invest in the firm enables the firm to take positive NPV projects that it otherwise would not be able to do, announcements of these investments should be positive news. Absent any countervailing factors, we would expect firms to benefit from these infusions of capital, and thus we predict positive abnormal returns upon announcement. We test these ideas by examining both CARs in the days

immediately surrounding these investments and longer-run returns over the subsequent one, two, three, and five-year periods.

As discussed, even if VCs have an information advantage, frictions and conflicts of interest may limit the benefits of these investments to either the firm or to outside shareholders. First, VCs may be motivated by convex compensation schemes or career concerns, which cause VCs to pursue projects with a small probability of a large payoff. Second, even if the VC's investment goes toward positive NPV projects, a debt overhang problem may cause shareholders to not receive much of this value. These two scenarios are particularly likely in cases where the VC funded the firm prior to the IPO (and likely owns some debt-type instruments in addition to equity) and the investment is currently under water. Third, because VCs frequently invest at a discount to the current market price and in light of the high information asymmetry of newly public companies, the market may interpret the VC's investment as a signal that the firm was overvalued. Moreover, the VC's investment terms might reveal information about the extent of overvaluation. In this case, market returns may be negative even if the investment was good news for all parties. Finally, it is also possible that venture capitalists represent a financing source of last resort, i.e., a last available source of financing to distressed firms, similar to what Chaplinsky and Haushalter (2010) and Brophy et al (2009) find for PIPEs.

Tables 6, 7, and 8 examine these issues, by looking at abnormal returns in the period before the post-IPO VC investment, in the days surrounding the investment (or announcement thereof), and in the years following the investment, respectively.

4.1 Performance prior to a post-IPO VC investment

Looking first at Table 6, we seek to determine if post-IPO financing is concentrated among poorly performing firms, a finding that would increase the probability that VCs'

investments were influenced by factors such as convex compensation schemes or debt overhang problems. If companies have underperformed since the IPO, they may be at risk of bankruptcy or delisting for poor performance without additional capital infusions, in which case the VC risks losing its entire investment. The VC might thus rationally choose to invest money in the company, even if the investment represents a low probability of a high payoff, analogous to an out-of-the-money option.

Table 6 shows a series of calendar time portfolio regressions. The purpose of these regressions is to ascertain whether the firms receiving post-IPO financing underperformed prior to this financing. The left-hand side of the table focuses on firms that receive post-IPO VC financing and examines their returns in the 12, 36, and 60 months preceding the post-IPO round. Specifically, in column one we form a rolling portfolio where each of these firms enters the portfolio 13 months before the VC-round (or less if the firm has been public for less than 13 months) and exits the month prior to the post-IPO VC financing (a maximum of 12 months). Regressions at the 36-month and 60-month intervals are defined analogously. In each case, the constant (also commonly referred to as the alpha) is insignificant at conventional levels, providing no support for the conjecture that these investments are under water.

To further test the extent to which firms receiving post-IPO VC investments have potentially underperformed other similar firms, we construct a portfolio of matching firms. For each sample firm, the matched firm represents the firm with the closest global proceeds, among those firms that went public within one year. We choose the matched sample with replacement and we assign the sample firm VC-round date to the matched control firm.[18] Regressions based

[18] Due to the small sample of possible matches in some cases, our main results are based on a matching procedure that does not include an industry parameter. However, univariate comparisons show no significant differences in industry composition between the sample and matched firms.

on portfolios of these matched firms are shown in columns 4 – 6, where rolling portfolios are formed in a manner similar to columns 1 – 3. Finally, columns 7 - 9 represent portfolios that are long in the post-IPO financing firms and short in the matched firms. The alphas on all three long-short portfolios are insignificant at conventional levels, providing further evidence against the possibility that firms receiving post-IPO VC investment performed especially poorly prior to obtaining such financing.

In sum, we find no evidence that VCs are injecting capital into the more poorly performing IPOs. This casts doubt on the possibility that VCs' investments are motivated by an effort to recover the value of a previous investment that is underwater, cases in which there exists a small probability of a large payoff but a negative NPV overall.

4.2 Performance upon announcement of a post-IPO VC investment

Table 7 examines the firm abnormal returns in the days surrounding the post-IPO VC investment. One challenge with measuring abnormal returns pertains to the fact that we do not know the exact date on which the VC funding was announced. While the date reported in VenturXpert matches an 8K date in many cases, in other cases the announcement date is less clear. As a result, we place more weight on the longer window CARs, for example, day (-2, +5) or day (-2, +10), rather than the shorter (-1,+1) or (-2, +2) windows. However, general conclusions are consistent across all intervals. CARs are measured as the raw firm return over the designated window, minus the return on the matched size quartile over the same period.

The first row of Table 7 reports CARs for the complete sample of VC-backed IPOs over the 1995 – 2010 period, for which fundings potentially occur over the 1995 – 2014 period. Looking at the (-2, +2) event window, we see that abnormal announcement returns equal 5.37%. Thus, we find strong evidence that the market interprets these post-IPO VC financings very

positively. This positive valuation impact is likely a combination of the signaling effect and the increased financial flexibility, which increases companies' abilities to realize their growth opportunities. Figure 4 depicts these CARs graphically. The figure shows abnormal returns measured using three alternative algorithms: market-adjusted, size-adjusted, and industry-adjusted. Results are qualitatively similar across all three.

Unfortunately, it is difficult to evaluate the precise present value of these investments for the venture capitalists, as we lack information on the price the VC paid for the shares. However, in a small sample of cases where we have detailed data (specifically, cases where the VC filed an 8-K), we know that the VC frequently buys the shares at a discount to the public share price, a finding that is consistent with investors in PIPEs, as documented by Chaplinsky and Haushalter (2012).

The finding that VC investments are perceived by the market to be positive news is consistent with the conclusions of Dai among a sample of mature firms. Subsequent rows of Table 7 examine the sources of gain to newly public firms, which are unique along a variety of dimensions that affect the availability and costs of external capital. Specifically, we examine whether the magnitude of these abnormal returns is related to VCs' information advantage and/or to their incentives to enhance the value of prior investments. Specifically, we examine the relation between the abnormal returns and both VCs' board representation and VCs' prior ownership. In cases where the VC firm holds one or more seats on the Board, they have better information about the workings of the firm. In such cases, the VC firm is more likely to have the necessary information to evaluate the NPV of an investment in the firm, and thus less likely to invest if the NPV is not positive. In a similar vein, it is likely that VCs have superior information in cases where they have prior ownership, either because their ownership position

gives them increased access to management or because they have greater incentives to expend resources collecting information. The greater information should enable them to more precisely estimate the NPV of an investment and, given limits to capital, restrict their investments to the most positive NPV cases. On the other side, the greater ownership position might create incentives to enhance the value of prior investments, suggesting that they might be associated with lower announcement returns.

Results provide strong support for the conjecture that returns are positively related to VCs' information advantage.[19] Looking at rows 3 and 4, abnormal returns over all time windows are greater among the subset of cases in which the VC firm holds one or more board seats in the firm, prior to the post-IPO financing. Looking at the (-2, +10) window, CARs equal 14.10% among firms in which the VC has a director on the board, compared to 3.54% in other cases. Results are similar when we contrast cases where the VC does versus does not have prior ownership in the firm, or when we contrast the subsample with both board seats and ownership with the subsample that has neither. Across all comparisons, we find that cases in which the VC likely has superior information have greater abnormal returns. These relations between abnormal returns and VCs' information advantage provide additional evidence against the conjecture that VCs' investments are primarily driven by agency-type problems such as debt overhang or career concerns.

4.3 Performance after a post-IPO VC investment

[19] Our analysis is limited to the subsample of cases for which we have data on VCs' directorships and ownership. As noted previously, our information on ownership is restricted to that reported in proxy statements, meaning in most cases we will only capture ownership positions greater than 5%. We have these data for 238 out of the total 268 firms that received post-IPO VC financing over the 1996 – 2014 period. Most of the missing observations are cases in which the financing occurred in the earlier portion of the sample or when the financing occurred within one year of the IPO. Abnormal returns over this subsample of 238 firms are similar to those in the broader sample of 268 firms, as shown in Row 2 of Table 7.

Table 8 examines whether these positive abnormal returns around the announcement of the post-IPO VC investment are later reversed. Prior literature has shown that firms tend to experience negative abnormal returns following equity issuances. Loughran and Ritter (1995) find that abnormal returns are negative over the three to five years following SEOs, and Hertzel, Lemmon, Linck, and Rees (2007) document similar underperformance following PIPEs. If VCs are particularly well informed and able to successfully distinguish overvalued from undervalued high-quality firms, then we would not expect to observe such underperformance.

We form a rolling portfolio, consisting of all firms that received post-IPO VC financing within the past 12 months. Each calendar month we calculate net returns, equal to average returns across all firms in the portfolio minus the risk-free rate. We regress the portfolio returns on the three Fama-French factors and the Carhart momentum factor (see Fama and French (1993) and Carhart (1997)). The constant, commonly referred to as the portfolio alpha, represents a measure of abnormal performance. Analogous regressions are estimated for the 36 and 60-month intervals. As shown in the left-hand three columns of Table 8, we observe no evidence that these firms significantly underperform the market after receiving post-IPO VC financing. The alpha is insignificant in all specifications, and positive in two of the three.

These findings contrast with Hertzel et al's (2002) finding of significantly negative long-run abnormal returns following PIPEs. PIPEs are similar to many aspects of post-IPO VC investments, but have the notable difference that the primary investor tends to be a hedge fund; hedge funds arguably have less of a comparative advantage in evaluating recent IPO firms. The middle three columns of Table 8 evaluate the abnormal returns subsequent to PIPEs, within our sample of VC-backed IPO firms. In contrast to the mostly positive alphas in the post-IPO VC investment regressions, the alphas in the PIPE regressions are negative over all three time

intervals. To better compare these two forms of investment, in the right-hand three columns we form a portfolio that is long in companies that received post-IPO VC financing and short in companies that received funding through a PIPE, where both samples are restricted to newly public companies (defined as companies that went public within the past five years). The alpha of this long-short portfolio is significantly positive at all intervals. The significant differences in returns following post-IPO VC financing versus PIPEs are consistent with VCs representing a value enhancing source of capital for these newly public firms, specifically with VCs having a unique ability to distinguish the high-quality firms from the rest.[20]

In sum, the positive abnormal returns around the announcements, in conjunction with no evidence of long-term underperformance, suggests that these post-IPO VC investments benefit firms. This is consistent with VCs being able to identify cases where a capital infusion will enable a firm to pursue positive NPV projects, which it would otherwise not be able to do. We argue that VCs are unique in their ability to overcome the information asymmetry at a lower cost for the company. However, it is also possible that VCs are simply better able than other market participants at identifying positive NPV opportunities, and that the firm would have performed equally well without the VC's investment. The next section attempts to differentiate between these possibilities.

5. Do firms benefit from post-IPO VC financing?

If post-IPO VC financing truly helps firms, then firms with an above-average probability of receiving such financing (if the state of the world where they demand such financing is realized) should outperform those with a lower probability. To test this prediction, we take

[20] It is also noteworthy that the coefficients on the risk factors are all insignificant at conventional levels, indicating that the risk characteristics of the firms receiving post-IPO VC financing and those receiving PIPEs are similar.

advantage of the fact that venture capitalists vary widely in their propensity to fund companies after the IPO. As shown in Appendix I, New Enterprise Associates and Sprout Group both invest in over 10% of their deals both prior to and following the IPO. In contrast, Sequoia Capital and Bessemer Venture Partners have analogous rates of 2% or less. To avoid a look-ahead bias, for each IPO firm in our sample, we identify the VCs that provided financing prior to the IPO, and we calculate the number of post-IPO financings of these VCs in the period beginning 10 years prior to the IPO and ending one month prior to this firm's IPO. The total number of post-IPO rounds performed by the VCs that were involved with a particular firm before its IPO represents our "VC's post-IPO funding experience" measure. All companies with an above median measure are placed into the high likelihood post-IPO funding portfolio, and all other companies are placed in the low likelihood portfolio.

Table 9 shows calendar time portfolio regressions, similar to those reported in Table 8. Specifically, we estimate regressions based on: a portfolio with a long position in the high likelihood of post-IPO funding portfolio, a portfolio with a long position in the low likelihood of post-IPO funding portfolio, and a portfolio that is long the first sample and short the second. Portfolios are formed over three intervals, specifically over the 12, 36, and 60 months after the IPO.

Results provide strong evidence that post-IPO VC financing is beneficial to companies. Looking first at the left-hand three columns of Table 9, among companies backed by VCs with a high propensity to fund companies after the IPO, the alpha is positive in all three specifications and significant in two. In contrast, the middle-three columns highlight the lower performance of firms backed by VCs with a lower tendency to provide post-IPO funding. Among these firms, the alphas are negative or close to zero, and none are significant. Finally, as shown in the right-

hand three columns, the long-short portfolio is significantly positive at all intervals. In economic terms, the benefits of being funded by a VC with a higher propensity to support companies after the IPO equal 1% per month over the first twelve months after the IPO. The magnitude of these benefits wanes over time to 0.5% per month, as VCs' information advantage decreases and the likelihood of VC funding diminishes (as shown in Figure 2).

In a similar vein, Table 10 examines whether companies backed by high post-IPO funding VCs are less likely to delist, and in particular whether they are less likely to delist for poor performance. We estimate logistic models, where the dependent variable is a dummy equal to one if the firm delists (column 1), one if the firm is acquired (column 2), or one if the firm delists for poor performance (column 3), zero otherwise. The independent variable of interest, 'Post-IPO funding experience', measures the total number of post-IPO rounds by the VCs that funded the firm before its IPO. Consistent with expectations, we find that firms are significantly less likely to delist if they are backed by VCs with a higher propensity to fund companies after the IPO. A one standard deviation increase in the post-IPO funding experience measure is associated with a 4.5% reduction in the likelihood of delisting. Moreover, this effect is driven by a lower likelihood of delisting for poor performance, rather than a decreased likelihood of being acquired.

Krishnan et al (2011) show that companies backed by higher quality VCs tend to outperform those backed by lower quality IPOs. Moreover, Megginson and Weiss (1991) conclude that companies backed by lower ranked venture capitalists (who have less reputation capital) suffer from more severe information asymmetry at the time of the IPO. Such differences are likely to persist after the IPO. For these two reasons, we conduct our analysis separately for firms backed by Top 10 ranked VCs and for firms backed by all other VCs. We find that (results

not tabulated) the effect in Table 10 is concentrated within the sample of firms backed by lower ranked VCs, i.e., within firms that are subject to higher information asymmetry and that arguably suffer from more severe Myers and Majluf type problems in raising capital.

6. Conclusion

Our results suggest that VCs' post-IPO investments are motivated by companies having positive NPV growth opportunities but suffering from a combination of high information asymmetry and cash shortfalls. In such a situation, an informed investor such as a venture capitalist can better differentiate between high and low-quality companies. In particular, VCs that have the largest informational advantage, such as extensive prior experience with the firm and/or industry specialization, are most likely to provide post-IPO financing.

The option of a newly public firm to raise funding from its venture capitalist has positive value. We first observe this positive value through an analysis of the subset of firms that exercise the option to raise capital from VCs: we find significantly positive abnormal returns around the announcements of these financings. Second, we also observe this positive value more broadly among firms that have the ability to raise capital through such venues but who may or may not ultimately exercise this option. Specifically, we find that firms backed by venture capitalists that are more likely to continue to invest post-IPO outperform other firms, and they are less likely to delist for poor performance. Ultimately, we document that venture capitalists serve as in important financial intermediary in the crucial early years after a firm's IPO.

References

Ai, C., and E. Norton, 2003. “Interaction Terms in Logit and Probit Models”. *Economics Letters* 80, 123–129.

Bharath, S., Dahiya, S., Saunders, A., and A. Srinivasan, 2010. "Lending Relationships and Loan Contract Terms". *Review of Financial Studies* 24, 1141-1203

Brophy, D., P., Ouimet, and C. Sialm., 2009. “Hedge Funds as Investors of Last Resort?” *Review of Financial Studies* 22, 541-574.

Carhart, M. M. (1997). "On Persistence in Mutual Fund Performance". The Journal of Finance 52, 57–82.

Celikyurt, U., Sevilir, M., and Shivdasani, A., 2012.”Venture Capitalists in Mature Public Firms”. Koc University working paper

Chaplinsky, Susan and David Haushalter. 2010. “Financing under Extreme Risk: Contract Terms and Returns to Private Investments in Public Equity”. *Review of Financial Studies* 23, 2789-2820.

Chaplinsky, Susan and David Haushalter. 2012. Vipe financing: venture (capital) investments in public equity. \

Dai, Na. 2007. “Does Investor Identity Matter? An Empirical Examination of Investment by Venture Capital funds and Hedge Funds in PIPEs”. *Journal of Corporate Finance* 13, 538-563.

Diamond, D., 1984, “Financial Intermediation and Delegated Monitoring”, Review of Economic Studies 62, 393-414.

Fama, E., 1985. “What’s Different About Banks?” *Journal of Monetary Economics* 15, 29-39.

Fama, E., and K. French, 1993. “Common Risk Factors in the Returns on Stocks and Bonds”. *Journal of Financial Economics* 33, 3–56.

Farre-Mensa, J., and A. Ljungqvist, 2016, “Do Measures of Financial Constraints Measure Financial Constraints?” *Review of Financial Studies* 29, 271-308.

Field, L., Karpoff, J., 2002. “Takeover defenses of IPO firms”. *Journal of Finance* 57, 1857–1890.

Field, L., Lowry, M., and A. Mkrtchyan, 2013. “Are Busy Directors Detrimental”. *Journal of Financial Economics* 109, 63-82.

Gompers, P., Lerner, J., 1996. “The use of covenants: an empirical analysis of venture partnership agreements”. *Journal of Law and Economics* 39, 463-498.

Greene, W., 2010. “Testing Hypotheses about Interaction Terms in Nonlinear Models”. *Economic Letters* 107, 291–296.

Hadlock, C., and C. James, 2002, “Do Banks Provide Financial Slack?”, *Journal of Finance* 57, 1383–1419.

Hadlock, C., and J. Pierce, 2010, “New Evidence on Measuring Financial Constraints: Moving Beyond the KZ Index”, *Review of Financial Studies* 23, 1909–1940.

Hertzel, M, Lemmon, M., Linck, J., and L. Rees, 2002. “Long-Run Performance Following Private Placements of Equity”. *Journal of Finance* 57, 2595–2617.

Hertzel, M., and R. Smith, 1993, “Market Discounts and Shareholder Gains from Placing Equity Privately”, *Journal of Finance* 48, 459–485.

Kaplan, S., and L. Zingales, 1997, “Investment-Cash Flow Sensitivities Provide Useful Measures of Financing Constraints?” *Quarterly Journal of Economics* 112, 169 –215.

Krishnan, C., Ivanov, V., Masulis, R., Singh, A., 2011. Venture capital reputation, post-IPO performance, and corporate governance. *Journal of Financial and Quantitative Analysis* 46, 1295 – 1333.

Lerner, J., 1995. “Venture capitalists and the oversight of private firms”. *Journal of Finance* 50, 301-318.

Loughran, T., Ritter, J., 2004. “Why has IPO underpricing changed over time?” *Financial Management* 33, 5–37.

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

Metrick, A., Yasuda, A., 2011. “Venture Capital and the Finance of Innovation”. John Wiley & Sons, Inc., Second edition.

Modigliani, F. and M. Miller, 1958. "The Cost of Capital, Corporation Finance and the Theory of Investment". *American Economic Review* 48, 261–297.

Myers, S., and N. Majluf, 1984. "Corporate financing and investment decisions when firms have information that investors do not have". *Journal of Financial Economics* 13, 187–221.

Nahata, R., 2008. Venture capital reputation and investment performance. Journal of Financial Economics 90, 127 - 151.

Ramakrishnan, R., and A. Thakor, 1984, “Information Reliability and a Theory of Financial Intermediation”. *Review of Economic Studies* 51, 415-432.

Sahlman, W. 1990, “The Structure and Governance of Venture Capital Organizations”. *Journal of Financial Economics* 27, 473–521.

Sørensen, M. (2007). How Smart Is Smart Money? A Two-Sided Matching Model of Venture Capital. *The Journal of Finance*, 62(6), 2725-2762.

Stiglitz, J., Weiss, A., 1981. Credit rationing in markets with imperfect information. American Economic Review 71, 393 – 410.

Whited, T., and G. Wu, 2006, “Financial Constraints Risk”, *Review of Financial Studies* 19, 531–559.

Appendix I

This table shows the names of the 30 most active venture capitalist firms, over the 1995 – 2010 period. Column 2 shows the number of IPO firms to which each VC provided funding. Column 3 shows the percent of these IPO firms that the VC funded prior to the IPO only. Column 4 shows the percent of these IPO firms that the VC funded both prior to the IPO and subsequent to the IPO, and column 5 shows the percent of IPO firms that the VC funded only subsequent to the IPO (where subsequent is defined as funding over the day 8 – year 5 period).

VC firm name	Number of deals by VC firm	% deals with VC involved only pre	% deals with VC involved pre and post IPO	% deals with VC involved only post IPO
Accel Partners & Co Inc	57	93	5.3	1.8
Advent International Corporation	48	95.8	4.2	0
Alta Partners	45	62.2	15.6	22.2
Apax Partners LLP	40	87.5	5	7.5
aPriori Capital Partners	54	85.2	3.7	11.1
Bessemer Venture Partners, L.P.	51	94.1	2	3.9
Domain Associates LLC	38	71.1	18.4	10.5
Goldman Sachs & Co	65	90.8	3.1	6.2
Greylock Partners	45	97.8	2.2	0
HarbourVest Partners LLC	39	100	0	0
Institutional Venture Partners	50	90	2	8
Integral Capital Partners	53	94.3	0	5.7
Intel Capital Corporation	55	94.5	5.5	0
Kleiner Perkins Caufield & Byers LLC	94	96.8	3.2	0
Mayfield Fund	55	98.2	1.8	0
Morgan Stanley Private Equity	39	94.9	5.1	0
New Enterprise Associates, Inc.	89	82	11.2	6.7
Norwest Venture Partners	50	96	0	4
Oak Investment Partners	68	86.8	8.8	4.4
Pliant Corp	185	93.5	2.2	4.3
Sequoia Capital	70	97.1	1.4	1.4
Sprout Group	59	81.4	11.9	6.8
Summit Partners LP	55	100	0	0
Sutter Hill Ventures	38	92.1	5.3	2.6
TA Associates Management, L.P.	50	98	0	2
Technology Crossover Ventures LP	41	85.4	4.9	9.8
U.S. Venture Partners	39	87.2	12.8	0
Venrock, Inc.	56	87.5	8.9	3.6
Warburg Pincus LLC	54	64.8	22.2	13
Windspeed Ventures	46	100	0	0

Appendix II: Examples of post-IPO investments by New Enterprise Associates, 1996 – 2012

This table lists the 30 cases in which VenturXpert lists New Enterprise Associates as investing in a newly public firm, defined as a firm that went public within the prior five years. Issuer name, IPO date, post-IPO VC funding date, and round amount are from VenturXpert. For each firm, we search through S-1, S-3, 8-k, 13G, and Form 4 filings for verification of the investment. The forms we use to verify the investment, as well as applicable notes, are shown in the last two columns.

Issuer	IPO Date	Post-IPO VC Funding Date	Round Amount	SEC Form	SEC Form Date	Notes
Summit Medical Systems Inc	8/4/1995	10/1/1996	2,256	13G	2/14/1997	New Enterprise invests
Clarify Inc	11/3/1995	4/25/1997	4,351			No SEC Filing*
GelTex Pharmaceuticals Inc	11/8/1995	7/1/1998	16,600			No SEC Filing*
Connective Therapeutics Inc	1/31/1996	11/19/1998	11,995	13G	2/16/1999	New Enterprise invests
Object Design Inc	7/23/1996	12/31/1998	648	13G	2/12/1999	New Enterprise invests
Object Design Inc	7/23/1996	1/1/1999	2,014	13G	2/12/1999	New Enterprise invests
CyberMedia Inc	10/23/1996	1/1/1997	1,350	13G	2/19/1997	New Enterprise invests
Applied Imaging Corp	11/7/1996	6/2/1998	10,000	8-k	6/16/1998	New Enterprise invests
Applied Imaging Corp	11/7/1996	5/22/1997	4,000	8-k	6/4/1997	New Enterprise invests
Carrier Access Corp	7/30/1998	9/30/1998	3,688			No SEC Filing*
Juniper Networks Inc	6/24/1999	9/17/2001	22,000			No SEC Filing*
TiVo Inc♣	9/29/1999	10/7/2002	25,000	8-k	10/9/2002	New Enterprise invests
Accelerated Networks Inc	6/22/2000	12/19/2002	11,000	8-k	12/20/2002	New Enterprise invests
Accelerated Networks Inc	6/22/2000	3/29/2005		8-k	3/24/2005	New Enterprise invests
Myogen Inc♣	10/29/2003	10/13/2004	60,000	8-k	9/29/2004	New Enterprise invests
Inhibitex Inc♣	6/3/2004	8/29/2005	41,250	8-k	10/28/2009	New Enterprise invests
HemoSense Inc♣	6/28/2005	12/12/2006	7,000	8-k	12/14/2006	New Enterprise invests
Sunesis Pharmaceuticals Inc♣	9/27/2005	10/30/2009	5,000	8-k	11/2/2009	New Enterprise invests
Sunesis Pharmaceuticals Inc♣	9/27/2005	4/3/2009	10,000	8-k	4/3/2009	New Enterprise invests
Iomai Corp♣	2/1/2006	10/25/2006	10,000	8-k	10/24/2006	New Enterprise invests
Cadence Pharmaceuticals Inc♣	10/24/2006	2/18/2009	86,600	8-k	2/20/2009	New Enterprise invests
Glu Mobile Inc♣	3/21/2007	7/8/2010	23,616	8-k	7/6/2010	New Enterprise invests
ARYx Therapeutics Inc♣	11/8/2007	11/24/2008	21,600	8-k	11/12/2008	New Enterprise invests
Alimera Sciences Inc♣	4/22/2010	10/2/2012	40,000	8-k	10/2/2012	New Enterprise invests.

* Shares outstanding increases around the time of the documented post-IPO VC Funding date, and in many cases the increase in shares outstanding times the share price at that time is approximately equal to the round amount.

♣ For these funding rounds we also traced the data to S-3 and S-1 filings which are registration statements typically filed a few months after a private placement and allow the buyers to sell their shares on the secondary market. These filings usually name New Enterprise Associates as one of the "selling stockholders".

Appendix III: Variable Descriptions

VC Characteristics: these variables are from VenturXpert

Total VC ownership at IPO – the number of shares owned by all VCs at the time of the IPO, divided by shares outstanding after the IPO

% VC directors at IPO – the number of Board seats held by any VC, divided by the number of directors

Pre-IPO VC Funding – millions of dollars obtained in the last VC round prior to the IPO (in 2014 $)

Top-10 pre-IPO VC – a dummy equal to one if the firm was backed by one of the top-10 venture capitalists prior to the IPO, which we define following Nahata (2008): JPMorgan Chase, Kleiner Perkins Caufield & Byers, New Enterprise Associates, Sequoia Capital, Integral Capital Partners, Oak Investment Partners, Accel Partners, Sprout Group, Goldman Sachs, and Alta Partners.

VC industry experience – the percent of rounds over the previous three years in which the VC participated that are in a particular Fama-French 48 industry group

VC Financed Firm pre-IPO – a dummy equal to one if the VC-financed the firm prior to the IPO

Years between first VC involvement and IPO – the number of years between the first pre-IPO financing round in which the VC provided funding and the IPO

Total # VCs involved pre-IPO – the number of VC firms that provided funding at any point prior to the IPO

Number of Rounds VC involved in – the number of pre-IPO financing rounds in which the VC provided funding

Percent of Rounds VC involved in – the percent of pre-IPO financing rounds in which the VC provided funding

Post-IPO VC Round Amount – the total dollar amount of the round in which the VC participated

Post-IPO Funding experience - the number of post-IPO rounds performed by the VCs that were involved with a particular firm before its IPO. For each IPO firm in our sample, we identify the VCs that provided financing prior to the IPO, and we calculate the number of post-IPO financings of these VCs in the period beginning 10 years prior to the IPO and ending one month prior to this firm's IPO.

Compustat Variables: all defined as of the fiscal year-end prior to the post-IPO VC financing

Total assets – millions of assets in 2014 $

Sales– millions of sales in 2014 $

ROA– Net Income / Total Assets

CFO – Net Cash Flow From Operating Activities/ Total assets

Negative CFO – a dummy equal to one if cash flow from operations was negative

Cash / Assets – holdings of cash plus marketable securities/assets

Tangibility – Property plant & equipment / assets

R&D / Sales – R&D expenditures/sales; set equal to 0 if R&D is missing

Capx / Assets – capital expenditures / assets

Tobin's Q – Market Value of Equity plus Book Value of Assets minus Book Value of Equity and Deferred Taxes divided by Book Value of Assets

Debt / Assets – the sum of short-term plus long-term debt divided by assets

Life Cycle Variables

Time to IPO – the number of years from the first venture capital investment (prior to the IPO) to the IPO

Firm Age – the number of years since incorporation, defined as the calendar year minus the year of incorporation (from Jay Ritter's website)

Years Since IPO – the number of years between the IPO and the post-IPO VC funding

Alternative Forms of Financing

Syndicated Loan – a dummy equal to one if the firm had a syndicated loan recorded during the year, as obtained from DealScan

Prior Syndicated Loan – a dummy equal to one if the firm has a syndicated loan recorded in DealScan either prior to the IPO or at any point after the IPO up until the post-IPO VC financing

SEO – a dummy equal to one if the firm had a seasoned equity offering during the year, as obtained from Thomson Financial

PIPE – a dummy equal to one if the firm had a private investment in public equity during the year (excluding cases where the PIPE observation represents a post-IPO VC financing), as recorded in Thomson Financial, during the year

Other Controls

Initial Return – the percent difference between the offer price and the first after-market closing price

Startup – a dummy variable equal to one if the SDC venture capital flag for the IPO company equals 'yes'. This dummy equals zero for cases in which SDC lists the company as having received venture capital funding rounds (a requirement that applies to all companies in our sample, but which potentially includes some private equity as well as venture capital-type investments) but the SDC venture-capital backed dummy equals "No"

Table 1: Sample of firms that receive post-IPO financing

Our sample consists of VC-backed IPOs between 1995 and 2010, defined as IPOs for which SDC identifies the company as having received funding from a venture capitalist prior to the IPO; we exclude REITs, ADRs, closed-end funds, unit offerings, reverse LBOs, and IPOs with an offer price of less than $5. We require all firms to have CRSP and Compustat Data. post-IPO VC funding is defined as firms that receive funding by a VC between 8 days post-IPO and five years post-IPO, as listed in VenturXpert and verified through SEC filings. Among this set of 1,761 companies, the venture capital flag equals 'yes' in 1,403 cases, and we label this as the startup subsample. The remaining 358 companies are more characteristic of later stage firms.

	# Firms	% of sample	% Cases with post-IPO financing
VC-backed IPOs, 1995 - 2010	1,761	100%	
With post-IPO VC funding, day 8 – year 5	270	15.3%	100%
With post-IPO VC funding by pre-IPO VC	160	9.1%	59.3%
Startup Subsample	1,403	100%	
With post-IPO VC funding, day 8 – year 5	232	16.7%	100%
With post-IPO VC funding by pre-IPO VC	135	9.6%	58.2%
Later-stage subsample	358	100%	
With post-IPO VC funding, day 8 – year 5	38	10.7%	100%
With post-IPO VC funding by pre-IPO PE	25	7.0%	65.8%

Table 2: Descriptive Statistics

Our sample consists of VC-backed IPOs between 1995 and 2010, as described in Table 1. The sample in Panel A consists of up to five firm years of post-IPO data, where firms that receive post-IPO VC financing are only included up to the year of this financing. Column 1 shows means for firm years with a post-IPO round (defined as post-IPO financing between day 8 and year 5), and column 2 shows means for firm years without a post-IPO round. Panel B summarizes the size of VC round amounts, including both the last round prior to the IPO and the first round after the IPO (defined as during the day 8 – year 5 period). Of the 1,761 VC-backed IPOs in our sample, 1,551 have data on the round amount for the last round prior to the IPO. As shown in the middle of the table, 247 of these received post-IPO VC financing and 1,304 did not. 'Difference' denotes whether the mean round amounts of these two groups are significantly different. Of the 239 firms with post-IPO financing and available data on post-IPO VC round amounts, the bottom of the table shows that 148 of these received this post-IPO funding from at least one VC that also funded the firm prior to the IPO and 92 did not. Similarly, 'Difference' denotes whether the mean round amounts of these two groups are significantly different. Panel C consists of firms that received VC financing following the IPO (defined as during the day 8 – year 5 period). For a subsample of 238 cases in which a company received post-IPO VC financing, we have data on the firm's Board composition and ownership structure as of the last proxy prior to the post-IPO VC financing. Variable descriptions are provided in Appendix III.

Panel A: Descriptive Statistics in firm years after IPO

	Firms with post-IPO round (665 firm-years)	Firms without post-IPO round (6,306 firm years)	Difference
Total Assets (mil)	249.522	482.913	-233.391***
Sales (mil)	127.795	303.5	-175.705***
ROA	-0.548	-0.227	-0.321***
% w negative CFO	0.783	0.474	0.310***
Cash / Assets	0.494	0.400	0.094***
Tobin's Q	4.524	3.957	0.567***
R&D / Assets	0.279	0.141	0.138***
CAPX / Assets	0.076	0.066	0.010***
Debt / Assets	0.195	0.170	0.025**
Tangibility	0.173	0.168	0.006
Syndicated Loan	0.386	0.427	-0.041**
Time to IPO	4.24	4.805	-0.565***
Firm Age	8.435	13.607	-5.172***
% Startup	0.866	0.781	0.085***
Pre-IPO VC/PE Funding	86.069	80.439	5.631
Top-10 pre-IPO VC	0.326	0.240	0.087***

Panel B: Descriptive Statistics on VC financing

	Mean	Q1	Median	Q3	Obs
Pre- IPO VC funding (last round prior to IPO)	44.3	6.04	15.7	35.6	1,551
Post-IPO VC funding (first round after IPO)	45.5	6.86	24.2	43.2	239
Pre- IPO VC funding (last round prior to IPO)					
Received post-IPO VC funding	42.5	8.36	19.4	39.8	247
No post-IPO VC funding	44.6	5.49	15	35.4	1,304
Difference	-2.1				
Post-IPO VC funding (first round after IPO)					
Post-IPO VC also funded firm prior to IPO	42.4	6.2	22.6	43.9	147
Post-IPO VC did not fund firm prior to IPO	50.3	11.2	26.9	40.6	92
Difference	-7.9				

Panel C: Descriptive Statistics on companies with a post-IPO VC round and data on the firm's Board composition and ownership structure (sample of 238 deals)

	Percent of Companies	Avg # directors (among firms with VC directors)	Avg ownership (among firms with VC ownership)
Post-IPO VC has directors sitting on Board	48.3%	1.66	
Another VC has directors sitting on Board	68.8%	2.24	
At least one VC has directors sitting on Board	89.2%	2.71	
Post-IPO VCs own shares	45.4%		25.8%
Other VCs own shares	24.6%		15.4%
At least one VC owns shares	58.3%		26.6%
Post-IPO VC has directors on Board and owns shares	40.4%	1.72	26.5%
Post-IPO VC has no directors on Board and doesn't own shares	46.7%		

Table 3: Which firms receive post-IPO VC financing?

In Panel A, the sample consists of VC-backed IPOs between 1995 and 2010. We require all firms to have CRSP and Compustat data. Columns 1 and 3 represent logistic regressions, while columns 2 and 4 include interaction terms and represent linear probability model estimations. In columns 1 – 2 (3 – 4), the dependent variable equals one if the firm received VC financing (VC financing from a VC that also funded the firm prior to the IPO) between day 8 and year 5 after the IPO. All specifications include year fixed effects, and standard errors are clustered by firm (z-statistics are in parenthesis). The reported coefficients in columns 1 and 3 are the marginal effects - the change in the probability to receive a financing for an infinitesimal change in each independent, continuous variable and, the discrete change in the probability for dummy variables. Asterisks denote statistical significance at the 1% (***), 5% (**), or 10% (*) levels. All variables are defined in Appendix III.

Dep't Var = 1 if:	Any VC funded post-IPO		a Pre-IPO VC funded post-IPO	
VC Characteristics				
Total VC ownership at IPO		0.0461***		0.0454***
		(3.77)		(4.97)
% VC directors at IPO		-0.0020		-0.0054
		(-0.18)		(-0.66)
Log(Pre-IPO VC Funding+1)	0.0041**	0.0034**	0.0031**	0.0023*
	(2.44)	(2.05)	(2.29)	(1.74)
Top 10 pre-IPO VC	0.0077*	0.0146**	0.0062*	0.0137**
	(1.81)	(2.02)	(1.91)	(2.33)
Operating Char's				
Negative CFO	0.0263***	0.0159**	0.0156***	0.0068
	(5.39)	(2.24)	(4.24)	(1.26)
CFO	-0.0047	-0.0094	-0.0078	-0.0238*
	(-0.66)	(-0.52)	(-1.47)	(-1.95)
Log(Sales)	-0.0031**	-0.0087***	-0.0008	-0.0036
	(-2.28)	(-2.86)	(-0.83)	(-1.52)
ROA	-0.0012	-0.0017	0.0023	0.0073
	(-0.23)	(-0.15)	(0.59)	(1.22)
Growth Opp's				
R&D/Assets	0.0126*	0.0458**	0.0067	0.0306
	(1.70)	(2.07)	(1.18)	(1.62)
CAPX/Assets	-0.0193	-0.0578	-0.0158	-0.0556
	(-0.76)	(-1.27)	(-0.85)	(-1.63)
Tobin's Q	-0.0009**	-0.0010*	-0.0004	-0.0005
	(-2.04)	(-1.81)	(-1.16)	(-1.17)
Firm Age				
Time to IPO	-0.0006	-0.0011**	-0.0005	-0.0008**
	(-1.42)	(-2.34)	(-1.42)	(-2.33)
Firm Age	-0.0001	-0.0001	-0.0001	-0.0001
	(-0.84)	(-0.83)	(-0.58)	(-1.26)
Years Since IPO	-0.0017	-0.0015	-0.0024**	-0.0032*
	(-1.25)	(-0.70)	(-2.23)	(-1.89)
Financing Structure				
Debt/Asset Ratio	0.0096	0.0065	0.0018	-0.0024
	(1.34)	(0.48)	(0.35)	(-0.23)
Prior Syndicated Loan	0.0112***	0.0126**	0.0067**	0.0084*
	(2.81)	(2.23)	(2.17)	(1.84)
Prior Syndicated Loan*CFO		-0.0454*		-0.0336
		(-1.78)		(-1.58)
Tangibility	0.0003	0.0128	0.0072	0.0207
	(0.02)	(0.60)	(0.81)	(1.25)
Cash/Assets	0.0000	-0.0042	0.0035	0.0046
	(0.00)	(-0.32)	(0.55)	(0.45)
Other Controls				
Startup	-0.0042	0.0076	-0.0047	0.0075
	(-0.67)	(0.94)	(-1.01)	(1.30)
Log(Total Assets)	-0.0001	0.0035	-0.0004	0.0019
	(-0.05)	(1.21)	(-0.30)	(0.84)
Initial Return	-0.0092***	-0.0120***	-0.0056**	-0.0080***
	(-2.59)	(-3.11)	(-2.12)	(-2.81)
Pseudo / Adj R-squared	0.093	0.029	0.102	0.025
Observations	6,971	5,668	6,754	5,668

Table 4: Comparing sources of post-IPO Financing

Each column shows a linear probability model estimation, where the dependent variable equals one if the firm raised the specified form of financing within the year: post-IPO VC investment, PIPE, SEO, and syndicated loan in cols 1 – 4, respectively. Firms are included in the regression until they obtain the designated type of financing, or in the event they do not obtain this type of financing until earlier of delisting or five years after the IPO. Year fixed effects are included in each regression, and standard errors are clustered by firm. Asterisks denote statistical significance at the 1% (***), 5% (**), or 10% (*) levels. All variables are defined in Appendix III. Robust t-statistics are in parentheses.

	Post-IPO VC inv't	PIPE	SEO	Syndicated Loan
VC Characteristics				
Total VC ownership at IPO	0.0005***	-0.0000	0.0006**	-0.0000
	(3.77)	(-0.52)	(2.40)	(-0.00)
% VC directors at IPO	-0.0000	0.0001	0.0003*	0.0002
	(-0.18)	(0.92)	(1.76)	(1.17)
Log(Pre-IPO VC Funding+1)	0.0034**	0.0002	0.0095**	0.0017
	(2.05)	(0.12)	(2.32)	(0.37)
Top 10 pre-IPO VC	0.0146**	0.0005	-0.0085	-0.0052
	(2.02)	(0.10)	(-0.72)	(-0.53)
Operating Char's				
Negative CFO	0.0159**	0.0252***	0.0155	-0.0043
	(2.24)	(4.51)	(1.15)	(-0.33)
CFO	-0.0094	0.0121	0.0615**	-0.0698***
	(-0.52)	(0.72)	(2.29)	(-3.35)
Log(Sales)	-0.0087***	-0.0090***	-0.0040	0.0024
	(-2.86)	(-3.25)	(-0.75)	(0.50)
ROA	-0.0017	-0.0003	-0.0099	0.0303**
	(-0.15)	(-0.03)	(-0.70)	(2.56)
Growth Opp's				
R&D/Assets	0.0458**	0.0819***	0.0441	-0.0813***
	(2.07)	(4.11)	(1.58)	(-4.05)
CAPX/Assets	-0.0578	-0.0260	0.1864*	0.0336
	(-1.27)	(-0.69)	(1.84)	(0.33)
Tobin's Q	-0.0010*	-0.0004	0.0029**	0.0002
	(-1.81)	(-0.87)	(2.50)	(0.23)
Firm Age				
Time to IPO	-0.0011**	-0.0008**	-0.0022	-0.0012
	(-2.34)	(-2.05)	(-1.63)	(-1.00)
Firm Age	-0.0001	-0.0001*	0.0009*	-0.0009**
	(-0.83)	(-1.92)	(1.89)	(-2.20)
Years Since IPO	-0.0015	0.0063***	-0.0411***	-0.0090**
	(-0.70)	(3.30)	(-9.78)	(-2.35)
Financing Structure				
Debt/Asset Ratio	0.0065	0.0064	0.0294	0.0704**
	(0.48)	(0.56)	(1.09)	(2.49)
Prior Syndicated Loan	0.0126**	0.0003	-0.0037	0.0935***
	(2.23)	(0.06)	(-0.30)	(6.97)
Prior Syndicated Loan*CFO	-0.0454*	0.0060	0.0168	0.1115***
	(-1.78)	(0.44)	(0.73)	(4.82)
Tangibility	0.0128	0.0248*	-0.0001	0.1179**
	(0.60)	(1.66)	(-0.00)	(2.20)
Cash/Assets	-0.0042	-0.0033	0.0034	-0.1052***
	(-0.32)	(-0.28)	(0.14)	(-4.63)
Other Controls				
Startup	0.0076	-0.0138*	-0.0451**	-0.0325*
	(0.94)	(-1.96)	(-2.29)	(-1.68)
Log(Total Assets)	0.0035	0.0026	0.0078	0.0175***
	(1.21)	(0.84)	(1.22)	(2.97)
Initial Return	-0.0120***	-0.0057*	0.0029	-0.0113*
	(-3.11)	(-1.79)	(0.41)	(-1.81)
Adj. R-squared	0.029	0.038	0.072	0.112
Observations	5,668	5,873	4,549	4,784

Table 5: Which VC provides post-IPO funding?

Panel A examines the tendency of any VC to provide post-IPO financing to a firm. The sample in column 1 consists of each VC-backed IPO firm matched with each venture-capitalist that participated in a VC round with any firm within the five years after the firm IPO, meaning the total number of observations equals the product # VC-backed IPOs * # VCs. The dependent variable equals one if the VC funded the firm within the first five years after the IPO, zero otherwise. The regression in column 2 is defined similarly, but the sample is restricted to those firms that received post-IPO VC financing. In Panel B, we limit the sample to VC firms that financed the firm prior to the IPO, and similar to Panel A the sample is defined as #Firms * #VCs in column 1 and as #Firms that received post-IPO VC financing * #VCs in column 2. Logistic regressions include year fixed effects, and standard errors are clustered by firm. The reported coefficients are the marginal effects - the change in the probability to receive a financing for an infinitesimal change in each independent, continuous variable and, the discrete change in the probability for dummy variables. Robust z-statistics are in parentheses. Asterisks denote statistical significance at the 1% (***), 5% (**), or 10% (*) levels. Variables are defined in Appendix III.

Panel A: Which VC firm provided financing after the IPO?

	All Firms	Firms that received post-IPO financing
Top 10 VC	0.0004***	0.0038***
	(3.86)	(3.50)
VC Industry Experience	0.0002***	0.0013***
	(7.30)	(7.66)
VC Financed Firm pre-IPO	0.0185***	0.1231***
	(7.45)	(9.10)
Pseudo R-squared	0.259	0.306
Observations	1,908,597	296,745

Panel B: Which pre-IPO VC firm provided financing?

	All Firms	Firms that received post-IPO financing
Top 10 pre-IPO VC	0.0250**	0.0993**
	(2.47)	(2.01)
VC Industry Experience	0.0255***	0.0770*
	(3.54)	(1.94)
Years b/w first VC involvement and IPO	-0.0057***	-0.0165**
	(-3.86)	(-2.13)
Total # of VCs involved pre-IPO	-0.0016**	-0.0217***
	(-2.02)	(-4.31)
Number of Rounds VC involved in	0.0065***	0.0167*
	(3.83)	(1.65)
Percent of Rounds VC involved in	0.0213*	0.1660***
	(1.86)	(2.79)
Log(Total Pre-IPO Funding)	0.0033	0.0143
	(1.08)	(0.75)
Pseudo R-squared	0.079	0.113
Observations	6,308	1,261

Table 6: Relation between post-IPO returns and tendency to receive post-IPO VC financing

This panel shows calendar time portfolio regressions, where a firm belongs to the portfolio for a maximum of 12, 36, or 60 months prior to the post-IPO VC financing. The sample of firms with a post-IPO VC investment (Cols 1 – 3) consists of VC-backed IPOs between 1995 and 2010, which received post-IPO financing at least 8 days after the IPO. The sample of matched firms (Cols 4 – 6) consists of firms that didn't receive post-IPO financing within this period, defined as follows: we choose a firm that went public within one year, with the closest global proceeds and the closest IPO date. Control firms are chosen with replacement. Columns 7 – 9 show regressions based on a portfolio that is long the post-IPO VC investment firms and short the matched firms. For the 12-month regressions, we form a rolling portfolio where the firm enters the portfolio 13 months prior to the VC-round date (or less if the firm has been public for less than 13 months) and exits the month prior to the post-IPO VC financing date (a maximum of 12 months). The 36- and 60-month regressions are defined analogously. Monthly common stock returns on these portfolios, net of the risk-free rate, are regressed on the three Fama-French factors and the Carhart momentum factor. Robust t-statistics are in parentheses. Asterisks denote statistical significance at the 1% (***), 5% (**), or 10% (*) levels.

	Firms with post-IPO VC inv't			Matched Firms			Long-short portfolio		
	12 months	36 months	60 months	12 months	36 months	60 months	12 months	36 months	60 months
Constant	-0.101	-0.138	0.149	-0.377	-0.166	0.153	0.276	0.028	-0.004
	(-0.13)	(-0.24)	(0.27)	(-0.73)	(-0.39)	(0.36)	(0.33)	(0.05)	(-0.01)
Market-Rf	1.120***	1.214***	1.272***	1.193***	1.241***	1.285***	-0.073	-0.027	-0.013
	(6.05)	(9.96)	(10.62)	(10.01)	(12.29)	(13.04)	(-0.37)	(-0.20)	(-0.10)
SMB	1.286***	1.330***	1.277***	1.345***	1.287***	1.264***	-0.059	0.043	0.013
	(5.56)	(8.02)	(7.76)	(7.49)	(8.45)	(8.37)	(-0.30)	(0.31)	(0.09)
HML	-0.741***	-0.814***	-0.858***	-0.618***	-0.676***	-0.663***	-0.123	-0.138	-0.195
	(-3.86)	(-5.64)	(-5.90)	(-3.87)	(-4.75)	(-4.72)	(-0.69)	(-0.99)	(-1.39)
Momentum	-0.601***	-0.494***	-0.451***	-0.386***	-0.295***	-0.263***	-0.215*	-0.199*	-0.187*
	(-4.30)	(-4.27)	(-3.92)	(-3.97)	(-3.72)	(-3.24)	(-1.70)	(-1.94)	(-1.72)
Adj. R-squared	0.387	0.578	0.580	0.633	0.702	0.695	-0.014	-0.006	-0.006
Observations	221	224	227	221	224	227	221	224	227

Table 7: CARs around post-IPO VC financings

The sample consists of VC-backed IPOs that received VC financing during the day 8 – year 5 period following the IPO. Cumulative abnormal returns (CARs) are defined as the raw firm return over the designated window, minus the return on the matched size decile over the same period. CARs are shown for the whole sample, conditional on whether the VC (who is providing the post-IPO financing) has a director on the Board, and conditional on the VC's level of ownership. Robust t-statistics are in parentheses.

	CAR (T-Test)				Obs
	(-1, +1)	(-2, +2)	(-2, +5)	(-2,+10)	
Whole Sample, [SDC VC funding dates, 1997 – 2014]	4.08% (4.00)	5.37% (4.41)	5.81% (3.98)	7.35% (4.05)	268
Sample with VC director and VC ownership information, 1997 – 2014	4.83% (4.46)	6.14% (4.67)	6.90% (4.34)	8.64% (4.35)	238
VC has director on Board	5.37% (3.32)	7.02% (3.32)	10.20% (3.84)	14.10% (4.26)	115
VC has no director on Board	4.33% (2.98)	5.33% (3.32)	3.80% (2.14)	3.54% (1.61)	123
VC owns shares	5.26% (3.03)	6.85% (3.02)	10.00% (3.46)	15.00% (4.20)	108
VC does not own shares	4.48% (3.28)	5.56% (3.68)	4.30% (2.66)	3.34% (1.67)	130
VC has a director and owns shares	5.37% (3.32)	7.02% (3.32)	10.20% (3.84)	14.10% (4.26)	115
VC has no director and does not own shares	5.13% (3.26)	6.08% (3.52)	4.56% (2.47)	3.43% (1.53)	111

Table 8: Long-run returns, following post-IPO VC investments and following PIPEs

The sample consists of VC-backed IPOs over the 1995 – 2010 period. The left-hand three columns focus on firms that receive VC financing during the day 8 – year 5 period following the IPO, the middle three columns focus on firms that raise capital through PIPEs during the first five years after the IPO, and the right-hand three columns are based on a portfolio that is long the former and short the latter. Each column shows calendar time portfolio regressions, where a firm enters the portfolio in the month following the post-IPO financing. The firm remains in the portfolio for the first 12, 36, or 60 months following the post-IPO financing. Monthly common stock returns on this portfolio, net of the risk-free rate, are regressed on the three Fama-French factors and the Carhart momentum factor. Robust t-statistics are in parentheses. Asterisks denote statistical significance at the 1% (***), 5% (**), or 10% (*) levels.

	Returns following post-IPO VC inv'ts			Returns following post-IPO PIPEs			Long-short portfolio		
	12 months	36 months	60 months	12 months	36 months	60 months	12 months	36 months	60 months
Constant	-0.067	0.396	0.416	-0.722	-0.864	-0.527	0.983	1.434**	1.117***
	(-0.09)	(0.68)	(0.78)	(-0.85)	(-1.44)	(-1.14)	(1.08)	(2.46)	(2.61)
Market-Rf	1.099***	1.148***	1.123***	1.200***	1.131***	1.111***	-0.064	0.025	0.019
	(6.99)	(8.42)	(8.70)	(5.65)	(9.15)	(10.54)	(-0.30)	(0.19)	(0.17)
SMB	1.707***	1.545***	1.589***	1.799***	1.626***	1.454***	-0.104	-0.075	0.142
	(7.05)	(8.40)	(8.17)	(8.32)	(8.73)	(10.11)	(-0.39)	(-0.38)	(0.74)
HML	-0.835***	-0.923***	-0.892***	-0.719**	-0.814***	-0.905***	-0.217	-0.127	-0.005
	(-3.29)	(-4.78)	(-4.95)	(-2.56)	(-4.49)	(-6.25)	(-0.76)	(-0.67)	(-0.03)
Momentum	-0.497*	-0.447**	-0.436**	-0.441**	-0.397**	-0.381***	-0.046	-0.053	-0.059
	(-1.81)	(-2.12)	(-2.58)	(-2.47)	(-2.43)	(-3.30)	(-0.19)	(-0.38)	(-0.44)
Adj. R-squared	0.516	0.608	0.632	0.462	0.579	0.671	-0.017	0.008	0.018
Observations	226	226	226	198	219	219	198	219	219

Table 9: Performance of IPO firms that were funded (prior to IPO) by VCs with above- vs below-median tendency to provide post-IPO financing

The sample consists of the 1,761 VC-backed IPOs over the 1995 – 2010 period. This table shows calendar time portfolio regressions, where a firm enters the portfolio in the month following the IPO. The firm remains in the portfolio for the first 12 months (col 1), 36 months (col 2), or 60 months (col 3) following the IPO. A portfolio is formed that is long in firms that were backed prior to the IPO by VCs that funded an above-median percent of companies following the IPO (left-hand three columns), a portfolio of firms that were backed prior to the IPO by VCs that funded a below-median percent of companies following the IPO (middle three columns), and a long-short portfolio (right-hand three columns), over the 1995 – 2010 sample period. Monthly returns on this portfolio, net of the risk-free rate, are regressed on the three Fama-French factors and the Carhart momentum factor. Asterisks denote statistical significance at the 1% (***), 5% (**), or 10% (*) levels. Robust t-statistics are in parentheses.

	IPO by VCs with above-median post-IPO funding experience			*IPO by VCs with below-median post-IPO funding experience*			Long-short portfolio		
	12 months	36 months	60 months	12 months	36 months	60 months	12 months	36 months	60 months
Constant	0.637	0.665**	0.714**	-0.417	0.131	0.131	1.055**	0.534**	0.583***
	(1.32)	(2.07)	(2.51)	(-0.95)	(0.46)	(0.53)	(2.15)	(2.24)	(3.06)
Market-Rf	1.333***	1.319***	1.280***	1.056***	1.156***	1.200***	0.278**	0.163***	0.080*
	(10.67)	(18.67)	(21.13)	(9.78)	(16.84)	(20.64)	(2.14)	(2.83)	(1.89)
SMB	0.898***	1.145***	1.219***	0.915***	1.100***	1.156***	-0.016	0.045	0.063
	(4.54)	(9.18)	(12.81)	(4.78)	(9.24)	(11.31)	(-0.14)	(0.81)	(0.96)
HML	-1.029***	-1.002***	-0.923***	-0.998***	-0.751***	-0.536***	-0.031	-0.250***	-0.387***
	(-5.61)	(-9.39)	(-9.99)	(-6.37)	(-8.03)	(-6.39)	(-0.19)	(-3.74)	(-6.29)
Momentum	-0.044	-0.326***	-0.362***	-0.008	-0.377***	-0.342***	-0.036	0.051	-0.020
	(-0.48)	(-3.33)	(-3.78)	(-0.07)	(-3.96)	(-4.22)	(-0.28)	(1.46)	(-0.46)
Adj. R-squared	0.680	0.832	0.853	0.677	0.834	0.860	0.045	0.136	0.226
Observations	202	226	238	202	226	238	202	226	238

Table 10: Are firms funded (prior to IPO) by VCs that tend to invest in companies following the IPO less likely to delist following IPO?

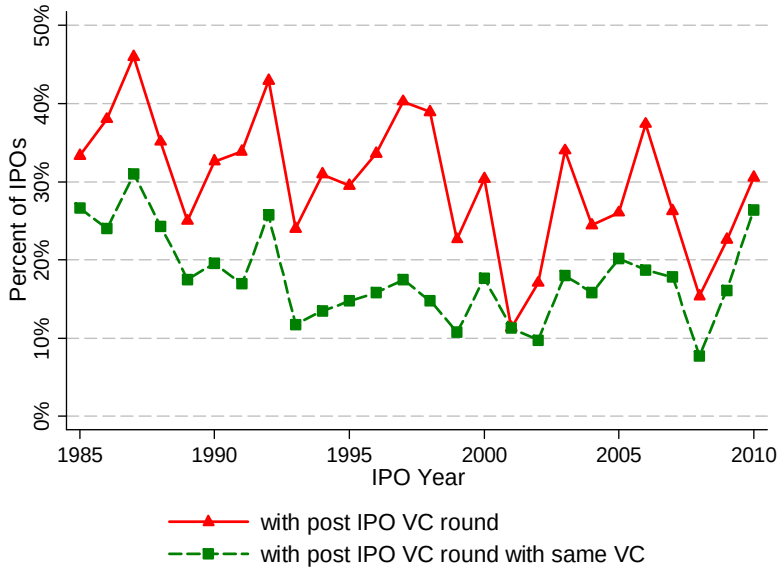
	All firms		
	Firm Delist	Firm Delists (Merger)	Firm Delist (Dropped from Exchange)
VC Characteristics			
Post-IPO funding experience	-0.002***	-0.001	-0.001**
	(-2.84)	(-1.28)	(-2.27)
Log(Pre-IPO VC Funding+1)	0.010	0.006	0.002
	(0.95)	(0.71)	(0.26)
Top 10 pre-IPO VC	0.079**	0.053*	0.020
	(2.24)	(1.67)	(1.06)
Operating Char's			
Negative CFO	0.046	-0.022	0.058***
	(1.34)	(-0.73)	(3.50)
CFO	0.010	0.018	-0.013
	(0.15)	(0.39)	(-0.46)
Log(Sales)	0.002	0.021*	-0.009
	(0.15)	(1.75)	(-1.38)
ROA	-0.080	-0.062*	-0.005
	(-1.60)	(-1.84)	(-0.26)
Growth Opp's			
R&D/Assets	-0.175***	-0.089*	-0.048*
	(-2.88)	(-1.76)	(-1.73)
CAPX/Assets	0.092	-0.136	0.093
	(0.49)	(-0.81)	(1.10)
Tobin's Q	-0.002	-0.002	-0.000
	(-1.16)	(-1.08)	(-0.51)
Firm Age			
Time to IPO	-0.010**	-0.009***	-0.001
	(-2.53)	(-2.85)	(-0.57)
Firm Age	-0.000	0.001	-0.002**
	(-0.15)	(1.25)	(-2.46)
Financing Structure			
Debt/Asset Ratio	0.059	-0.031	0.060**
	(1.18)	(-0.74)	(2.43)
Syndicated Loan	0.039	0.048*	-0.010
	(1.38)	(1.88)	(-0.71)
Tangibility	-0.262***	-0.167*	-0.055
	(-2.60)	(-1.83)	(-1.15)
Cash/Assets	-0.054	0.032	-0.059*
	(-0.83)	(0.56)	(-1.94)
Other Controls			
Startup Company	0.019	-0.010	0.014
	(0.49)	(-0.29)	(0.71)
Log(Total Assets)	-0.012	-0.031**	0.011
	(-0.80)	(-2.32)	(1.46)
Initial Return	-0.048**	-0.010	-0.026**
	(-2.23)	(-0.59)	(-2.01)
Pseudo R-squared	0.049	0.034	0.104
Observations	1,690	1,690	1,690

The sample consists of 1,761 VC-backed IPOs over the 1995 – 2010 period. This table shows conditional logistic regressions, where the dependent variable equals one if the firm delists within five years after the IPO, zero otherwise. Control variables are all defined as of the time of the IPO. Post-IPO funding experience equals the number of other companies in which the pre-IPO VCs provided post-IPO funding to other newly public companies, and is scaled by the variable standard deviation. All specifications include year fixed effects, and standard errors are clustered by firm (z-statistics are in parenthesis). The reported coefficients are the marginal effects - the change in the probability to receive a financing for an infinitesimal change in each independent, continuous variable and, the discrete change in the probability for dummy variables. Asterisks denote statistical significance at the 1% (***), 5% (**), or 10% (*) levels. All variables are defined in Appendix III.

Figure 1

Our sample consists of VC-backed IPOs with CRSP data, initial return data, and Compustat data. The sample in Panel A consists of 2,459 firms that went public between 1985 and 2010 and that that were backed by venture capital prior to the IPO. In Panel B, the sample is restricted to IPOs between 1995 and 2010 for which we can confirm whether or not the firm raised post-IPO venture capital financing via SEC filings. In each panel, The solid red line shows the percent of firms that receive VC financing between 8 days post-IPO and five years post-IPO, and the green dashed line shows the percent of firms that receive VC financing during this same interval, from a venture capitalist that also funded the company prior to the IPO.

Panel A: SDC Data



Panel B: Verified Data

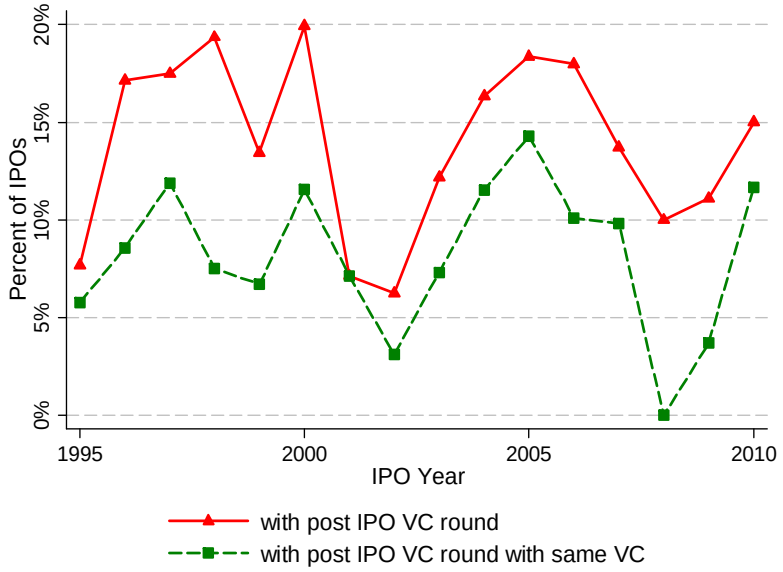


Figure 2

The sample consists of VC-funded IPOs between 1995 and 2010. We require all firms to have CRSP and Compustat Data. The solid line shows the percent of firms that receive VC financing each year following the IPO, as listed in VenturXpert and verified through SEC filings. Year 1 is defined as the period between day 8 and day 365 (following the IPO). Each subsequent year is defined as the following 365-day period.

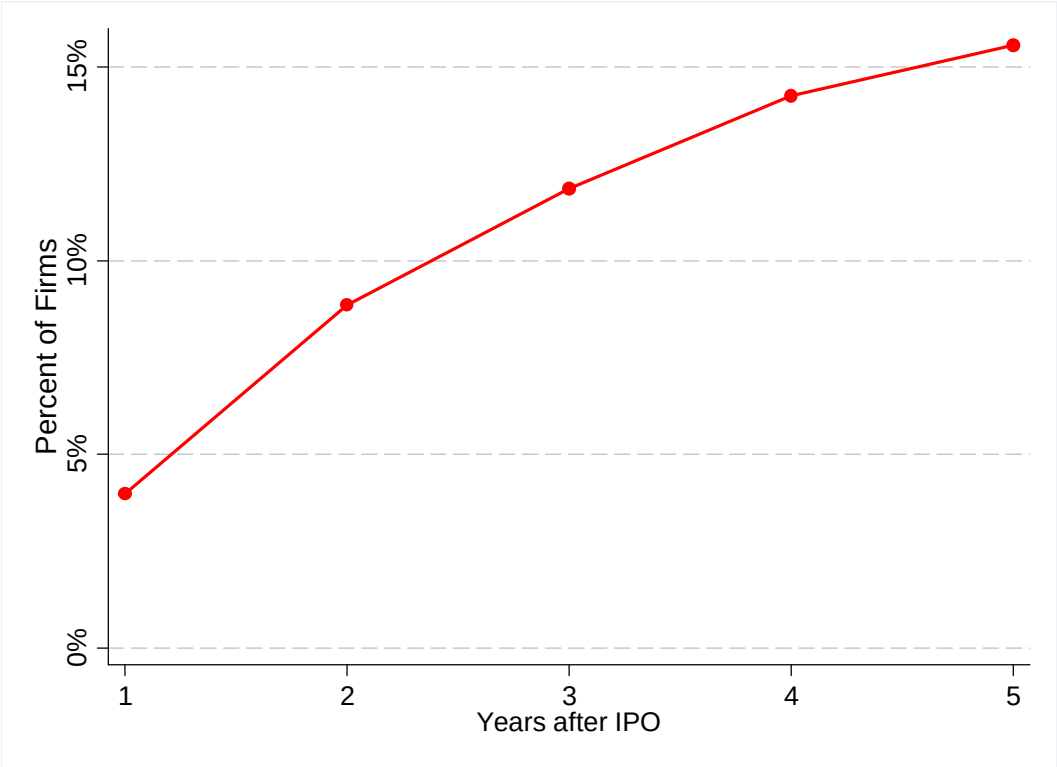
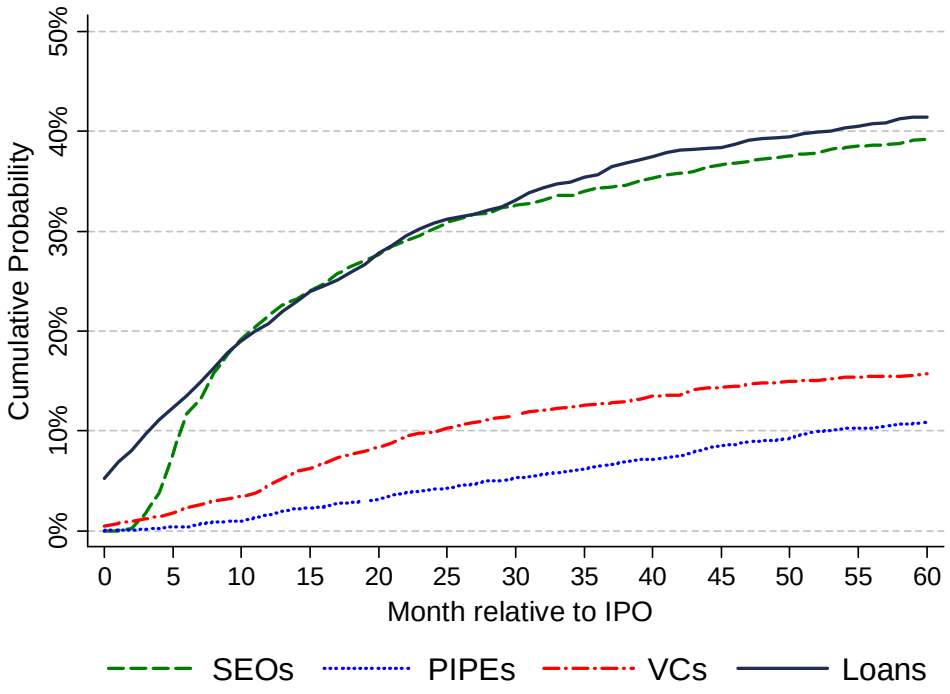


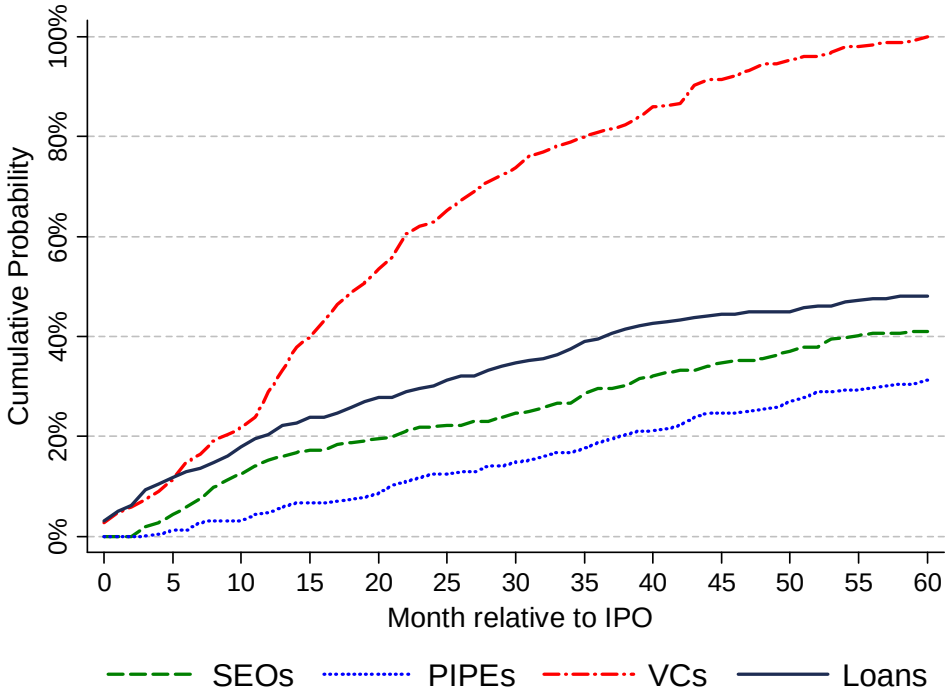
Figure 3: Extent to which firms rely on multiple sources of financing

The sample consists of VC-backed IPOs between 1995 and 2010. We require all firms to have CRSP and Compustat Data, and we determine the percent of firms that raise capital during the first 60 months after the IPO through an SEO, via a PIPE, from a VC, and through a syndicated loan. Panel A shows the percent of firms that receive these types of financing across all VC-backed IPOs, and Panel B limits the sample to those that received post-IPO VC financing. Panel C graphs the amount of money raised as a fraction of proceeds through each of these forms of financing, for the subsample of firms that received post-IPO VC financing.

Panel A: All firms, with or without post-IPO VC financing



Panel B: Subsample of firms with post-IPO VC financing



Panel C: Subsample of firms with post-IPO VC financing

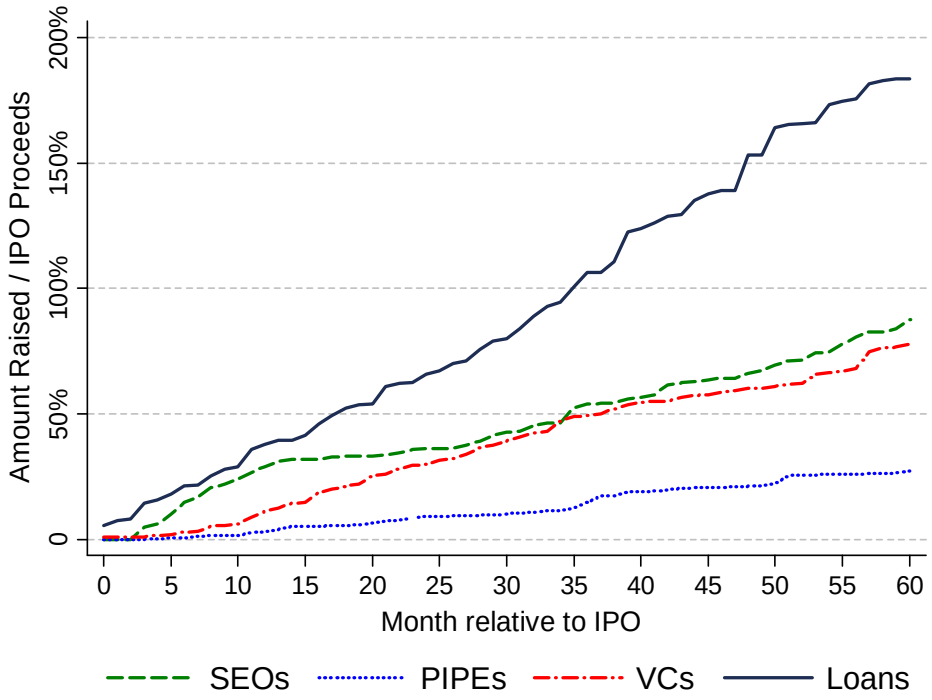


Figure 4

The sample in Panel A consists of 712 VC-backed IPOs between 1995 and 2010, which received post-IPO financing between day 8 and year 5 after the IPO. Because VC rounds potentially occur up to five years after the IPO, the post-IPO VC rounds extend through 2014